The Spatial Equilibrium Effects of Hospital Closures

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Abstract

This paper examines the spatial equilibrium effects of hospital department downsizing in Italy in the context of the large-scale restructuring of the hospital network that followed the 2008 financial crisis. Using a novel ward-level dataset covering all medical specializations over the period 2015–2022, we analyze how large and persistent reductions in bed capacity reshape healthcare delivery beyond the treated hospitals, affecting neighbouring same-specialty departments in terms of activity, congestion, and quality of care. Identification relies on the staggered timing and geographic dispersion of downsizing shocks, which we exploit within a difference-in-differences framework with rich fixed effects and hospital-clustered standard errors.

Our results point to sizable patient reallocation effects. Neighbouring wards experience higher bed utilization, increased discharges, and greater surgical activity, indicating that closures generate substantial spillovers within local hospital markets. At the same time, these gains in activity come at the cost of rising congestion, reflected in longer ordinary and preoperative lengths of stay. Quality trade-offs also emerge: we document higher 30-day mortality following hip fracture and increases in overall mortality. These effects are highly heterogeneous. Public hospitals absorb most of the reallocated demand and exhibit the strongest increases in congestion and deterioration in quality, whereas accredited private providers respond more selectively, primarily through short-stay admissions. Spatial heterogeneity is also pronounced, with stronger volume responses in the North and Centre and more limited absorption capacity in the South, where downsizing is associated with increased outward patient mobility. Overall, hospital department downsizing acts as a local supply shock with system-wide repercussions, suggesting that consolidation policies may generate non-negligible access and quality costs unless accompanied by adequate capacity planning and coordination.

Keywords: hospital closures; spatial spillovers; healthcare capacity; quality of care; Italy.
JEL codes: I11; I18; H51; R12.

The spatial equilibrium effects of hospital closures

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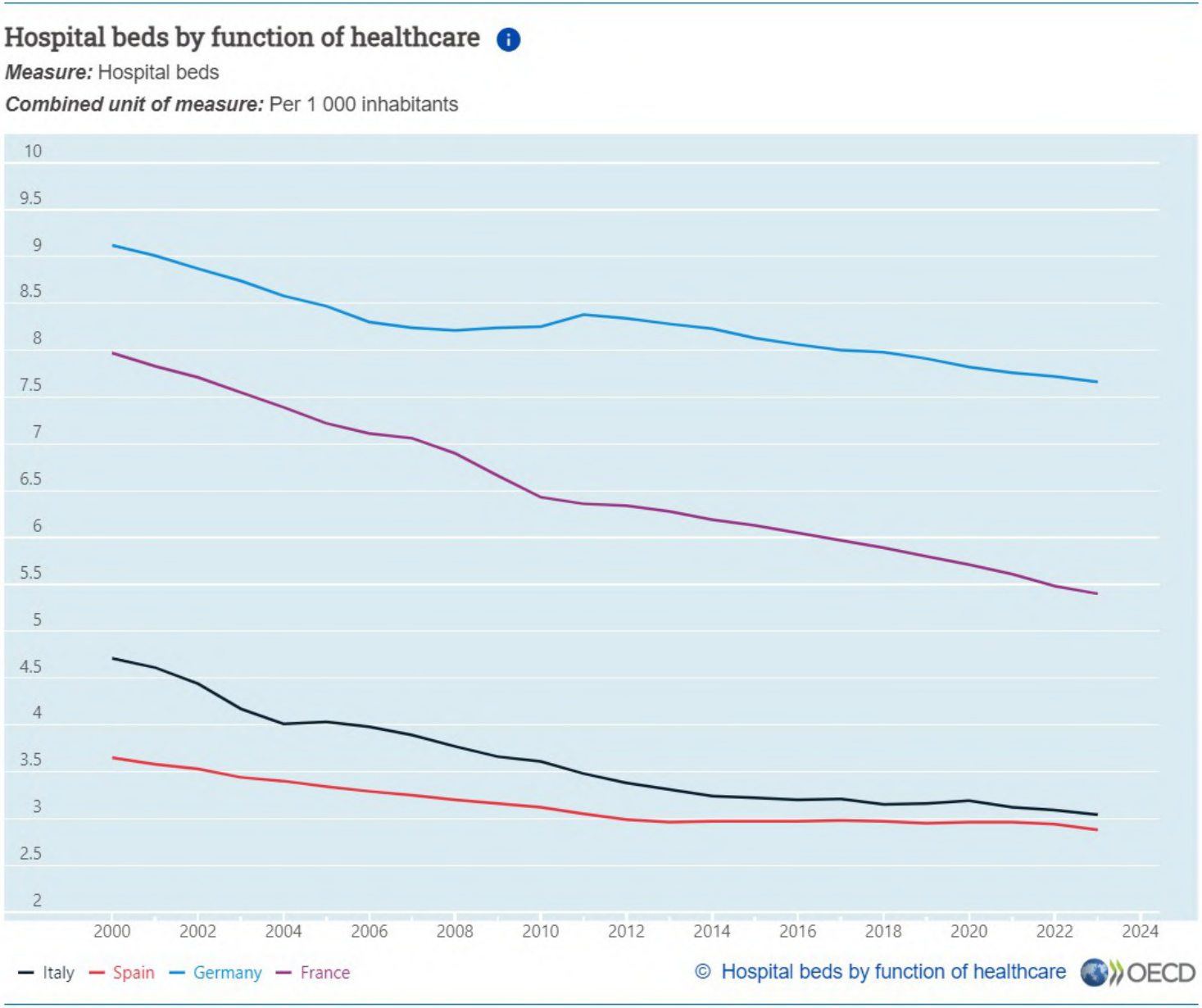
Outline

Hospital Downsizing after the 2008 Crisis

- Since the 2008 crisis, OECD countries have experienced sustained **hospital downsizing** through closures, mergers, and reductions in beds and staff (OECD/European Commission, 2024).
- Large declines in bed capacity occurred in **France (11%)**, **Austria (12%)**, and **Sweden (26%)**; Italy followed with a **9%** reduction.
- In Italy, **Ministerial Decree 70/2015** formally reorganized the hospital network (population thresholds, hospital tiers, closure of low-volume wards).
- In practice, the reform largely remained on paper (Fregoni and Leonardi, 2025), and implementation focused on enforcing a **regional bed cap** of **3.7 beds per 1,000 inhabitants**.
- As a result, public hospitals declined by about **20%** between 2010 and 2020, reducing capacity to **3.1 beds per 1,000 inhabitants** by 2021 (OECD average: **4.3**).

Hospital Cutbacks



Expected Trade-offs

Hospital department closures generate ambiguous effects, as they simultaneously reshape healthcare supply, patient flows, and local capacity.

Potential efficiency gains

- Closures often target low-volume or inefficient wards.
- Patient reallocation may increase volumes in surviving departments.
- Higher volumes can improve capacity utilization and economies of scale.

Potential access and quality costs

- Closures reduce spatial access and increase patient mobility.
- Neighbouring hospitals may face congestion and longer lengths of stay.
- Delays and capacity strain may negatively affect quality of care.

Heterogeneous effects expected

- Differences across public vs. private providers.
- Strong variation across geographical areas with unequal capacity.

Whether efficiency gains outweigh access and quality costs is ultimately an empirical matter.

Background Literature

Empirical Evidence: Italy

- **Hospital closures and emergency care**:
  - Ghislandi et al. (2025): Hospital closures are associated with a 10% increase in in-hospital mortality and a 0.3-day increase in length of stay for emergency AMI admissions.
- **Budget containment and the PdR reforms**:
  - Arcà et al. (2020), Depalo (2019), di Bobini et al. (2019): PdR reforms reduced healthcare expenditure but led to worsening health outcomes.
  - Bordignon et al. (2019): Budget containment increased efficiency with no significant effects on population health.
- **Broader welfare and political effects**:
  - Fregoni and Leonardi (2025): Service cuts (including closures) increased unmet healthcare needs and political discontent.

Background Literature

International Evidence on Hospital Closures

- International evidence on hospital closures points to **heterogeneous effects on patient outcomes**.
- **Negative effects** are more likely when closures:
  - Increase **distance to care** or reduce **emergency access** (AMI: Avdic, 2016; Buchmueller et al., 2006).
  - Affect **elective** care (i.e. hip replacement, Gravelle et al., 2024) or **maternity** care in rural or underserved areas (Durrance et al., 2024).
- **Neutral or positive effects** arise when closures:
  - Increase **treatment volumes** and generate **learning-by-doing** (cancer surgery: Avdic et al., 2019).
  - Reallocate patients to **higher-quality hospitals** (obstetric units: Fischer et al., 2024).
- Several studies find **no significant effects** on mortality or utilization (England: Gaynor et al., 2012; Norway: Grytten et al., 2014; US: Hsia et al., 2012; Joynt et al., 2015).
- Beyond health outcomes, closures can have **persistent local labor market effects** (US: Alexander and Richards, 2023).

Setting and Empirical Contribution

Institutional context (Italy)

- Large-scale hospital downsizing following the 2008 crisis.
- Post-2008 austerity and *Piani di Rientro* reshaped hospital supply.
- Decree 70/2015 promoted consolidation by closing or downsizing low-volume hospital departments.

Objectives and contribution

- Quantify the spillover effects of hospital department closures on neighbouring hospitals, focusing on same-specialty wards.
- Assess trade-offs between higher activity, congestion, and quality of care arising from patient reallocation.
- Key novelty: use of ward-level data covering all medical specializations in Italy (2015–2022).
- Document heterogeneous effects across provider types and geographical areas.

Data

- **Unique original dataset** on Italian hospitals, covering **2015–2022**.
- Combines multiple sources:
  - Hospital volumes and quality of departments (ISTAT)
  - Data on health outcomes (AGENAS–Ministry of Health)
  - Municipal-level data (ISTAT)
  - Economic and financial accounts of Local Health Authorities (ASP)
- Final structure: information at the **ward-by-hospital level**, integrated with **ASP-level financial indicators**

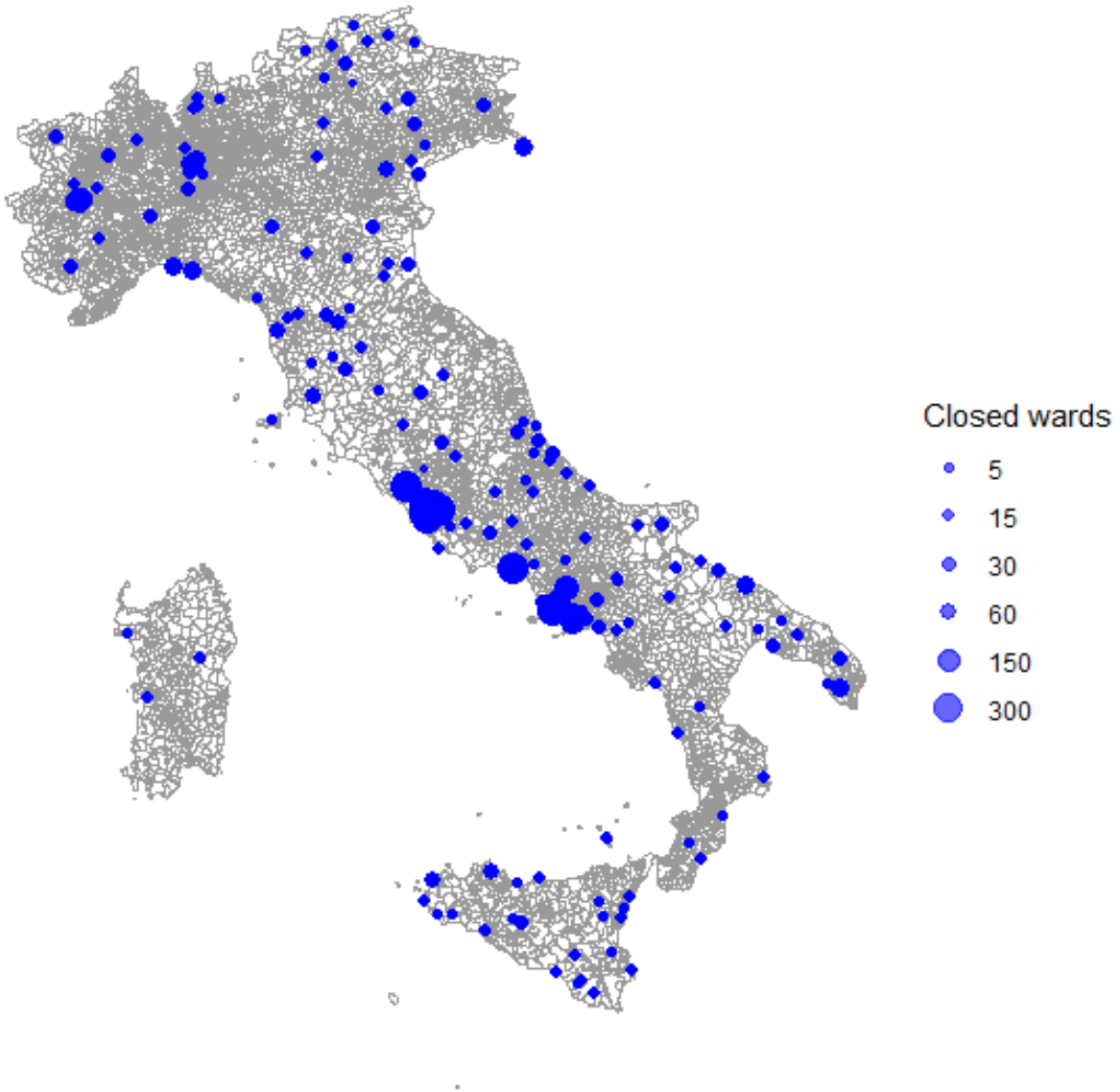
Data

Downsizing definition

- No official or centralized definition of ward closures in Italy: formally, wards do not "close", reflecting the politically sensitive nature of hospital cutbacks.
- As a result, closures are observed through large and persistent reductions in bed capacity at the **ward-within-hospital level**.
- Consistent with the empirical literature on hospital closure (e.g. Ghislandi et al. 2025; Avdic 2016), we define a ward as treated when bed capacity falls by a certain theshold relative to the previous year.
- We use the $\geq 50\%$ threshold here, but sensitivity analyses confirm that results are not driven by the specific threshold choice.

Map

Ward closure



Media coverage

Ward closure

CT
Redazione
24 giugno 2022 10:04

ATTUALITÀ

All'ospedale di Chieti chiude il reparto di Geriatria, il sindaco Ferrara: "Si continua a spogliare il nostro territorio"

Il provvedimento, firmato dal direttore Asl Thomas Schael martedì scorso, diventerà operativo martedì prossimo

Si parla di

Ospedale di Polistena, Conia: «Chiusura rianimazione è un disastro annunciato»

Il vice presidente nazionale demA, e la referente locale Creazzo, chiedono chiarezza al commissario ad Acta e presidente regionale Occhiuto

1 luglio 2022 22:00

Homepage

August 7, 2015

Sanità: la chiusura del reparto di chirurgia ortopedica pediatrica dell'ospedale dei bambini di Palermo

POLITICA SCIACCA

Reparto di Ortopedia verso la chiusura? Azione chiede chiarimenti: "Zappia risponda"

In una nota si avanza l'ipotesi di una possibile rimodulazione della struttura, che oggi serve un vasto bacino territoriale

CONFINE

Menaggio, chiude il reparto di psichiatria dell'ospedale

Le dimissioni di tre medici e il depotenziamento del servizio a Porlezza portano alla luce la carenza di personale sanitario nelle zone di frontiera

ATTUALITÀ AVERSA

Ospedale senza medici: "Pronto soccorso in affanno e un reparto a rischio chiusura"

Il 'caso Moscati' arriva in Parlamento: interrogazione al ministro Speranza

Chiusura pediatria al Frangipane: Ariano non può restare senza il punto nascite

"Vi è un costante e complessivo impoverimento dei reparti, nei termini di personale e di dotazioni"

Data

Outcome variables

Variable	Interpretation
Activity volumes and capacity use	
Surgical procedures	Inpatient/day-hospital interventions capturing changes in activity.
Utilized hospital beds	Average occupied beds, proxying capacity pressure.
Available hospital beds	Structurally available beds, measuring residual supply.
Total discharges	Total patients discharged, capturing demand absorption.
Discharged in 1 day	Short stays, informative on case-mix and selection.
Surgical discharges	Discharges with surgery, reflecting surgical case-load.
Congestion and length of stay (LOS)	
Pre-operative LOS	Days to surgery, capturing surgical delays.
Ordinary LOS	Average stay, proxying congestion and severity.
Quality of care and health outcomes	
30-day mortality (hip fracture)	Standard indicator of hospital quality under strain.
30-day readmission (hip fracture)	Measure of continuity and quality of care.
Overall mortality rate	Municipal deaths per 1,000, capturing broader population effects.
Patient mobility	
Extra-regional mobility	ASP-level net patient flows across regions, capturing spatial reallocation and access responses to closures.

Empirical Strategy

Methods

- We employ a staggered Difference-in-Differences approach to assess the impact of hospital department closures on activity volumes, congestion, and quality outcomes in neighbouring departments of the same specialty.

$$Y_{jhit} = \alpha_0 + \alpha_1(Treat_{jhi} \times Post_{jhit}) + \delta_j + \lambda_t + \gamma_{jt} + \mu_{it} + \epsilon_{jhit} \quad (1)$$

Where:

- Y_{jhit}: outcome for the neighbouring same-specialty department i of hospital h in local health authority j at time t (Leave-one-out mean).
- $Treat_{jhi} \times Post_{jhit}$: interaction identifying the post-closure exposure to a department downsizing shock.
  $\Rightarrow \alpha_1$ is the parameter of interest.
- δ_j: Local Health Authority (ASP) fixed effects
- λ_t: Year fixed effects
- γ_{jt}: ASP-by-year fixed effects
- μ_{it}: department-by-year fixed effects
- ϵ_{jhit}: error term; standard errors clustered at the hospital level.

Empirical Strategy

Methods

- The identifying assumption is that the supply shock from a ward downsizing is conditionally exogenous to volume and quality outcomes in neighbouring same-specialty departments.
- This assumption is plausible because closures were primarily driven by regional-level economic and fiscal constraints (see Ghislandi et al., 2025; Fregoni and Leonardi, 2025), rather than by pre-existing trends in health outcomes or hospital-level performance.

- We conduct additional analyses to assess heterogeneous effects:
  1. across public vs. accredited private providers;
  2. across macro-geographic areas with different capacity and access conditions;
  3. economic effects on neighbouring municipalities (forthcoming).

Regression Results: Volumes and Performance

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	Utilized hospital beds	Available hospital beds	Total discharged	Discharged 1-day	Surgical discharges	Surgical interventions
Treatment Group	0.156***	0.156***	0.224***	0.108**	0.294***	0.292***
	(0.032)	(0.030)	(0.045)	(0.048)	(0.062)	(0.061)
Observations	17,507	17,507	17,338	17,118	15,552	15,552
R-squared	0.84838	0.85010	0.86260	0.86056	0.82069	0.80466
Treatment	$\geq 50\%$	$\geq 50\%$	$\geq 50\%$	$\geq 50\%$	$\geq 50\%$	$\geq 50\%$

Notes: Standard errors in parentheses. * p<0.10, ** p<0.05, *** p<0.01.

Regression Results: Length of Stay

VARIABLES	(1) Preoperative LOS	(2) Ordinary LOS
Treatment Group	0.251***	0.308***
	(0.053)	(0.068)
Observations	17,338	15,552
R-squared	0.85	0.79
Treatment Threshold	$\geq 50\%$	$\geq 50\%$

Regression Results: Quality Outcomes

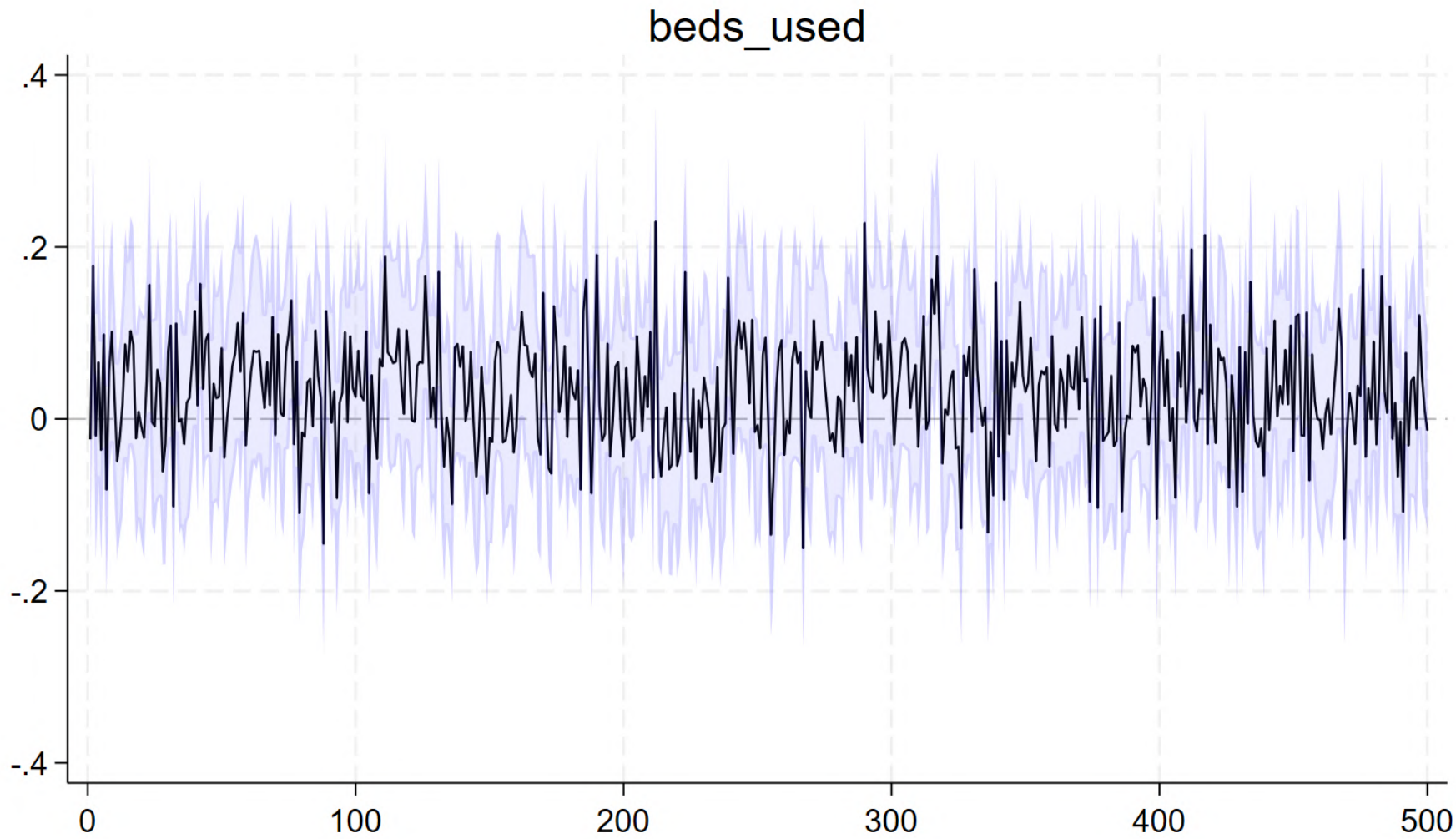
VARIABLES	(1) Mortality 30days Hip Fracture	(2) Hospital readmission 30day Hip Fracture	(3) Overall Mortality
Treatment Group	0.057**	0.023	1.300***
	(0.024)	(0.030)	(0.0521)
Observations	20,121	17,658	1,318
R-squared	0.76119	0.854456	0.7534
Treatment	$\geq 50\%$	$\geq 50\%$	2/3 tercile

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

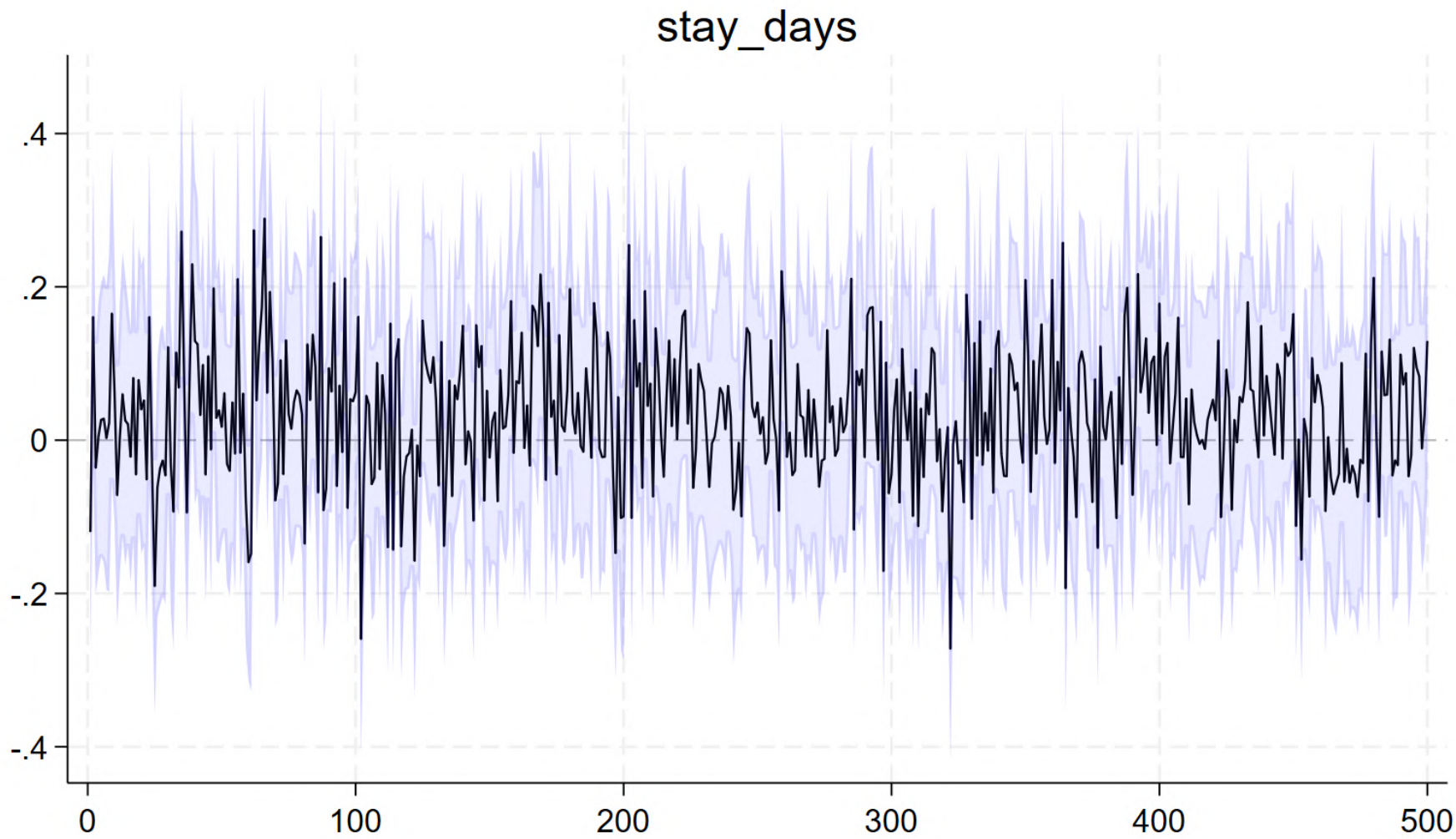
Randomization Test (Staggered DiD Robustness)

- As a robustness check, we implement a randomization (placebo) test within a staggered DiD framework.
- We randomly reassign the timing and location of the treatment (i.e. ward downsizing), while preserving the original staggered adoption structure.
- For each outcome, we re-estimate the baseline DiD specification **500 times**, replacing the true treatment with placebo treatments.
- The figures display the distribution of coefficients and confidence intervals obtained under these placebo assignments.

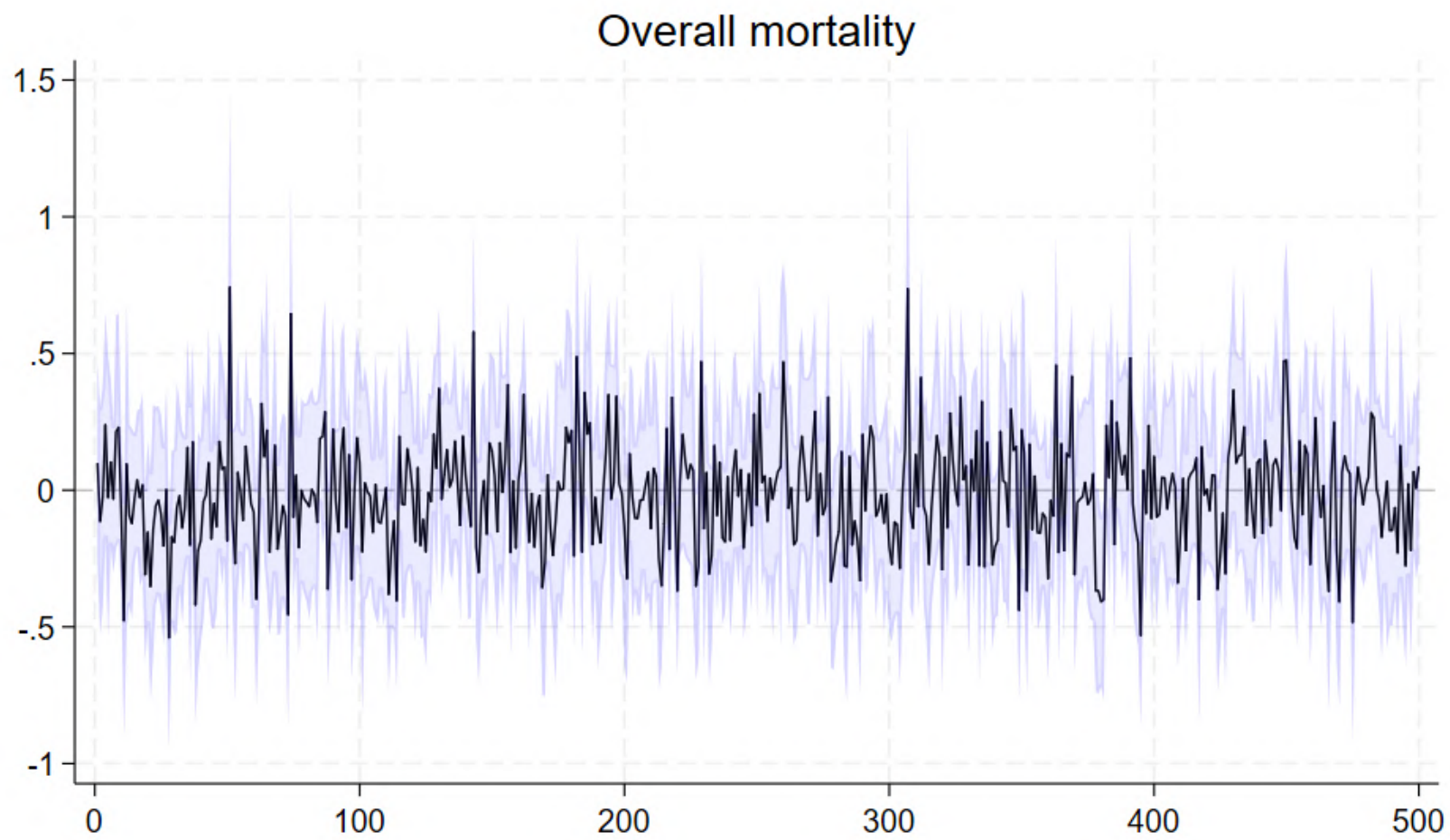
Randomization tests-Available beds



Randomization tests-LOS



Randomization tests-Overall mortality



Heterogeneity

- Effects of hospital–ward closures may vary across contexts
- Two main channels:
  - **Type of structure (Public vs. Private)**
    - Downsizing in the public sector may shift demand to private providers
    - Heterogeneity is assessed by including the interaction between $Treat_{hji} \times Post_{jit}$ and the $Private_{hji}$ and $Public_{hji}$ dummies
  - **Geographical differences (North–Centre–South)**
    - Italy shows persistent regional disparities in access and quality
    - Closures may have stronger effects in regions with weaker health systems

Public vs Private Heterogeneity: Volumes and Performance

VARIABLES	(1) Utilized beds	(2) Available beds	(3) Total discharged	(4) Discharged 1-day	(5) Surgical discharges	(6) Surgical interventions
Private Hospitals	0.075	0.088*	0.097	0.241**	0.034	0.001
	(0.051)	(0.048)	(0.073)	(0.100)	(0.110)	(0.118)
Public Hospitals	0.122***	0.136***	0.179***	0.044	0.270***	0.252***
	(0.036)	(0.034)	(0.052)	(0.052)	(0.071)	(0.070)
Observations	17,507	17,507	17,338	17,118	15,552	15,552
R-squared	0.98789	0.99008	0.99621	0.98447	0.98623	0.99045
Treatment	$\geq 50\%$	$\geq 50\%$	$\geq 50\%$	$\geq 50\%$	$\geq 50\%$	$\geq 50\%$

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.10.

Public vs Private Heterogeneity: LOS

	(1) Preoperative LOS	(2) Ordinary LOS
Private Hospitals	0.070	0.025
	(0.074)	(0.114)
Public Hospitals	0.209***	0.296***
	(0.063)	(0.078)
Observations	17,338	15,552
R-squared	0.97	0.98
Treatment	$\geq 50\%$	$\geq 50\%$

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Public vs Private Heterogeneity: Quality Outcomes

VARIABLES	(1) Mortality 30days Hip Fracture	(2) Hospital readmission 30day Hip Fracture
Private Hospitals	0.049	0.060
	(0.155)	(0.039)
Public Hospitals	0.101**	0.030
	(0.043)	(0.061)
Observations	19,879	17,424
R-squared	0.86337	0.88146
Treatment	$\geq 50\%$	$\geq 50\%$

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Geographical Heterogeneity: Volumes and Performance

VARIABLES	(1) Utilized hospital beds	(2) Available hospital beds	(3) Total Discharged	(4) Discharged 1-day	(5) Surgical Discharges	(6) Surgical procedures
North	0.184***	0.237***	0.244***	0.103	0.131	0.184
	(0.062)	(0.058)	(0.081)	(0.089)	(0.113)	(0.118)
Centre	0.107**	0.144**	0.220**	0.081	0.326***	0.333***
	(0.058)	(0.062)	(0.095)	(0.087)	(0.102)	(0.104)
South	0.150***	0.098**	0.149**	0.102	0.295**	0.273**
	(0.052)	(0.044)	(0.068)	(0.077)	(0.121)	(0.121)
Observations	17,507	17,507	17,338	17,118	15,552	15,552
R-squared	0.98628	0.98858	0.99574	0.98280	0.98389	0.98867
Treatment	$\geq 50\%$	$\geq 50\%$	$\geq 50\%$	$\geq 50\%$	$\geq 50\%$	$\geq 50\%$

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1.

Geographical Heterogeneity: LOS

	Ordinary LOS	Preoperative LOS
North	0.247***	0.117
	(0.080)	(0.118)
Centre	0.263**	0.370***
	(0.115)	(0.115)
South	0.162**	0.304**
	(0.081)	(0.131)
Observations	17,338	15,552
R-squared	0.99708	0.98823
Treatment	$\geq 50\%$	$\geq 50\%$

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Geographical Heterogeneity:Quality Outcomes

VARIABLES	(1) Mortality 30days Hip Fracture	(2) Hospital readmission 30day Hip Fracture
North	0.238***	0.040
	(0.089)	(0.061)
Centre	-0.027	0.002
	(0.047)	(0.059)
South	0.025	-0.022
	(0.027)	(0.036)
Observations	20,121	17,658
R-squared	0.91893	0.90252
Treatment	$\geq 50\%$	$\geq 50\%$

Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Effects on Extra-Regional Patient Mobility

	(1)	(2)	(3)
Dependent variable:	Extra-Regional Patient Mobility		
Treatment effect	-1.692	-2.165	-13.268***
	(12.694)	(1.916)	(2.768)
Observations	142	90	212
R-squared	0.08220	0.14348	0.53108
Macro-area	North	Centre	South
Controls	Y	Y	Y

Notes: Robust standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.10.
ASP-level data; outcome is passive/active extra-regional mobility reimbursement.

Summary of Findings

Main effects

- Department downsizing ($\geq 50\%$ bed reduction) leads to higher activity in neighbouring same-specialty wards: beds used/available, discharges, and surgical activity.
- Length of stay increases (ordinary and pre-operative), consistent with congestion and the absorption of more complex cases.
- Quality trade-offs emerge: higher 30-day mortality after hip fracture and higher overall mortality.

Public vs. accredited private providers

- Public hospitals absorb most of the reallocated demand, with large effects across volumes, LOS, and quality.
- Accredited private hospitals respond selectively, mainly through increases in 1-day discharges, consistent with cream-skimming.
- Deterioration in quality outcomes is concentrated in the public sector.

Geographical heterogeneity

- Stronger volume responses in the North and Centre; more muted effects in the South.
- LOS increases in all macro-areas, with the largest effects in the Centre.
- Outward patient mobility rises only in Southern regions, indicating limited local absorption capacity.

Conclusion and Next Steps

What we learn so far

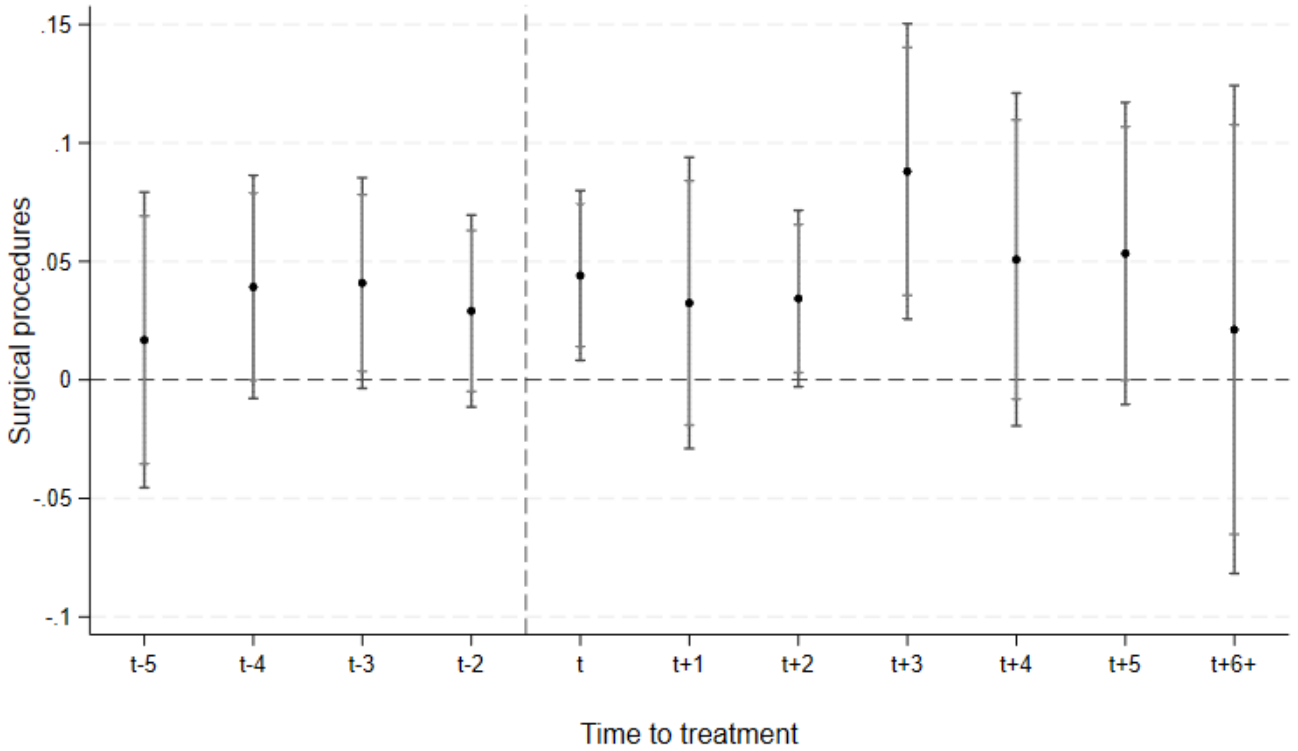
- Hospital department downsizing acts as a local supply shock with system-wide spillovers across neighbouring same-specialty wards.
- Patient reallocation leads to higher volumes and congestion, and is associated with non-negligible quality trade-offs, especially in public hospitals and capacity-constrained areas.
- Effects are heterogeneous across territories and provider types, with limited local absorption and stronger mobility responses in the South.

Work in progress / next steps

- We are extending the analysis with additional robustness checks (alternative definitions of downsizing, timing, exposure, and spillovers).
- We are currently exploring place-level effects of hospital downsizing. Preliminary estimates suggest:
  - lower natality in areas experiencing reductions in maternal beds,
  - higher poverty rates and
  - increased out-migration.

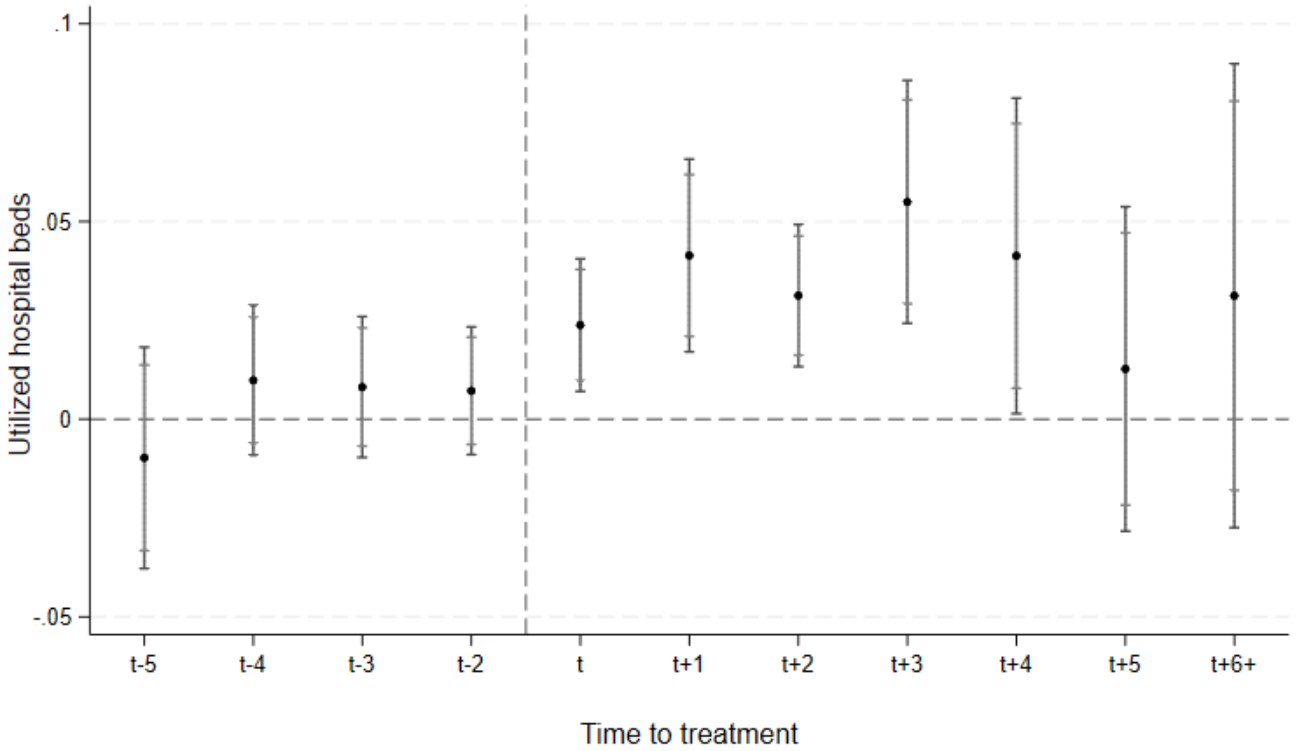
Event study

Results on Volumes & Performance



Event study

Results on Volumes & Performance



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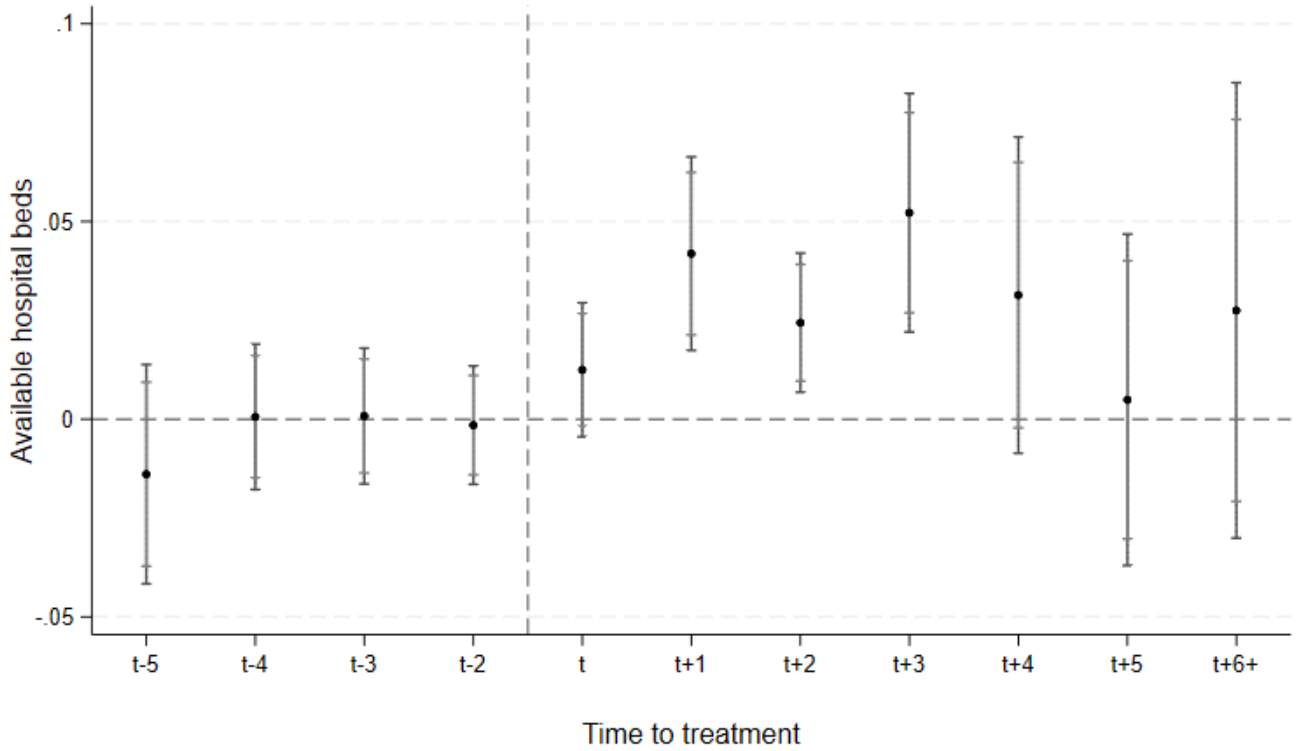
Results on Volumes & Performance



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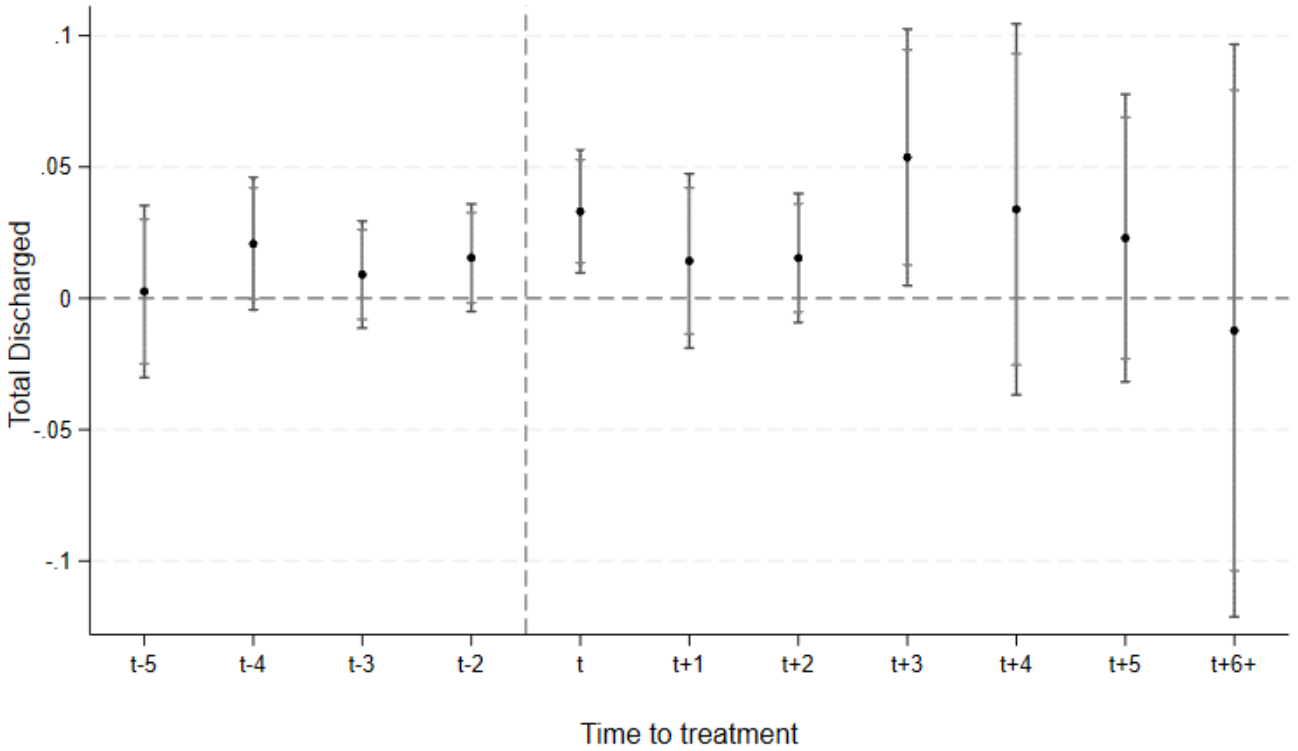

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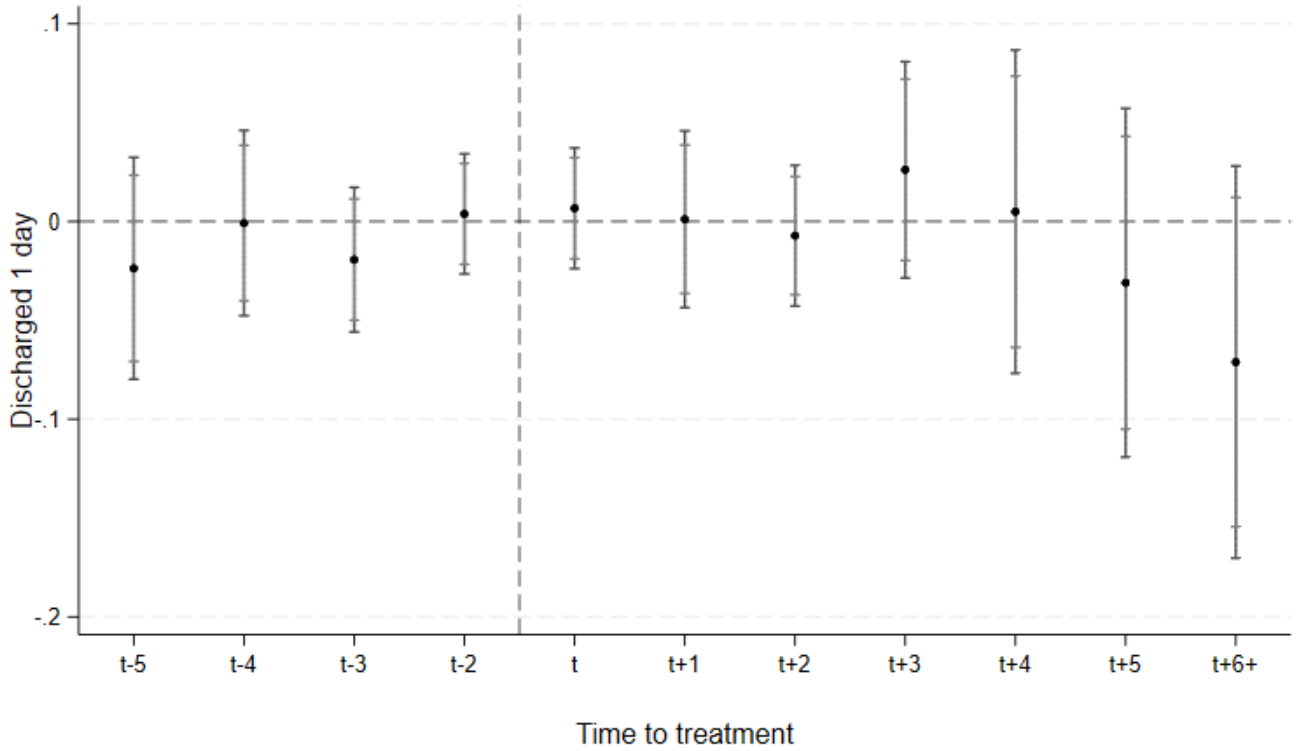

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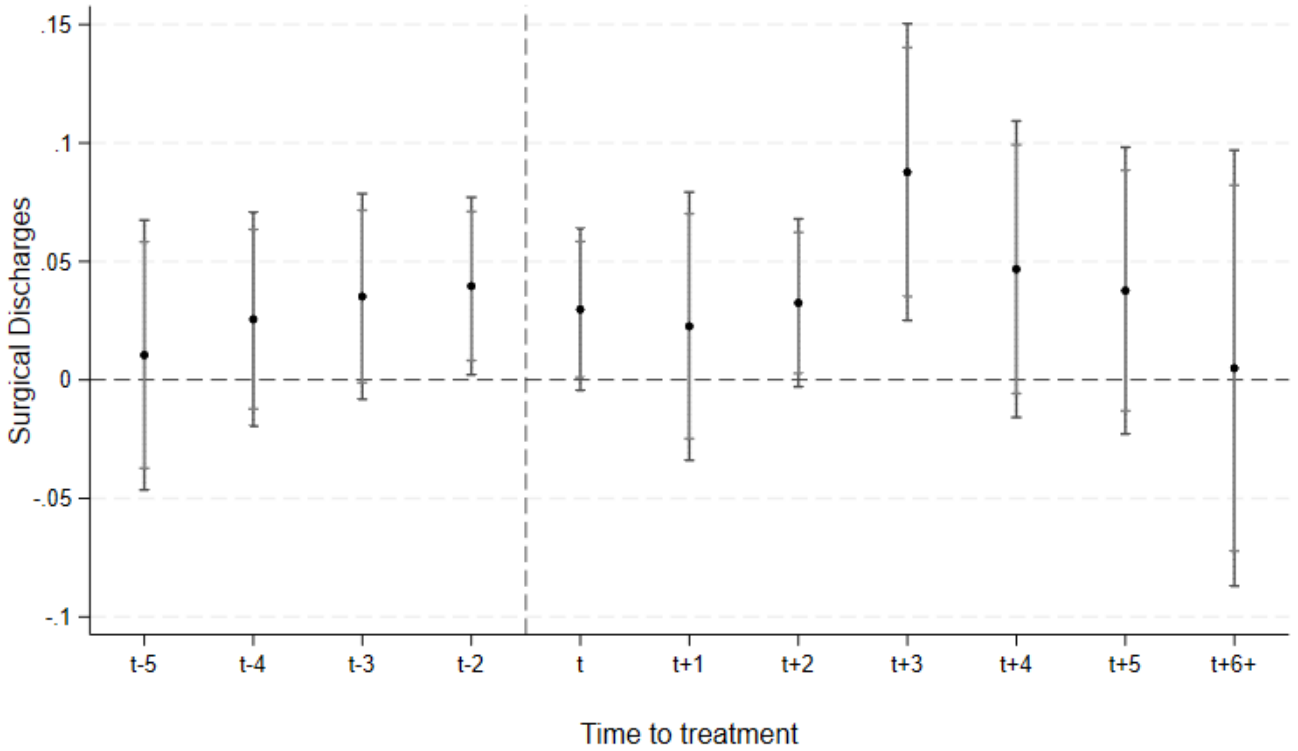
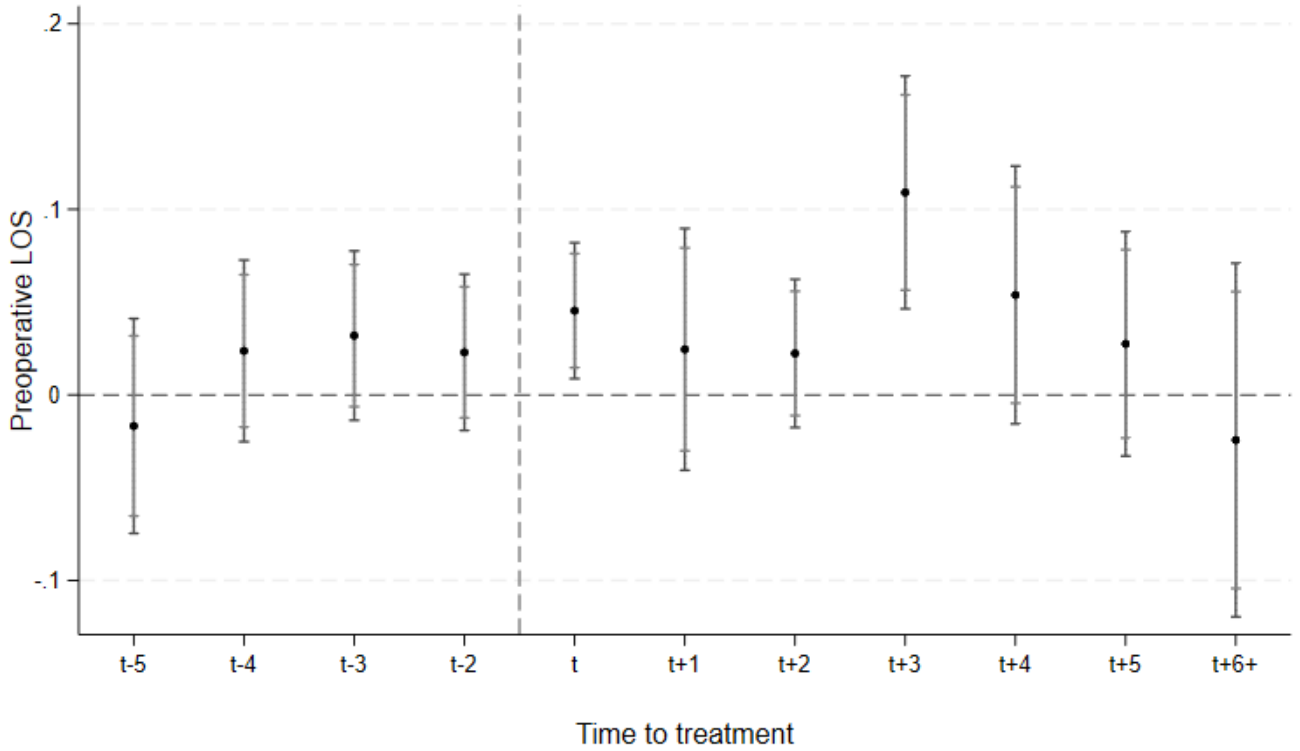


Event study

Results on LOS



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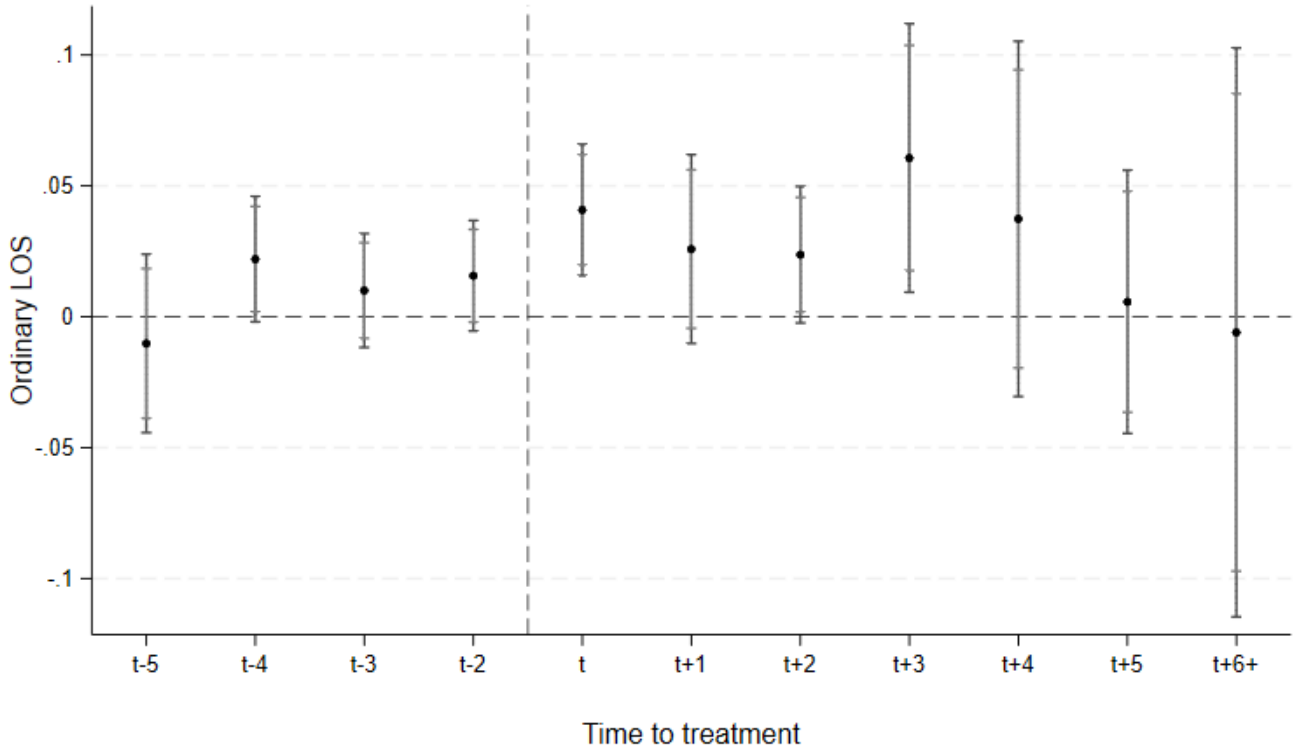
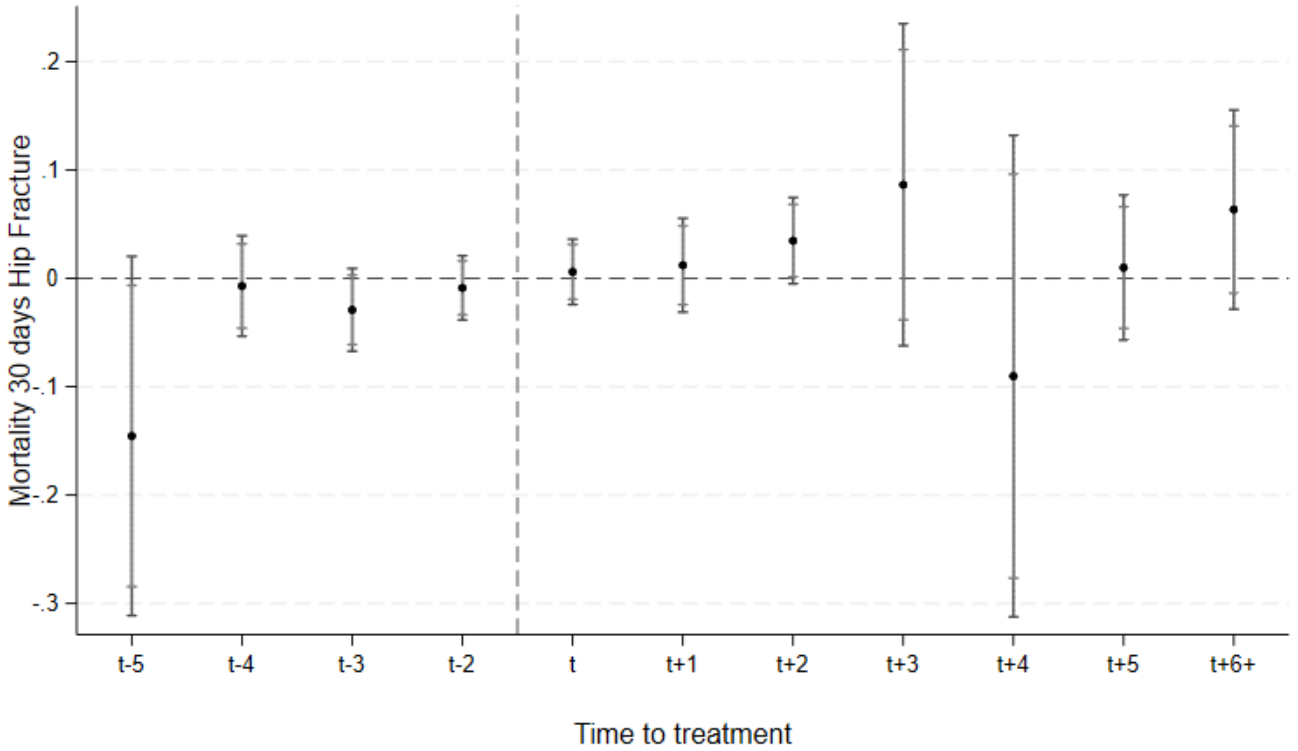
Results on LOS



Event study

Results on Health Quality



Event study

Results on Health Quality