Public Managers and Hospital Performance

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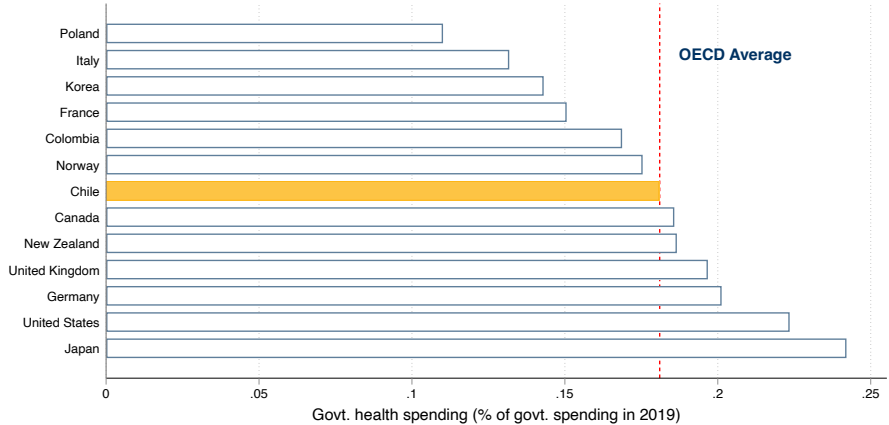
  (Janke et al. 2020, Bertrand et al. 2020, Fenizia 2022, Besley et al. 2022)
  1. shortage of quasiexperimental variation in state personnel selection processes
  2. lack of objective and verifiable performance outcomes in the public sector

This paper

- Study a reform in Chile that changed the selection process for public managers
- Focus on public hospitals
  - observe objective, reliable, and relevant short-term outcomes

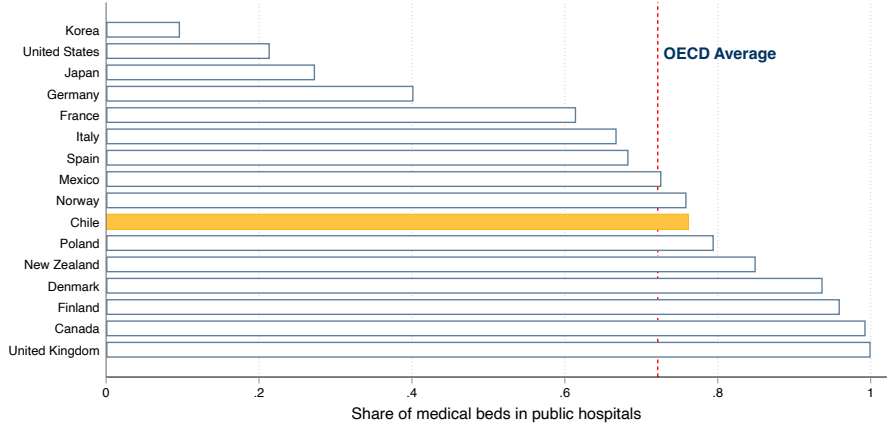
$\Rightarrow$ Examine the impact of newly appointed CEOs on hospital outcomes, and mechanisms

Health sector is large and costly



- $\approx$ 20% of govt. spending goes to healthcare
- Health care costs increasing rapidly: 15% in OECD countries (2000-19)

Public hospitals are important for access and equity



- Largest providers of medical beds in developed countries
- Maintain a minimum level of access in underserved communities

Chile provides an interesting and informative case study

- In 2003, govt. introduced a reform to strengthen selection system of top managers
  - provides quasi experimental variation in the quality of appointed managers
- Very limited scope for selection in public tertiary care
  - patients cannot choose providers, and hospitals cannot select patients
  - patients referred to public hospitals following strict referral guidelines
- Representative of the average OECD country in health outcomes

Three main findings

1. The policy reduced hospital mortality between 9% - 14%, and persisted after 3 years

2. The financial incentives included in the reform—performance pay and higher wages—do not explain our findings

3. The policy changed the pool of CEOs: displaced older doctors with no management training in favor of younger CEOs with training in management
    - Reform affected hospital mortality mostly when new CEOs had management studies
    - New managers introduced more efficient use of medical resources and better personnel practices

Related literature

- Impact of discretionary appointments on performance: Myerson 2015; Padró i Miquel et al. 2018; Xu 2018; Colonelli et al. 2021; Voth and Xu 2021
- Impact of managers and managerial skills in public organizations: Bloom et al. 2015a; Bloom et al. 2015b; Rasul and Rogger 2018; Fenizia 2022; Limodio 2021; Janke et al. 2020; Muñoz and Prem 2021
- Health personnel and health outcomes: Propper and Van Reenen 2010; Friedrich and Hackmann 2021
- Management and hospital performance: Bloom et al. 2014; Bloom et al. 2020; Janke et al. 2021
- Performance of public hospitals: Gaynor et al. 2013; Propper et al. 2015
- Effects of financial incentives on sorting into the public sector: Dal Bó et al. 2013; Ferraz and Finan 2011
- State personnel and productivity: Finan et al. 2017; Deserranno et al. 2022

Outline of this talk

1. **Setting, reform overview, and data**
2. Reform impact on hospital performance
3. Financial incentives effects of the reform
4. Recruitment effects of the reform
5. Conclusion

The healthcare system in Chile

- Health system has both public and private health insurers and providers
- Public insurance is funded by general taxation and payroll taxes
  - individuals without the ability to pay can freely access the public system

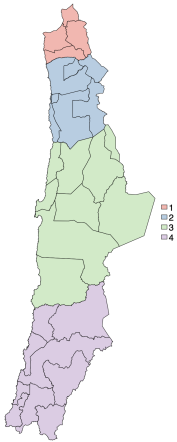
  $\Rightarrow$ nearly universal health coverage
- Individuals can opt-out and use their health contributions to buy private insurance
  - 78% of the population under public insurance and 15% have private insurance
- Individuals with public insurance cannot choose provider within the public network
  - 97% of patients in public hospitals are under public insurance

Very little scope for selection within public network

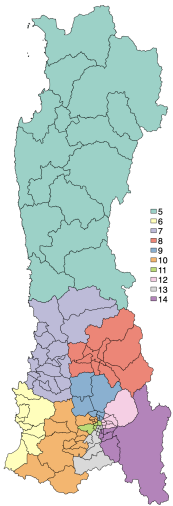
- Individuals need to register in the primary healthcare center nearest to their residence
- Patients who need specialized attention are referred to specialty clinics or a hospital
- Referrals follow strict referral and counter-referral guidelines
  - based on primary care center location, and patient demographics and diagnosis

    ▸ example ▸ evidence

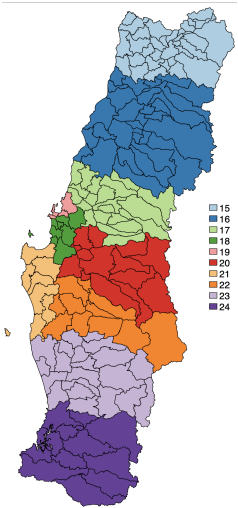
Healthcare provision is organized geographically



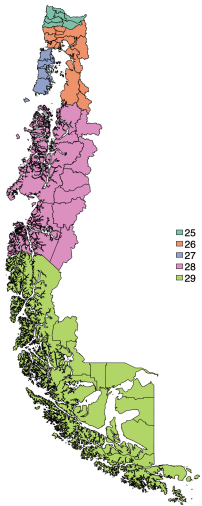
North



North-Center

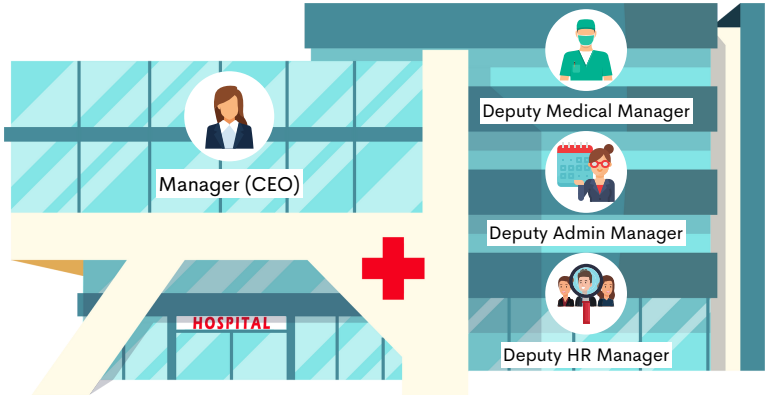


Center-South



South

Managerial structure in public hospitals



- CEO duties include: *(i)* personnel administration, *(ii)* allocation of inputs and human resources, *(iii)* management of financial resources and proposing annual budget, *(iv)* infrastructure and technological equipment decisions

Recruitment reform

- In 2003, Congress passed a reform to attract talent to public management positions

  "to provide government institutions—through public and transparent competitions— with executives with proven management and leadership capacity to execute effectively and efficiently the public policies defined by the authority"

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- Two components of the reform:
  1. selection: competitive recruiting process
  2. financial incentives: substantial wage increase + performance pay

1. Selection process of top managers

- Before the reform: discretionary appointments by the superior officer
- After the reform: elected through public, competitive, and transparent competitions

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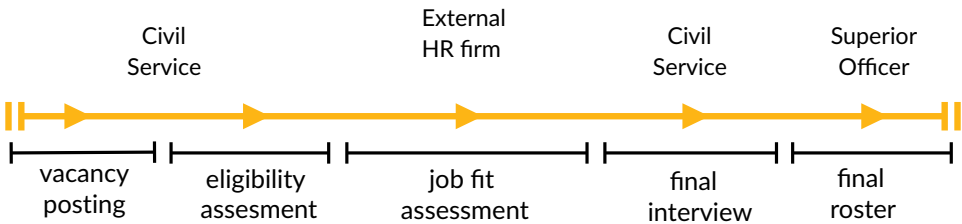

▸ Detailed process

2. Financial Incentives

(i) Higher base wages in the form of a monthly unconditional bonus
- bonus represents a 33% increase in the position's pay

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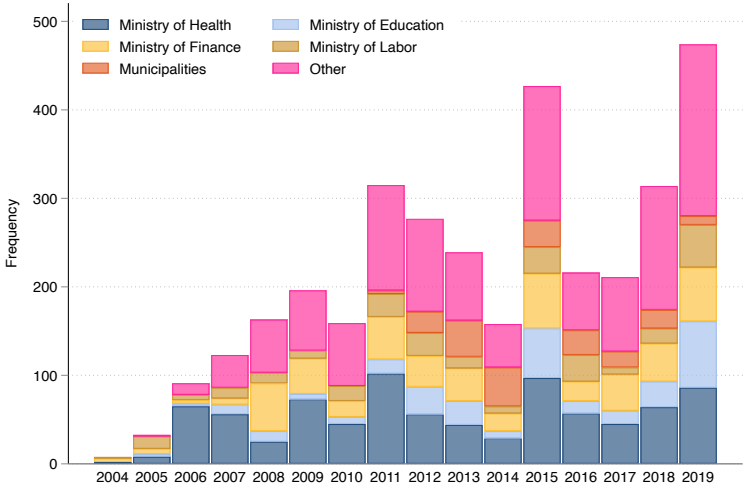
(ii) Performance pay incentives:
- only small penalty and no possibility of wage increase ‣ Schedule

Reform gradually implemented across organizations

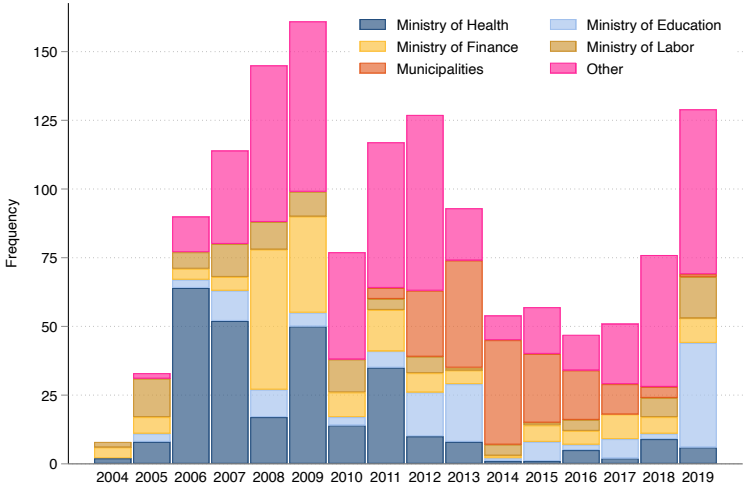
- Adoption occurs across several public organizations and is specific to a given position
- Once a position adopts the reform, has to select future managers by the new process
  $\Rightarrow$ treatment is an absorbing state
- Adoption mainly explained by:
  1. constrained capacity of the Civil Service
     - in public hospitals, priority depends mainly on size/complexity
  2. turnover of incumbent managers in the position

Reform gradually implemented across organizations



Number of recruitment processes overseen by the Civil Service

Reform gradually implemented across organizations



Number of public agencies adopting the recruitment process for the **first time**

▸ Hospital adoption ▸ By hospital type

Data

1. **Employees in the public health sector**
   - [NEW] identity and characteristics of public hospitals managers (2001-19)
   - restricted-use admin. records covering the universe of employees (2011-19)

2. **Health Outcomes**
   - individual-level discharges in all public hospitals (2001-19)
   - individual-level death records (2001-18)
   - hospital-level inputs and procedures (2009-19)

3. **Civil Service**
   - timing of adoption of the reform
   - CEOs performance score

▸ Details

Data

- Main outcome variable is hospital mortality
  - used extensively to measure output-based hospital performance
    (Gaynor et al. 2013; Bloom et al. 2015; Doyle et al. 2015; Gupta 2021; Chan et al. 2022)
- Construct death indicators at patient level following a hospital event
  - merge inpatient and death records, regardless of location
  - in-hospital deaths could miss patients who die shortly after discharge
    (Gaynor et al., 2013)
- Hospital mortality is share of in-hospital deaths + out-of-hospital deaths 28 days after admission
- Aggregate the data at hospital-by-quarter level for the analysis

Descriptive statistics

	Mean	Std. Dev.	Bottom 10%	Median	Top 10%	# of Obs.
	(1)	(2)	(3)	(4)	(5)	(6)
Hospital Outcomes:						
Number of Deaths	38.21	63.27	1.00	12.00	116.00	13,988
Death Rate	2.46	1.94	0.38	2.15	4.69	13,988
Death Rate 28 days	4.21	2.87	1.18	3.66	7.83	13,988
Death Rate ER	3.01	3.53	0.15	2.55	5.69	11,087
Actual over Predicted Death Rate	0.77	0.48	0.16	0.74	1.34	13,988
Hospital Characteristics:						
High-level Hospital	0.33	0.47	0.00	0.00	1.00	13,988
Medium-level Hospital	0.15	0.36	0.00	0.00	1.00	13,988
Total Number of Patients	1,491	2,006	101	587	4,568	13,988
Total Number of Beds	143	177	16	65	415	13,946
Total Number of Surgeries	461	867	0.00	4	1,730	13,988
Physicians per 100 patients	6.75	8.58	2.30	4.91	11.89	6,624
Nurses per 100 patients	6.17	7.72	2.22	4.79	9.89	6,624

Descriptive statistics

	Mean	Std. Dev.	Bottom 10%	Median	Top 10%	# of Obs.
	(1)	(2)	(3)	(4)	(5)	(6)
Patient Characteristics:						
% Female	0.59	0.08	0.47	0.60	0.68	13,988
% Age $<$ 29	0.36	0.16	0.14	0.37	0.49	13,988
% Age $\in$ (30,29)	0.12	0.05	0.06	0.12	0.17	13,988
% Age $\in$ (40,49)	0.10	0.04	0.06	0.10	0.13	13,988
% Age $\in$ (50,59)	0.10	0.04	0.06	0.09	0.14	13,988
% Age $\in$ (60,69)	0.11	0.05	0.07	0.10	0.16	13,988
% Age $\in$ (70,79)	0.12	0.06	0.06	0.11	0.20	13,988
% Age $\in$ (80,89)	0.09	0.06	0.03	0.07	0.16	13,988
% Age $>$ 89	0.02	0.02	0	0.01	0.05	13,988
% Public Insurance	0.96	0.05	0.92	0.98	1.00	13,988

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Impacts on hospital performance

- We estimate the following staggered differences in differences:

$$y_{ht} = \alpha_h + \gamma_t + \beta \times \text{Reform}_{ht} + X'_{ht}\Delta + \epsilon_{ht}, \tag{1}$$

  - y_{ht} is a logged measure of an outcome at hospital h at time t
  - Reform_{ht} is a dummy variable indicating a hospital adopted the selection process
  - Standard errors clustered at the hospital level

- β summarizes the impact of the reform

- Identifying assumption: parallel trends in absence of the policy

Main results

	Ln Death Rate						Poisson
	All			28-days	ER	ER: AMI	# Deaths
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1 if reform adopted in hospital	-0.131***	-0.091***	-0.141***	-0.099***	-0.153***	-0.269**	-0.055***
	(0.025)	(0.024)	(0.022)	(0.017)	(0.025)	(0.119)	(0.016)
Observations	8,104	8,104	8,104	8,104	6,592	771	8,104
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hospital FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Case Mix Controls	No	Yes	Yes	Yes	Yes	Yes	Yes
Flexible Interaction of Case Mix	No	No	Yes	Yes	Yes	No	Yes
# of Hospitals	181	181	181	181	175	89	181
Mean Dep. Variable (levels)	2.625	2.625	2.625	4.726	3.088	30.22	21.85

CMS risk-adjusted results

- Concern: hospital death rates might reflect shifts in patient characteristics
- CMS risk-adjusted mortality is a reliable and valid indicator of hosp. quality in the U.S. (Doyle et al. 2019)
  - the institutional setting is prone for patient selection
- Procedure:
  1. Fit a logit of dead at the patient level on a set patient charac. in the pre-period
  2. Predict death likelihood at the patient level
  3. Compute the average predicted death rate at the hospital level, $\bar{y}_{ht}$
  4. Risk-adjusted mortality is $y_{ht} - \bar{y}_{ht}$

CMS risk-adjusted results

	Death Rate			
	Ln Predicted	Ln Actual/Predicted		
	(1)	(2)	(3)	
1 if reform adopted in hospital	-0.004	-0.086***	-0.090***	-0.089***
	(0.004)	(0.023)	(0.024)	(0.024)
Observations	8,104	8,104	8,104	8,104
Time FE	Yes	Yes	Yes	Yes
Hospital FE	Yes	Yes	Yes	Yes
Patient Demographics	Yes	Yes	Yes	Yes
Type of Insurance	Yes	No	Yes	No
Enhanced Elixhauser Comorbidity Index	Yes	No	No	Yes
Pseudo-R^2 Logit		0.147	0.158	0.176
# of Hospitals	181	181	181	181
Mean Dep. Variable	3.506	0.780	0.712	0.737

Validity of results and alternative explanations

1. Testing for parallel trends: event study evidence
2. Testing for patient selection
3. Manager transition mechanical effect

1. Testing for parallel trends

- We estimate the following event study:

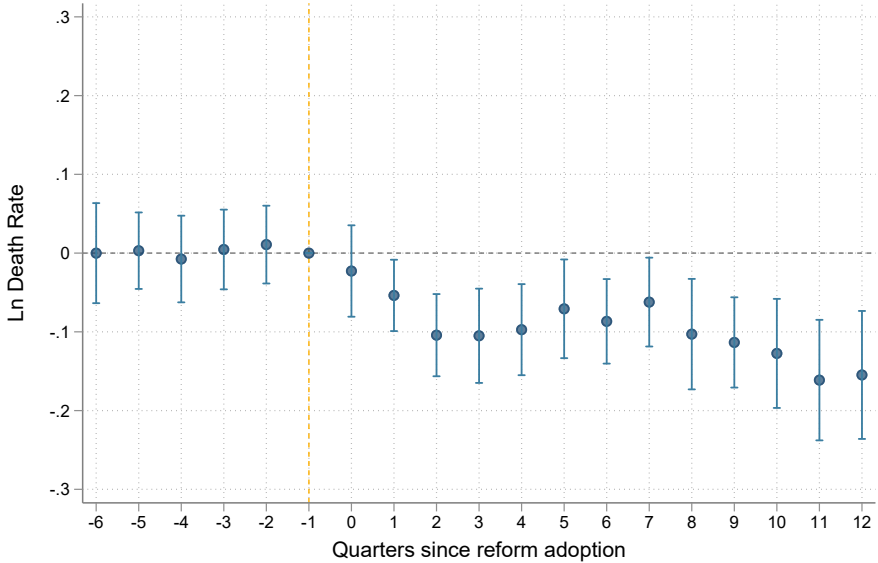
$$y_{ht} = \alpha_h + \gamma_t + \sum_{k=-6}^{12} \beta_k D_{ht}^k + X_{ht}'\Delta + \epsilon_{ht}, \tag{2}$$

  - y_{ht} is a logged measure of an outcome at hospital h at time t
  - D_{ht}^k is a dummy variable indicating a hospital adopted the new selection process k periods earlier or ahead
  - Standard errors clustered at the hospital level

- β_k are the effects of adoption new selection process for each k quarter

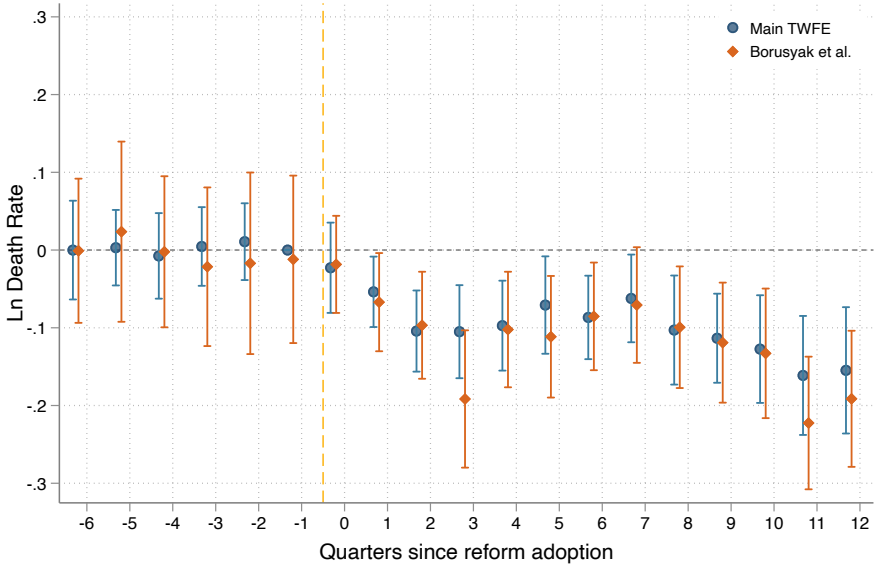
- Identifying assumption: parallel trends in absence of the policy

1. Event study evidence



1. Event study evidence

▸ Poisson Model ▸ Honest pre-trends



2. Testing for patient selection

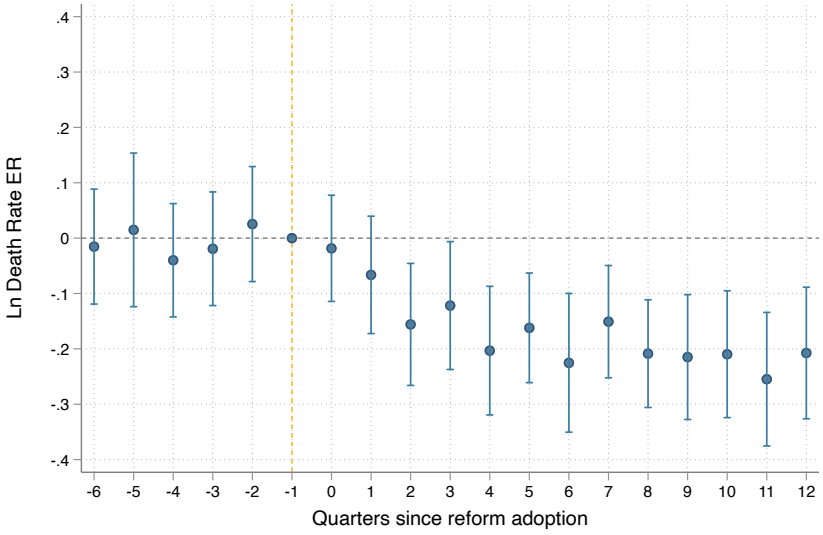
2.1. Results are robust in specifications for ER patients

2.2. Composition of diagnoses does not change after reform adoption

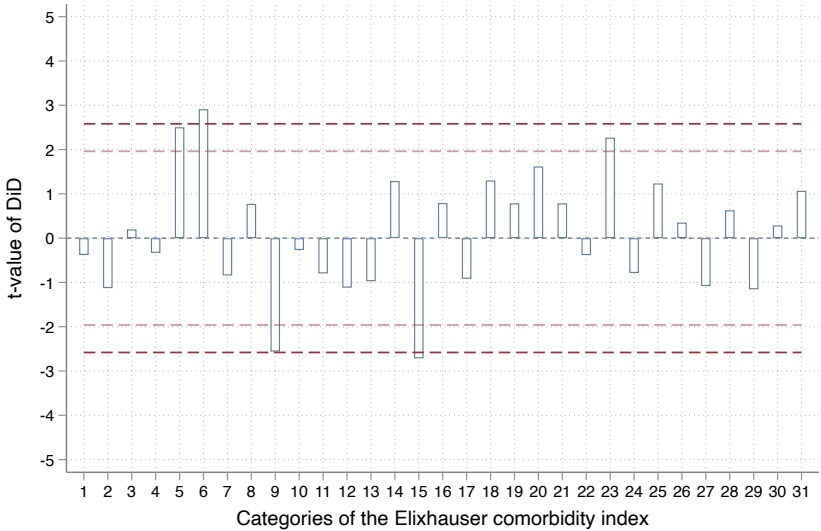
2.3. No evidence of supply-side unobserved selection

2.4. No evidence of unobserved patient sorting (demand-side unobserved selection)

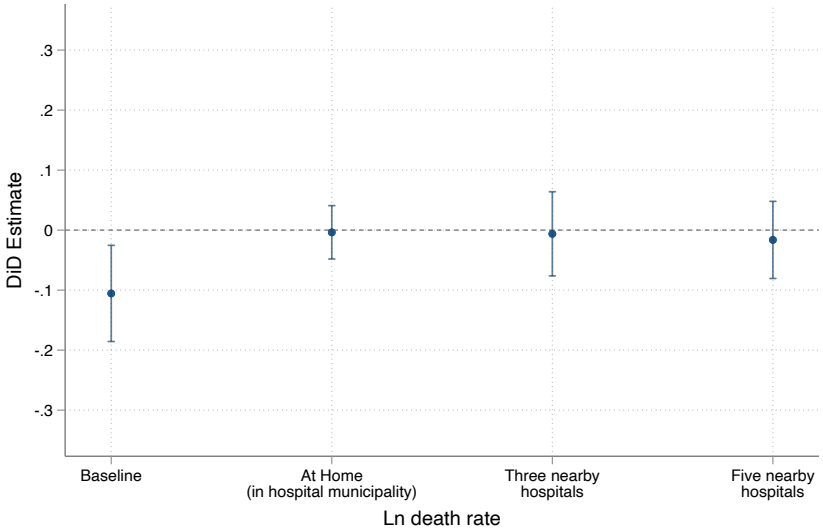
2.1. Results are robust in specifications for ER patients



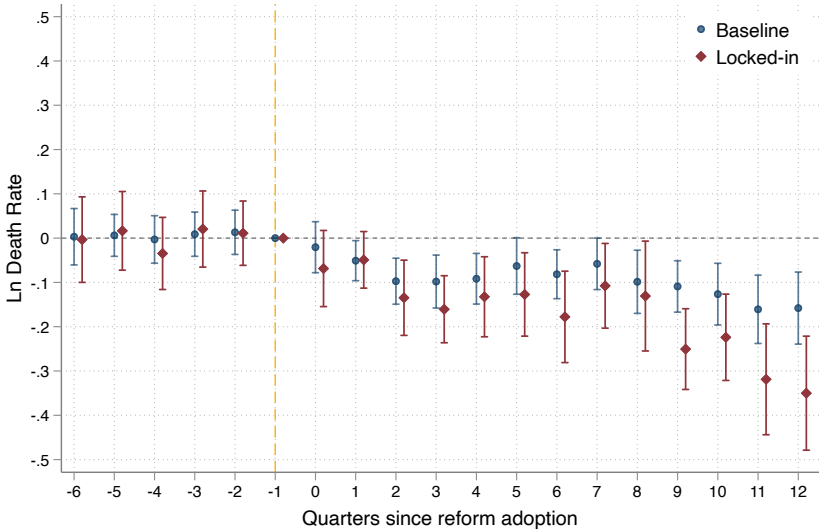
2.2. Diagnoses composition doesn't change after adoption



2.3. No evidence of supply-side unobserved selection



2.4. No evidence of unobserved patient sorting



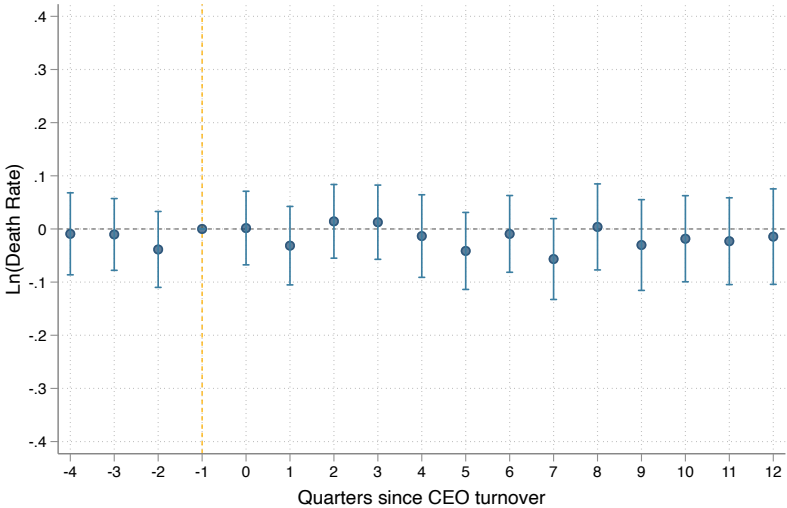
3. Are results mechanically explained by CEO transitions?

- Stacked event study to deal with multiple CEO transitions within hospital
  (Cengiz et al. 2019, 2022; Baker et al. 2021; Atal et al. 2022)
- An event is a CEO transition in a never treated or yet-to-be treated hospital
- For each event:
  - define a time window around turnover event: [-4, 12]
  - define a control group of hospitals with no turnovers in the time window
- Select valid events: balanced & no turnovers in 4 periods before event
- Append data for all valid events and estimate:

$$y_{hte} = \alpha_{he} + \gamma_{te} + \sum_{k=-4}^{12} \beta_k D_{hte}^k + \epsilon_{hte}, \tag{3}$$

  - e is a valid turnover event

3. Are results mechanically explained by CEO transitions?



Stacked Event Study: Event is manager transition (excluding after-reform periods in treated units)

CEO selection reform in context of other policies

Policy	Paper	Death rate definition	Average death rate	Impact on death rate	Sample of patients
(1)	(2)	(3)	(4)	(5)	(6)
Spending					
↑ 10% p/capita	Doyle et al. *JPE* '15	All, 1-year	37%	↓ 6%	ER + Amb. + ≥ 65*
	Ours		32%	↓ 7%	ER + ≥ 65
Public vs Private					
VA v. Non-VA hospitals	Card & Chan '22	All, 1-year	29%	↓ 7%	ER + Amb.+ ≥ 65
	Ours		32%	↓ 7%	ER + ≥ 65
Competition					
+1 hospital in neighborhood	Bloom et al. *ReStud* '15	In-hospital, 28-day	15%	↓ 10%	ER + AMI
	Ours		30%	↓ 27%	ER + AMI
↓ 10% HHI	Gaynor et al. *AEJ EP* '13	In-hospital, 28-day	1.6%	↓ 1%	All patients
	Ours		2.3%	↓ 15%	All patients
↓ 10% HHI	Gaynor et al. *AEJ EP* '13	All, 30-day	7%	↓ 3%	AMI + ages 35-74
	Ours		28%	↓ 20%	AMI + ages 35-74

Notes: AMI: Acute Heart Infarction; Amb: arriving by ambulance; *: non-deferrable medical conditions.

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Financial incentives effects of the reform

- Reform included financial incentives: performance pay incentives and higher wages
- Lack of financial incentives often pointed as a source of inefficient performance
- Financial incentives can increase performance of public employees
  (Khan et al., 2015; Biasi, 2021; Deserranno et al., 2022)

$\Rightarrow$ Financial incentives might induce managers to exert higher effort and explain results
(Lazear 2000, Katz 1986)

Performance pay incentives

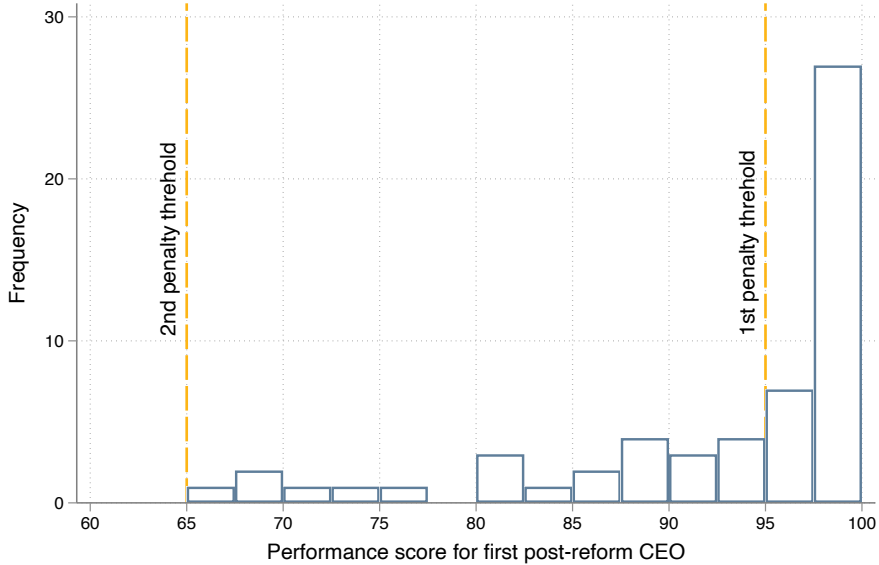
- Compensation includes performance pay incentives according to:

$$\text{Yearly Wage}_t = \begin{cases} 100\% & \text{if performance}_{t-1} \geq 95\% \\ 98.5\% & \text{if } \quad 65\% \leq \text{performance}_{t-1} < 95\% \\ 93\% & \text{if performance}_{t-1} < 65\% \end{cases}$$

  - performance incentives de-facto lax, non-binding, and apply after second year

Results are not driven by performance pay

▸ Regression results



Are results driven by higher wages?

- Selection reform increased wages by $\approx$ 33% on average ‣ Wage effects
- Aim: isolate effect of efficiency wages (if any)
- Exploit an amendment to the reform that changed the pay scheme:
  - Doctors appointed after Nov. 2016 could choose medical laws pay grade or public employees pay grade
  - Change did not affect pay for managers with no med degree

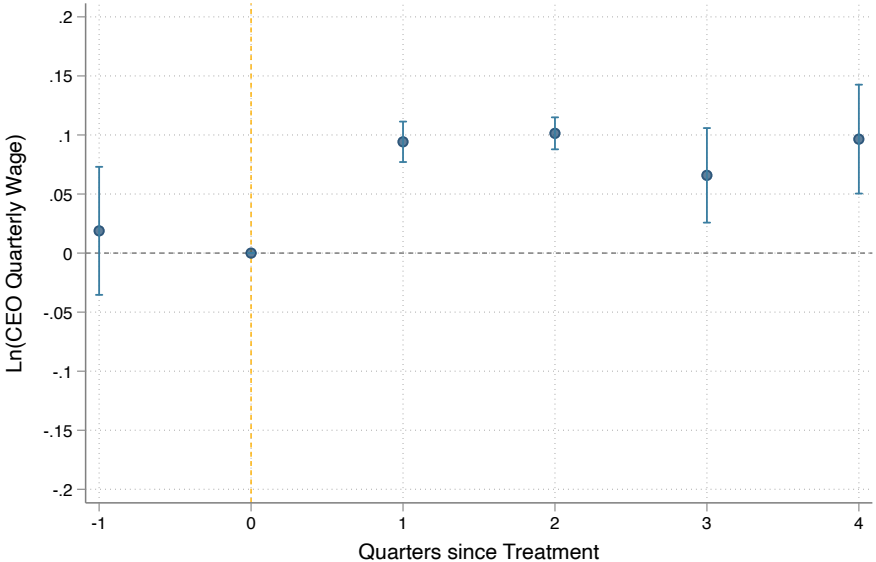
Amendment to the reform: stacked event study

- Turnover is an event if: after 11/16, using new selec. system & new manager is doctor
- For each event:
  - define time window around turnover event: [-1, 4]
  - define control group:
    (i) units with no turnover
    (ii) turnovers to professionals other than doctors
- Select valid events (26/35): balanced & no turnovers 3 periods before event
- Append data for all valid events and estimate:

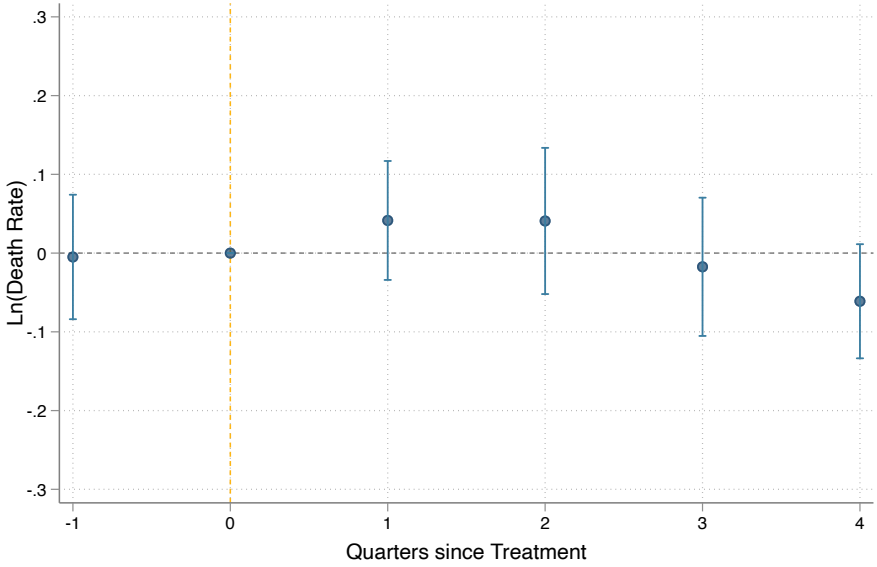
$$y_{hte} = \alpha_{he} + \gamma_{te} + \sum_{k=-1}^{4} \beta_k D_{hte}^k + \epsilon_{hte}, \tag{4}$$

  - e is a valid turnover event
  - y is either the manager's wage or the hospital's death rate

Amendment to the reform effect on wages



Results are not explained by higher wages



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Recruitment effects of the reform

- Impact of the reform on CEO characteristics
- Skills mismatch
- Hospital efficiency
- Alternative research design

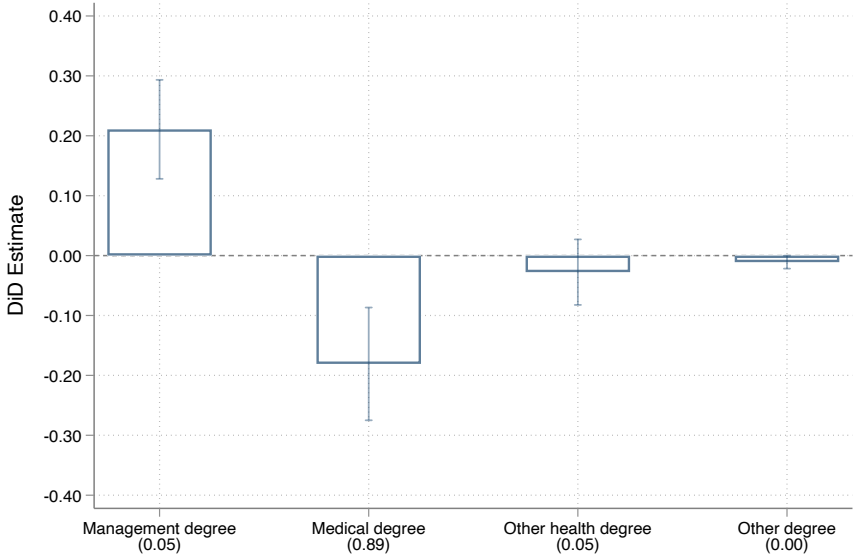
Impact of the reform on CEO characteristics

- We estimate the following staggered differences in differences:

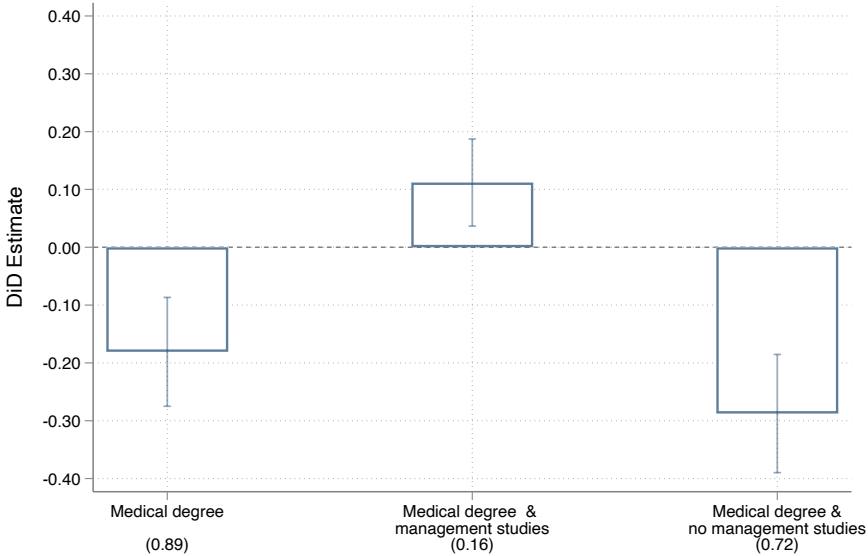
$$X_{M(h,t)} = \alpha_h + \alpha_t + \beta \times \text{Reform}_{ht} + \epsilon_{ht}, \tag{5}$$

  - $M(h,t)$ is a function indicating the identity of the CEO of hospital h at time t
  - X are an individual-specific traits
  - Reform_{ht} takes value 1 after hospital h adopts new selection process and 0 otherwise
  - The coefficient of interest is β

Reform decreased % of doctors in CEO positions



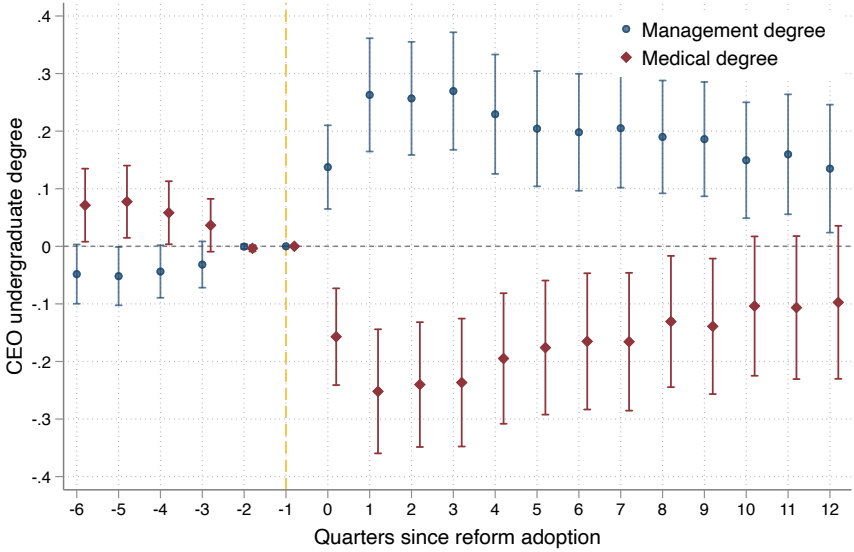
Reform only displaced doctor CEOs w/o mgmt. training



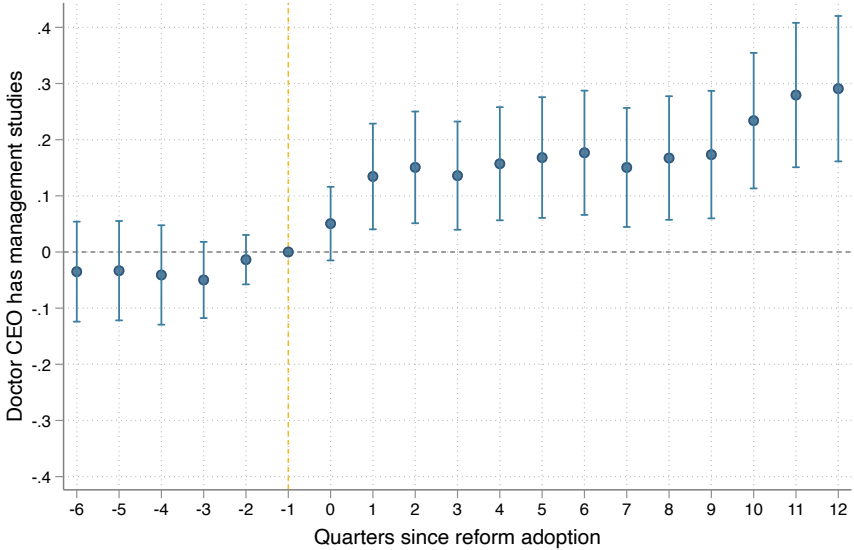
Effect of new selection process on CEO's covariates

	Management Education				Skills			Demographics	
	Mgmt. Undergrad.	Mgmt. Postgrad. Studies	Any Mgmt. Studies	Any Mgmt Studies	Avg. PSU Score	Math Specific Exam	Science Specific Exam	Age	Female
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1 if reform adopted in hospital	0.21***	0.33***	0.37***	0.22***	-0.12	0.09	-0.14***	-1.82*	-0.02
	(0.04)	(0.05)	(0.05)	(0.06)	(0.10)	(0.07)	(0.05)	(1.04)	(0.05)
Sample	All	All	All	Doctor CEOs	All	All	All	All	All
Observations	8,953	8,953	8,996	6,354	7,654	6,053	6,053	8,700	8,953
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hospital FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of Hospitals	186	186	188	182	183	167	167	186	186
Mean Dep. Variable	0.05	0.24	0.25	0.20	1.97	0.71	0.96	49.83	0.22

Dynamic effects on CEO educational background



Reform incentivized doctors to study management



Reform incentivized doctors to study management

Formación & Carrera

MBA en salud para que médicos chilenos entren al mundo del management

La Universidad Mayor y la UNAB imparten programas de gestión hospitalaria.
Autor: AméricaEconomía.com | 12 November 2010

Algunas universidades chilenas ofrecen MBA en Salud, para que sus egresados puedan trabajar en cargos administrativos como gerentes o directores de hospitales e incluso Seremis.

Una de las instituciones que ofrece este MBA con especialización en Salud es la Universidad Andrés Bello (Unab), que permite a los alumnos adquirir y profundizar materias como economía, administración, marketing, epidemiología aplicada al management y gestión clínica.

La Unab ha realizado 21 versiones de este programa desde 2005, y su éxito se basa en su realización en varias ciudades del país, desde Iquique a Punta Arenas, en hoteles y hospitales, con más de 500 graduados, indicó el diario La Tercera.

También existe una versión de Alta Dirección, dirigida a profesionales con mayor experiencia y que pretenden alcanzar o mantenerse en altos puestos directivos. La diferencia de este programa es que cuenta con una doble titulación con la Escuela de Negocios Iede-UEM de España, incluso uno de los tres semestres que dura el MBA es impartido íntegramente por profesores españoles, y es necesario que los alumnos realicen una pasantía en Europa.

La Universidad Mayor cuenta con el MBA en Dirección y Gestión en Salud, un programa de un año y medio con un enfoque más estratégico, centrado en la solución de problemas, desarrollo del emprendimiento para nuevas ideas de negocios. El magíster de 18 meses cuenta con tres líneas de desarrollo, el análisis estratégico, gestión de empresa y dirección estratégica.

Este programa posee convenio de Grado Convalidado (Join Degree) con instituciones de Estados Unidos como la Universidad de North Florida y la Texas Christian University. En España, cuenta con el respaldo del EAE Business School.

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Negocios & Empresas
Nordstrom adopta una "píldora venenosa" luego de que Liverpool de México compró una participación

Reform incentivized doctors to study management

Some Chilean universities offer an MBA in Health, so that their graduates can work in administrative positions such as managers or directors of hospitals and even Seremis.

One of the institutions that offers this MBA with a specialization in Health is the Andrés Bello University (Unab), which allows students to acquire and deepen subjects such as economics, administration, marketing, epidemiology applied to management and clinical management.

Unab has carried out 21 versions of this program since 2005, and its success is based on its implementation in several cities in the country, from Iquique to Punta Arenas, in hotels and hospitals, with more than 500 graduates, reported the newspaper La Tercera.

There is also a Senior Management version, aimed at professionals with more experience and who intend to achieve or remain in senior management positions. The difference of this program is that it has a double degree with the Iede-UEM Business School of Spain, even one of the three semesters that the MBA lasts is taught entirely by Spanish professors, and it is necessary that the students carry out an internship in Europe.

Universidad Mayor has the MBA in Health Management and Management, a one-and-a-half year program with a more strategic focus, focused on problem solving, development of entrepreneurship for new business ideas. The 18-month master's degree has three lines of development: strategic analysis, business management and strategic direction.

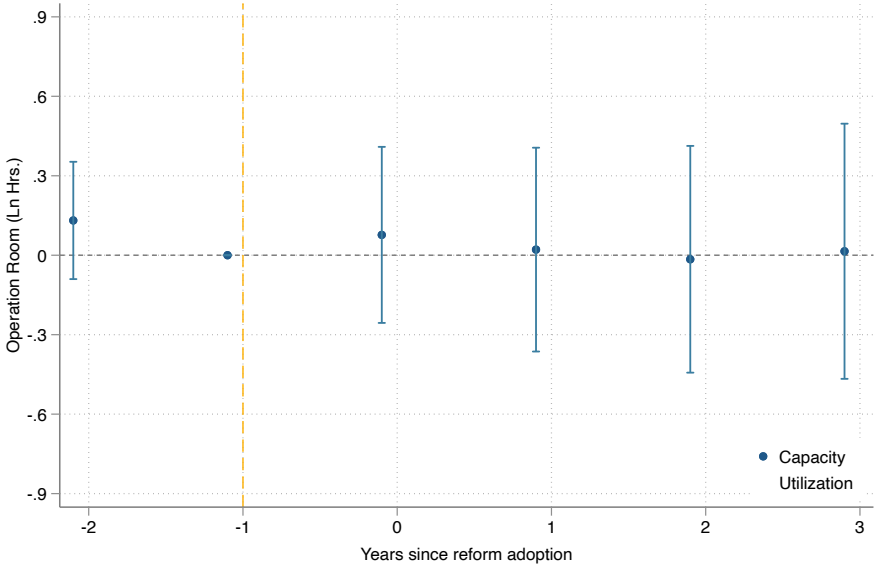
Skills mismatch

- Defintion: *the extent to which individuals are employed in an occupation unrelated to their main field of study*
- Several factors may create skill mismatches in public sector employees (Besley et al., 2022)
  - social norm before the reform was that CEO positions were reserved for doctors
- The reform displaced doctor CEOs for professionals with management training
  $\Rightarrow$ potentially mitigated the skill mismatch
- We examine whether correcting skill mismatch enhances organization performance
  - limited or no research in the public sector (Nordin et al. 2010; Besley et al. 2022)
  - CEOs with management studies are well matched, the rest represent mismatches

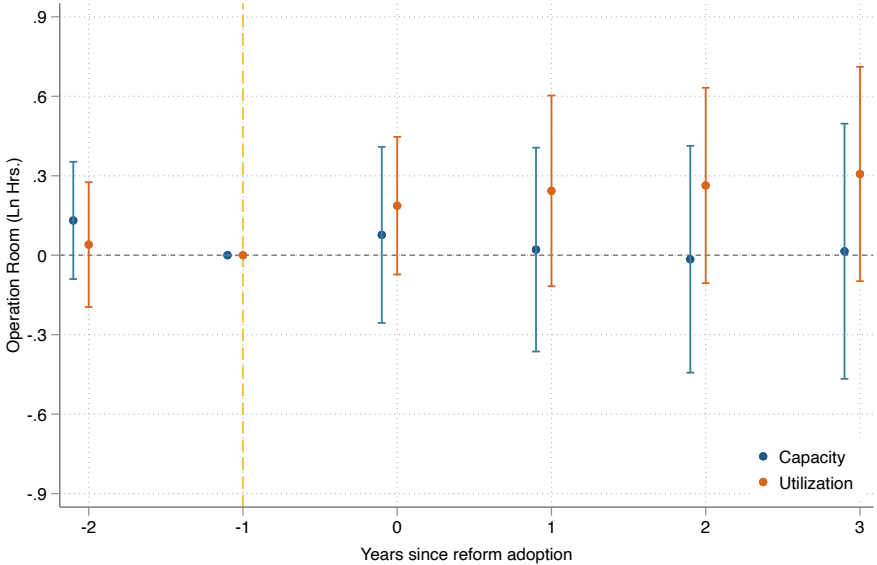
Differential reform impact by managerial background

Identifying variation is:	Reform adoption			CEO transition	
	Ln Death (%) (1)	Ln Death (%) (2)	Ln Death (%) (3)	Ln Death (%) (4)	Ln Death (%) (5)
Reform & mgmt. undergrad.	-0.111***				
	(0.029)				
Reform & non-mgmt. undergrad.	-0.076***				
	(0.026)				
Reform & any mgmt. studies		-0.122***	-0.130***		
		(0.025)	(0.028)		
Reform & non-mgmt. studies		-0.028	-0.027		
		(0.027)	(0.027)		
CEO with management studies				-0.072***	
				(0.025)	
CEO with no management studies					-0.010
					(0.022)
Sample	All CEOs	All CEOs	Doctor CEOs		
Observations	8,085	8,085	5,732	71,027	193,177
Time FE	Yes	Yes	Yes	Yes	Yes
Hospital FE	Yes	Yes	Yes	Yes	Yes
Case mix Controls	Yes	Yes	Yes	Yes	Yes
# of Hospitals	181	181	176	168	175
Mean Dep. Variable	2.63	2.63	2.49	2.88	2.41
p-value *Mgmt. = Non Mgmt.*	0.22	0.00	0.00		

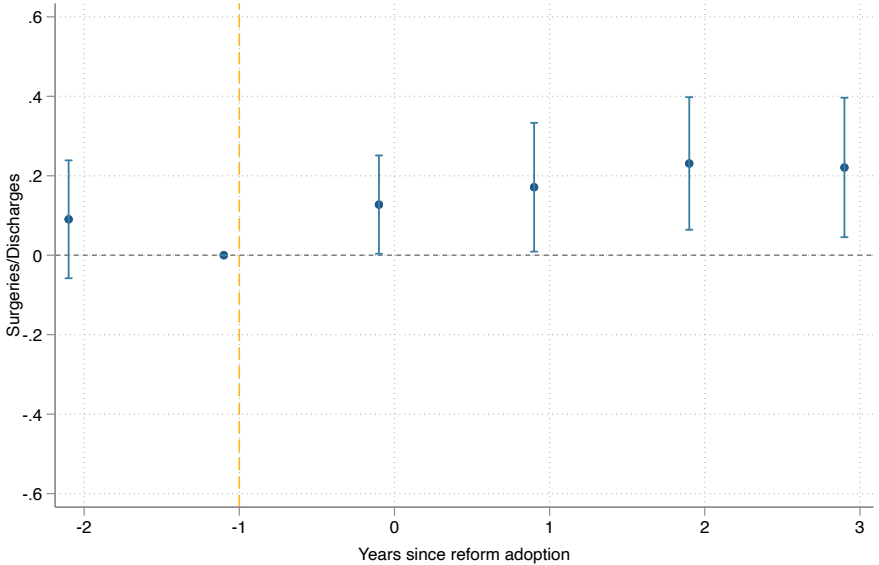
Mechanisms: more efficient utilization of operating room



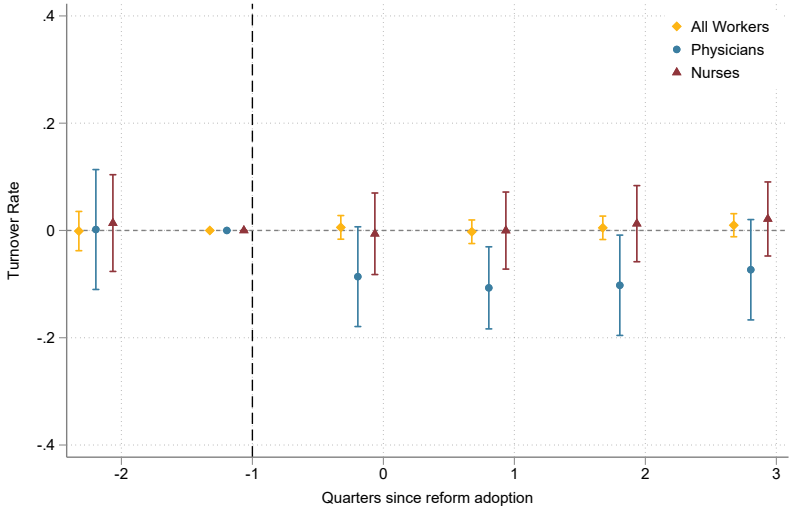
Mechanisms: more efficient utilization of operating room



Mechanisms: more efficient utilization of operating room



Mechanisms: reduced turnover of doctors



- No effect on personnel wages

Middle managers, hiring and finances

- Analyze *middle* managers
  - middle managers' managerial talent associated with better outcomes in hospitals (Tsai et al. 2015; Bloom, Propper, Seiler & Van Reenen 2015)
  - strategies for improvement of hospital performance should focus on middle managers (Janke, Propper & Sadun 2020)
  - strong correlation between establishment-specific measures of observed skills and productivity, in particular through the skills of middle managers (Bender, Bloom, Card, Van Reenen & Wolter 2018)
- Examine quality of new hires and tenure of high quality doctors
  - better-managed firms recruit and retain workers with higher human capital (Bender et al. 2018)
- Examine impact of the reform on hospitals finances

Comments and feedback

cotero@berkeley.edu

Next steps: model ▸ Model

- Reform shifted two different margins of personnel selection:

(i) Who is selected: conditional on the same pool of applicants, removal of discretionary appointments likely to improve quality of appointed manager
(Galasso & Nannicini 2011; Muñoz & Prem 2021)

(ii) Who applies: jobs publicly posted + extra financial incentives likely to attract higher-quality candidates
(Dal Bó et al. 2013; Ferraz & Finan 2011)
  - Relevant in settings where "outsiders" are implicitly banned from top positions

Do top managers affect hospital performance?

- How much variation in hospital performance can be attributed to top managers?
- We track top managers across different public hospitals over time
  (Bertrand & Schoar 2003; Janke, Propper & Sadun 2020; Fenizia 2022)
- We estimate

$$\text{Ln(death rate)}_{ht} = \alpha_h + \psi_{M(h,t)} + \gamma_t + \beta' X_{ht} + u_{ht},$$

  - where α_h and $\psi_{M(h,t)}$ are hospital and CEO fixed effects, respectively
  - also control for case-mix and time fixed effects (X_{ht}, γ_t)
  - # CEOs: 595; # Hospitals: 100; # Connected Sets: 20; # Movers: 65

Variance-Covariance Decomposition

- Recall that: Ln(death rate)$_{ht} = \alpha_h + \psi_{M(h,t)} + \gamma_t + \beta' X_{ht} + u_{ht}$

Variance-Covariance Decomposition

- Recall that: Ln(death rate)$_{ht} = \alpha_h + \psi_{M(h,t)} + \gamma_t + \beta' X_{ht} + u_{ht}$

$\Rightarrow$ $\mathbb{V}$(Ln(death rate)$_{ht} - \beta' X_{ht} - \gamma_t) =$

Variance-Covariance Decomposition

- Recall that: Ln(death rate)$_{ht} = \alpha_h + \psi_{M(h,t)} + \gamma_t + \beta' X_{ht} + u_{ht}$

$$\Rightarrow \mathbb{V}(\text{Ln(death rate)}_{ht} - \beta' X_{ht} - \gamma_t) = \underbrace{\mathbb{V}(\alpha_h)}_{\text{Hospital Effect}} + \underbrace{\mathbb{V}(\psi_{M(h,t)})}_{\text{CEO Effect}} + \underbrace{2\mathbb{C}(\alpha_h, \psi_{M(h,t)})}_{\text{Sorting}} + \underbrace{\mathbb{V}(u_{ht})}_{\text{Residual}}$$

Variance-Covariance Decomposition

- Recall that: Ln(death rate)$_{ht} = \alpha_h + \psi_{M(h,t)} + \gamma_t + \beta' X_{ht} + u_{ht}$

$$\Rightarrow \mathbb{V}(\text{Ln(death rate)}_{ht} - \beta' X_{ht} - \gamma_t) = \underbrace{\mathbb{V}(\alpha_h)}_{\text{Hospital Effect}} + \underbrace{\mathbb{V}(\psi_{M(h,t)})}_{\text{CEO Effect}} + \underbrace{2\mathbb{C}(\alpha_h, \psi_{M(h,t)})}_{\text{Sorting}} + \underbrace{\mathbb{V}(u_{ht})}_{\text{Residual}}$$

Panel B: Bias-corrected variance-covariance decomposition

	Component	Share of Total
	(1)	(2)
Var (Resid. Log Death Rate)	0.1709	100%
Var (Manager)	0.0671	39.2%
Var (Hospital)	0.0675	39.4%
Cov (Manager,Hospital)	-0.0422	-24.6%
Var (Residual)	0.0786	45.9%

Notes: Bias-corrected variances and covariances estimated on the largest connected set (Andrews et al. 2008)

Variance-Covariance Decomposition

- Recall that: Ln(death rate)$_{ht} = \alpha_h + \psi_{M(h,t)} + \gamma_t + \beta' X_{ht} + u_{ht}$

$$\Rightarrow \mathbb{V}(\text{Ln(death rate)}_{ht} - \beta' X_{ht} - \gamma_t) = \underbrace{\mathbb{V}(\alpha_h)}_{\text{Hospital Effect}} + \underbrace{\mathbb{V}(\psi_{M(h,t)})}_{\text{CEO Effect}} + \underbrace{2\mathbb{C}(\alpha_h, \psi_{M(h,t)})}_{\text{Sorting}} + \underbrace{\mathbb{V}(u_{ht})}_{\text{Residual}}$$

	Component (1)	Share of Total (2)
Var (Resid. Log Death Rate)	0.230	100%
Var (Manager)	0.042	18.3%
Var (Hospital)	0.051	22.2%
Cov (Manager,Hospital)	0.017	7.3%
Var (Residual)	0.129	52.2%

Notes: Bias-corrected variances and covariances estimated on the largest connected set (Andrews et al. 2008)

▸ AKM Figure ▸ R^2 ▸ AKM Residuals ▸ CEO FEs & Xs

Appendix

Referrals follow strict guidelines

ESTABLECIMIENTOS ATENCIÓN SECUNDARIA Y TERCIARIA				
	1	COMPLEJO HOSPITALARIO SAN JOSÉ	5	UAPO COMUNAL
	2	HOSPITAL CLÍNICO DE NIÑOS ROBERTO DEL RÍO	6	COSAM COMUNAL
	3	INSTITUTO PSIQUIÁTRICO DR. JOSÉ HORWITZ BARAK		
	4	INSTITUTO NACIONAL DEL CÁNCER DR. CALPOLICÁN PARDO CORREA		

SERVICIO DE SALUD	Colina									Conchalí				
COMUNA														
ESTABLECIMIENTO	109310 - Centro de Saud Familiar Colina	109316 - Centro de Salud Familiar Esmeralda	109416 - Posta Salud Rural Colorado	109417 - Posta Salud Rural Los Ingleses	109418 - Posta Salud Rural Las Canteras	109419 - Posta Salud Rural Santa Marta de Liray	109420 - Posta Salud Rural Chacabuco	109716 - Centro Comunitario de Salud Familiar Esmeralda	109810 - SAPU Colina	109302 - Centro de Salud Familiar Lucas Sierra	109308 - Centro de Salud Familiar Alberto Bachelet Martínez	109309 - Centro de Salud Familiar José Symon Ojeda	109314 - Centro de Salud Familiar Juanita Aguirre	109709 - Centro Comunitario de Salud Familiar Dr. José Symon Ojeda
PEDIATRÍA														
CARDIOLOGÍA PEDIÁTRICA	2	2	2	2	2	2	2	2		2	2	2	2	2
ENDOCRINOLOGÍA PEDIÁTRICA	2	2	2	2	2	2	2	2		2	2	2	2	2
ENFERMEDADES RESPIRATORIAS PEDIÁTRICAS	2	2	2	2	2	2	2	2		2	2	2	2	2
GASTROENTEROLOGÍA PEDIÁTRICA	2	2	2	2	2	2	2	2		2	2	2	2	2
GINECOLOGÍA PEDIÁTRICA Y DE LA ADOLESCENCIA	2	2	2	2	2	2	2	2		2	2	2	2	2
HEMATOLOGÍA ONCOLÓGICA PEDIÁTRICA	2	2	2	2	2	2	2	2		2	2	2	2	2
HEMOFILIA (SIN LÍMITE DE EDAD)	2	2	2	2	2	2	2	2		2	2	2	2	2
INFECTOLOGÍA PEDIÁTRICA	2	2	2	2	2	2	2	2		2	2	2	2	2
NEFROLOGÍA PEDIÁTRICA	2	2	2	2	2	2	2	2		2	2	2	2	2
NUTRICIÓN CLÍNICA DEL NIÑO Y EL ADOLESCENTE	2	2	2	2	2	2	2	2		2	2	2	2	2
NANEAS	2	2	2	2	2	2	2	2		2	2	2	2	2
MEDICINA INTERNA	1	1	1	1	1	1	1	1		1	1	1	1	1
CARDIOLOGÍA	1	1	1	1	1	1	1	1		1	1	1	1	1
NUTRICIÓN Y DIABETES	1	1	1	1	1	1	1	1		1	1	1	1	1
PROGRAMA MANEJO DE LA OBESIDAD	1	1	1	1	1	1	1	1		1	1	1	1	1
ENDOCRINOLOGÍA ADULTO	1	1	1	1	1	1	1	1		1	1	1	1	1
ENFERMEDADES RESPIRATORIAS ADULTO	1	1	1	1	1	1	1	1		1	1	1	1	1
GASTROENTEROLOGÍA ADULTO	1	1	1	1	1	1	1	1		1	1	1	1	1
HEMATOLOGÍA	1	1	1	1	1	1	1	1		1	1	1	1	1
VIH														
< 15 AÑOS	2	2	2	2	2	2	2	2		2	2	2	2	2
> 15 AÑOS	1	1	1	1	1	1	1	1		1	1	1	1	1
NEFROLOGÍA ADULTO	1	1	1	1	1	1	1	1		1	1	1	1	1
ONCOLOGÍA MÉDICA														
< 15 AÑOS	2	2	2	2	2	2	2	2		2	2	2	2	2
> 15 AÑOS (Derivación desde APS sólo con confirmación diagnóstica realizada)	4	4	4	4	4	4	4	4		4	4	4	4	4
REUMATOLOGÍA														
< 15 AÑOS	2	2	2	2	2	2	2	2		2	2	2	2	2
> 15 AÑOS	1	1	1	1	1	1	1	1		1	1	1	1	1

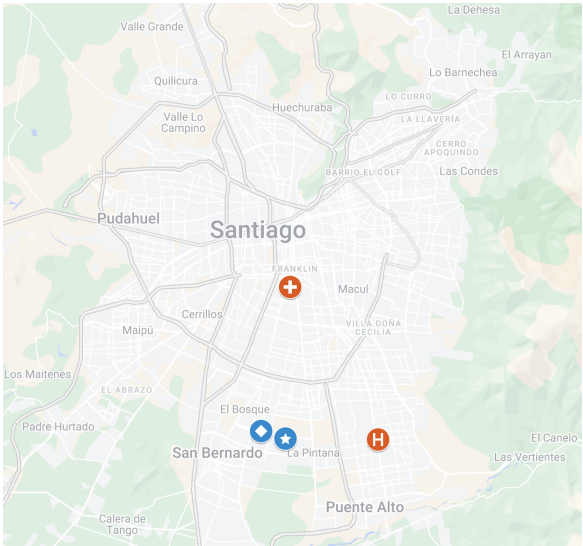
Referrals follow strict guidelines

Health Service Name	*Metropolitano Norte*		*Metropolitano Oriente*	
Primary Care	CESFAM Colina (1)	CESFAM Esmeralda (2)	CESFAM Aguilucho (3)	CESFAM La Faena (4)
Pediatrics				
Pediatric respiratory diseases	2	2	4	4
Internal Medicine				
Cardiology	1	1	5	4
Medical Oncology				
$<$ 15 years	2	2	7	7
$>$ 15 years	3	3	5	5
General Surgery				
Thoracic Surgery	3	3	6	6

1. Complejo Hospitalario San José; **2.** Hospital Clínico De Niños Roberto Del Río; **3.** Instituto Nacional Del Cáncer Dr. Caupolicán Pardo Correa; **4.** Centro de Referencia de Salud Cordillera Oriente; **5.** Hospital Del Salvador; **6.** Instituto Nacional del Torax; **7.** Hospital de Niños Dr. Luis Calvo Mackenna.

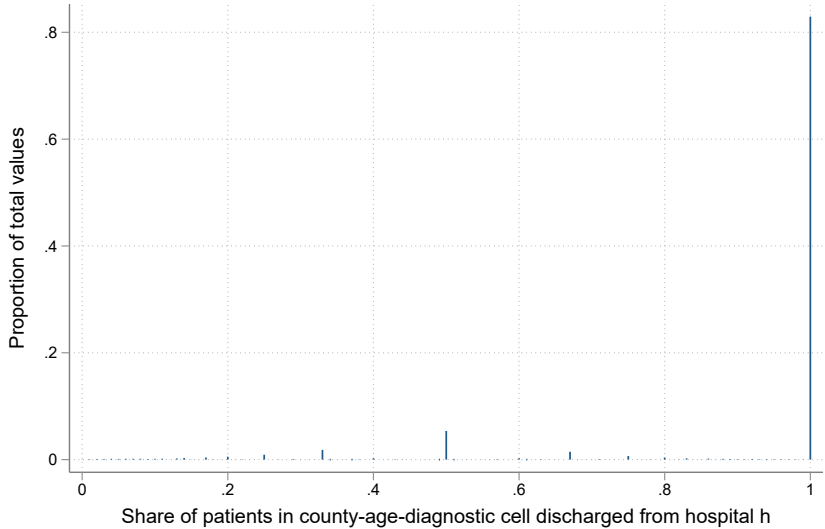
Referrals follow strict guidelines

Back



Strict Referrals

▸ Back



Data

‣ Back

1. Inpatient discharges $>$ 30 million individual-level admin records of all public hospital discharges (2001-19)
   - include an id, the date and cause of admission, the date of discharge or the in-hospital death date, type of admission (ER), individual covariates, a set of hospital characteristics
2. Death records: $>$ 1.5 million individual-level observations covering all deaths in the country (2001-18)
   - include same id as hospital discharges, date of death, cause of death, and place of death
3. Employees in the public health sector:
   - FOIA + hand-collected: monthly-level records all public hospitals top and middle manager characteristics and turnover (2001-19)
   - novel and administrative data covering the universe of employees in the public health sector between (2011-19)

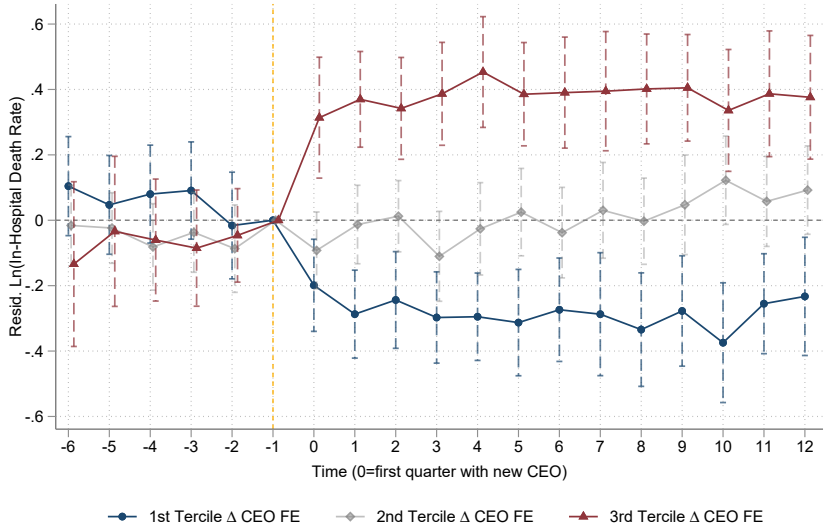
No differential impact in performance pay scores

Back

	Ln Death (%) (1)	Ln Death (%) (2)
Reform	-0.087***	
	(0.028)	
Reform & High Score		-0.086**
		(0.033)
Reform & Low Score		-0.089**
		(0.036)
Observations	7,670	7,670
Time FE	Yes	Yes
Hospital FE	Yes	Yes
Case Mix Controls	Yes	Yes
# of Hospitals	181	181
Mean Dep. Variable	2.61	2.61
p-value *High Score = Low Score*		0.94

AKM Figure

Back



Top managers do matter for hospital performance

Panel A: Analysis of variance of hospital quality

	Ln Death Rate					
	(1)	(2)	(3)	(4)	(5)	(6)
Observations	6712	6712	6712	6712	6712	6712
R^2	.41	.42	.67	.76	.73	.76
Adj. R^2	.40	.41	.66	.73	.69	.72
Case Mix Controls	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	Yes	Yes	Yes
Hospital FE	No	No	Yes	Yes	No	Yes
Manager FE	No	No	No	Yes	Yes	Yes
Hospital-Manager FE	No	No	No	No	No	Yes
F-statistic for Manager FEs	-	-	-	3.4	10.06	-
F-statistic for Hospital Manager FEs	-	-	-	-	-	10.19

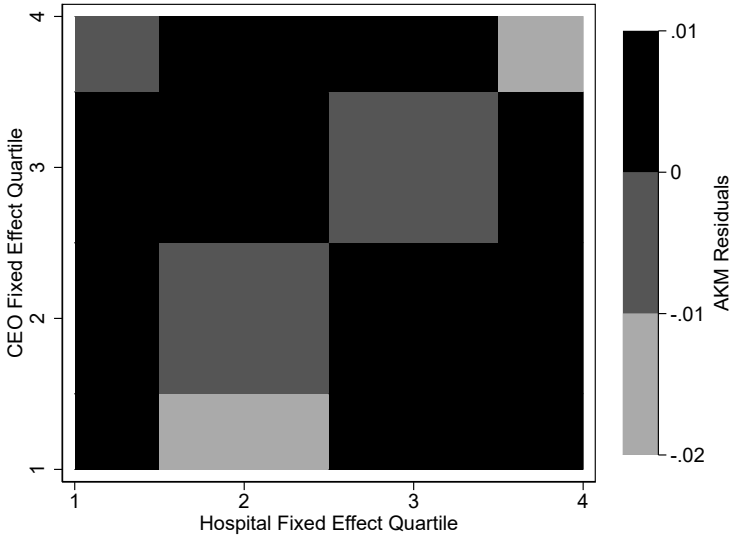
Top managers do matter for hospital performance

‣ Back

Outcome is: *Ln(Death Rate)*	(1)	(2)	(3)	(4)	(5)
Observations	6,166	6,166	6,166	6,166	6,166
R^2	.312	.332	.674	.768	.728
Adj. R^2	.311	.323	.664	.736	.695
Case-mix Controls	Yes	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	Yes	Yes
Hospital FE	No	No	Yes	Yes	No
Manager FE	No	No	No	Yes	Yes
p-value Manager FEs = 0	-	-	-	0.000	0.000

Top managers do matter for hospital performance

‣ Back



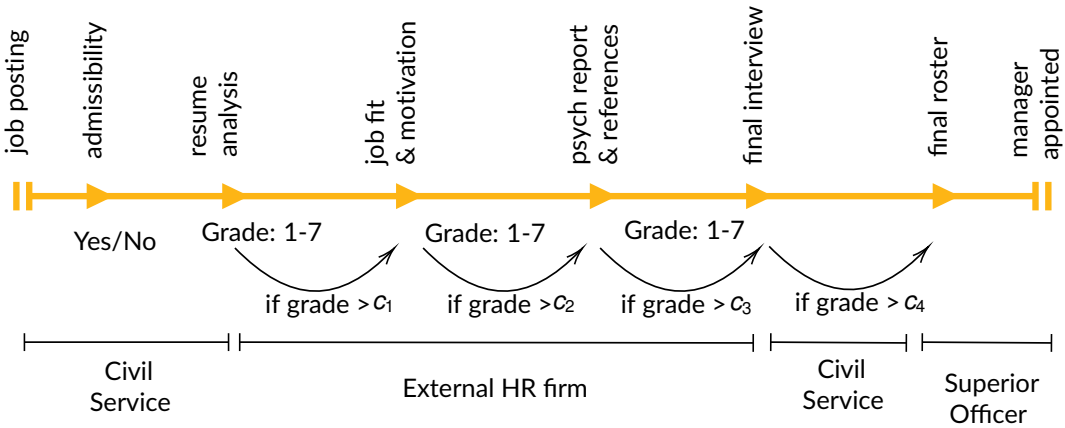
CEOs FE and CEO Characteristics

▸ Back

	CEO's Fixed Effect			
	(1)	(2)	(3)	(4)
Female	-0.003	-0.005	-0.005	-0.033
	(0.039)	(0.039)	(0.039)	(0.041)
Age	0.031***	0.030***	0.031***	0.035***
	(0.009)	(0.010)	(0.010)	(0.012)
Age^2	-0.000***	-0.000**	-0.000**	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Physician		-0.013	-0.011	0.047
		(0.058)	(0.059)	(0.063)
Mgmt. Background		-0.015	-0.015	-0.013
		(0.066)	(0.067)	(0.067)
Physician $\times$ Mgmt. Studies			-0.019	-0.014
			(0.055)	(0.058)
Avg. Test Score				-0.018
				(0.028)
Constant	0.082	0.100	0.093	-0.011
	(0.205)	(0.237)	(0.241)	(0.275)
Observations	688	688	688	582
R-squared	0.418	0.418	0.418	0.425

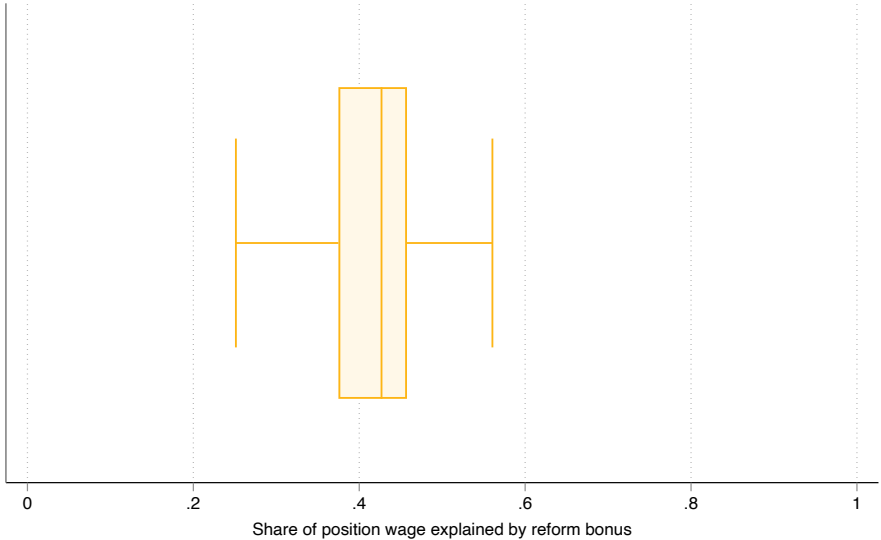
Hiring process in detail

▸ Back



Share of total wage explained by bonus

Back



excludes outside values

Performance pay schedule

‣ Back

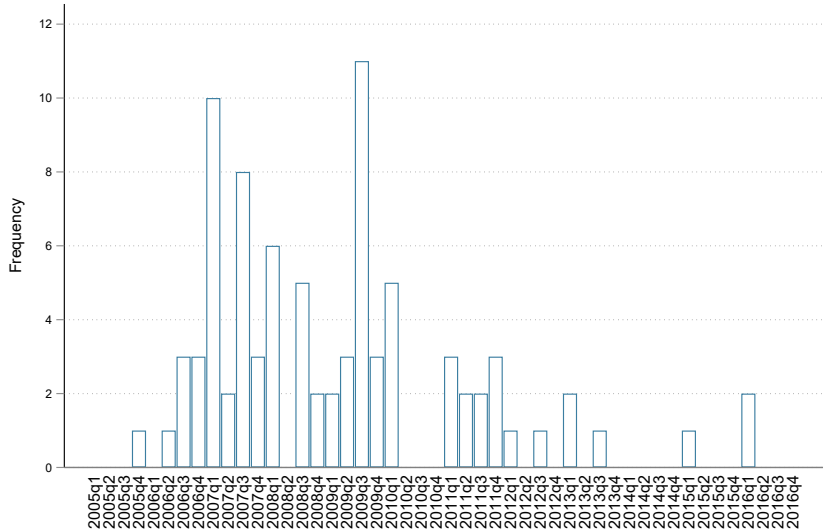
- Performance incentives de facto lax

$$\text{Yearly Wage}_t = \begin{cases} 100\% & \text{if performance}_{t-1} \geq 95\% \\ 98.5\% & \text{if } \quad 65\% \leq \text{performance}_{t-1} < 95\% \\ 93\% & \text{if performance}_{t-1} < 65\% \end{cases}$$

  - only small penalty and no possibility of wage increase
  - resets every three years and applies only after second year each cycle

Public hospitals adopting reform for first time

Back



Balance on Observables

▸ Back

	Avg. Never adopters	β Ever adopters (Levels)	β Ever adopters (First-Diff)	Ord. Logit Pseudo-R^2
	(1)	(2)	(3)	(4)
Patient Characteristics:				
% Age $<$ 29	0.401	0.048**	0.000	0.092
		(0.020)	(0.001)	
% Age $\in$ (30,39)	0.135	0.009	-0.000	0.092
		(0.006)	(0.000)	
% Age $\in$ (40,49)	0.090	0.010**	-0.000	0.092
		(0.005)	(0.000)	
% Age $\in$ (50,59)	0.081	0.001	0.000	0.092
		(0.004)	(0.000)	
% Age $\in$ (60,69)	0.095	-0.011**	0.001**	0.092
		(0.005)	(0.000)	
% Age $\in$ (70,79)	0.111	-0.025***	-0.000	0.092
		(0.007)	(0.000)	
% Age $\in$ (80,89)	0.072	-0.026***	-0.000	0.092
		(0.006)	(0.000)	
% Age $>$ 89	0.015	-0.006***	-0.000	0.092
		(0.001)	(0.000)	
% Female	0.609	-0.001	0.000	0.092
		(0.011)	(0.001)	
% Public Insurance	0.958	-0.032***	0.001**	0.075
		(0.007)	(0.001)	
Hospital Outcomes:				

Adoption By Type of Hospital

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	Never Treated	Ever d Treated	Total
High-level Hospital	5	58	63
Medium-level Hospital	5	23	28
Low-level Hospital	90	7	97
Total	100	88	188

New selection process decreased # of deaths

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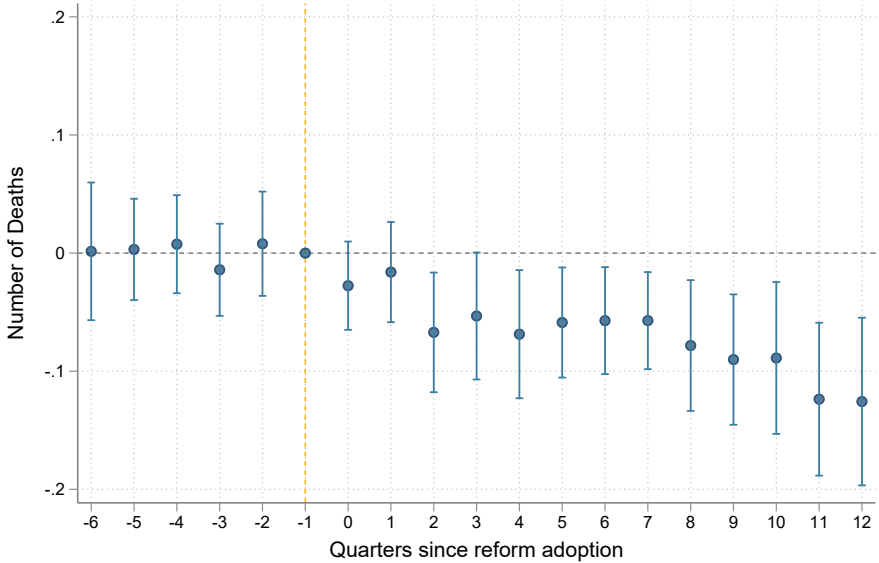
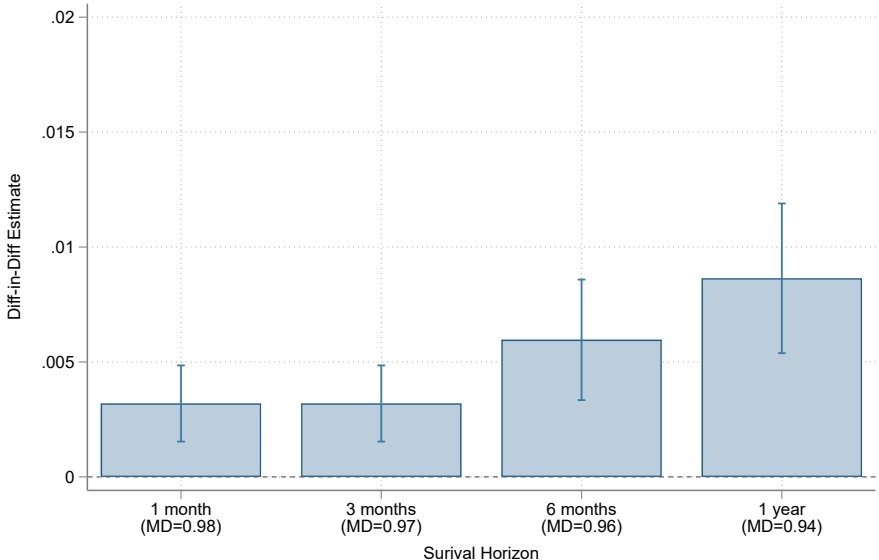


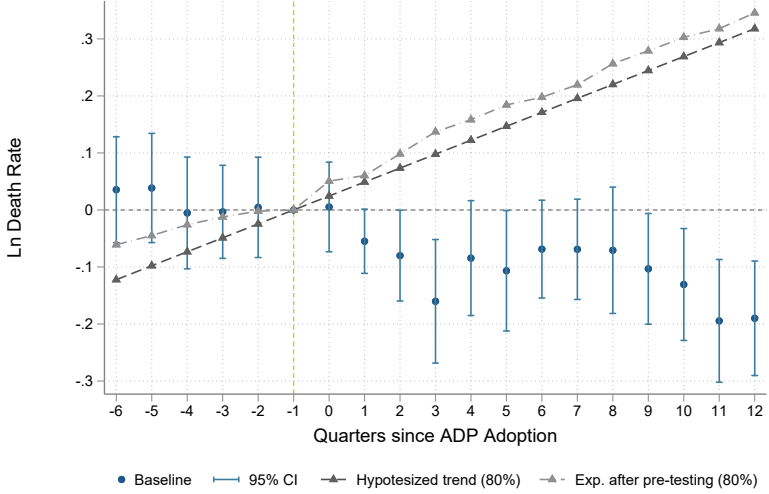
Survival by Horizon

Back

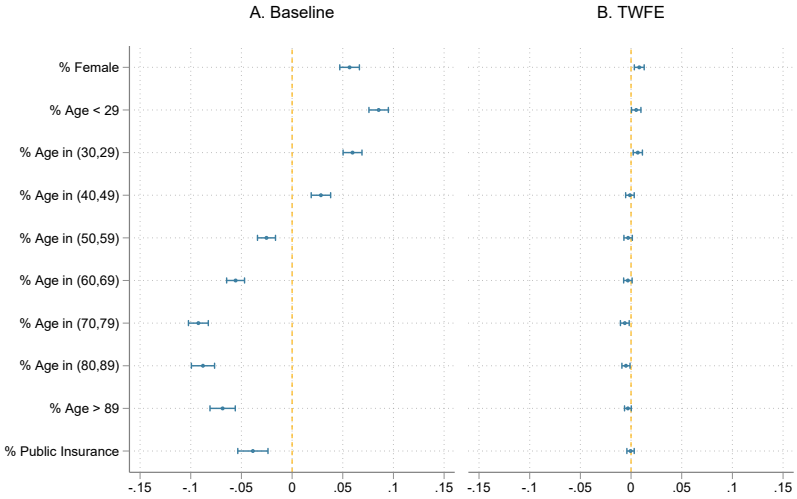


No Pre-trends (Roth 2022)

Figure: "Honest" Pre Trends Analysis ‣ Back

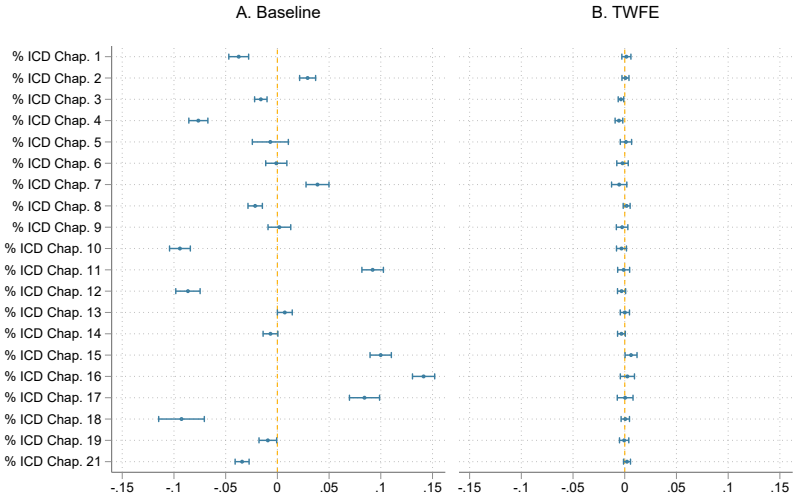


Conditional on hospital and time fixed effects, timing of reform is uncorrelated with case mix



Conditional on hospital and time fixed effects, timing of reform is uncorrelated with cause of admission

Back



Robustness Checks

▸ Back

	Death Rate			Death Rate ER		
	(1)	(2)	(3)	(4)	(5)	(6)
1 if selection process adopted	-0.116***	-0.062**	-0.121***	-0.145***	-0.096***	-0.152***
	(0.028)	(0.028)	(0.032)	(0.037)	(0.034)	(0.039)
Observations	8,098	8,098	8,098	6,549	6,549	6,549
Time FE	Yes	Yes	Yes	Yes	Yes	Yes
Hospital FE	Yes	Yes	Yes	Yes	Yes	Yes
Predetermined Xs	No	No	Yes	No	No	Yes
Time-variant (bad) Xs	No	Yes	No	No	Yes	No
# of Hospitals	181	181	181	175	175	175
Mean Dep. Variable	2.63	2.63	2.63	3.01	3.01	3.01

Heterogeneity: Results by Income Group

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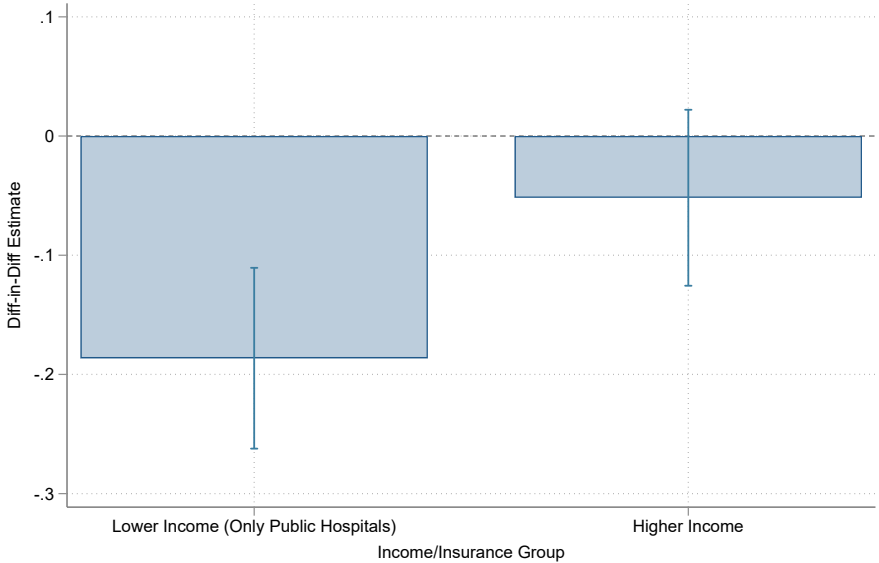


ML prediction based on observables

1. Select LASSO predictors of death rate on the pre-period

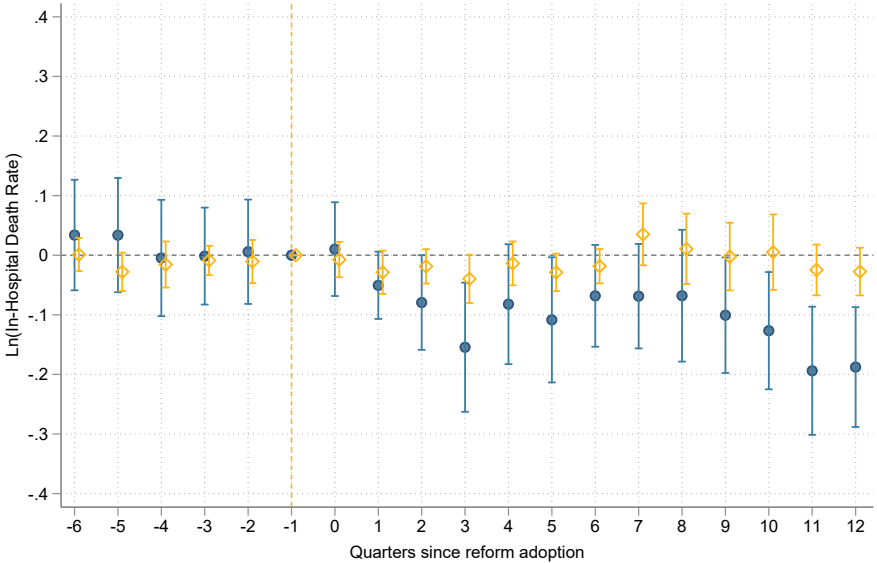
2. Set of potential hospital-level predictors includes:
   - share of patients in 10-year age buckets
   - share of female patients
   - flexible interactions with the share of ICD 10 chapter of admission

3. Predict death rate using selected LASSO variables

4. Estimate the impact of new selection process on predicted death rate

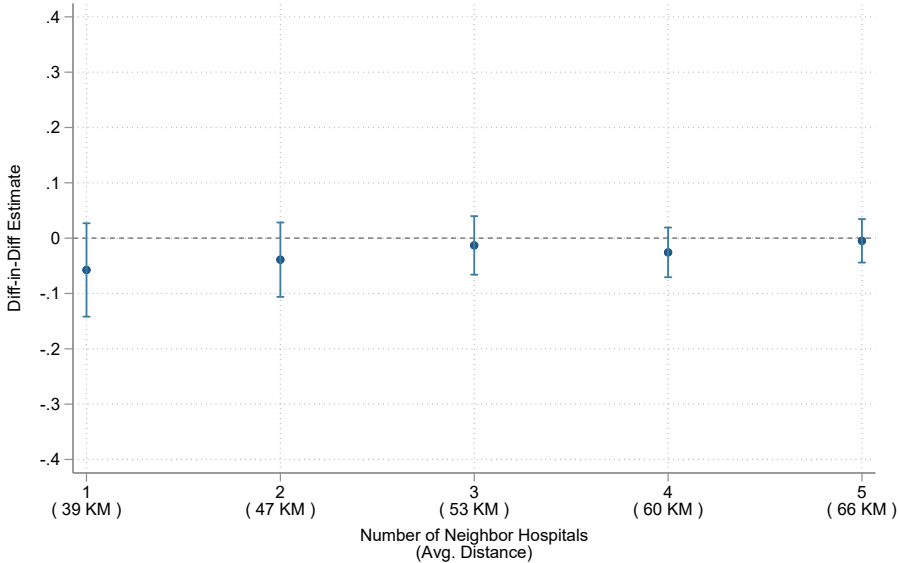
ML prediction based on observables: no effect!

Back



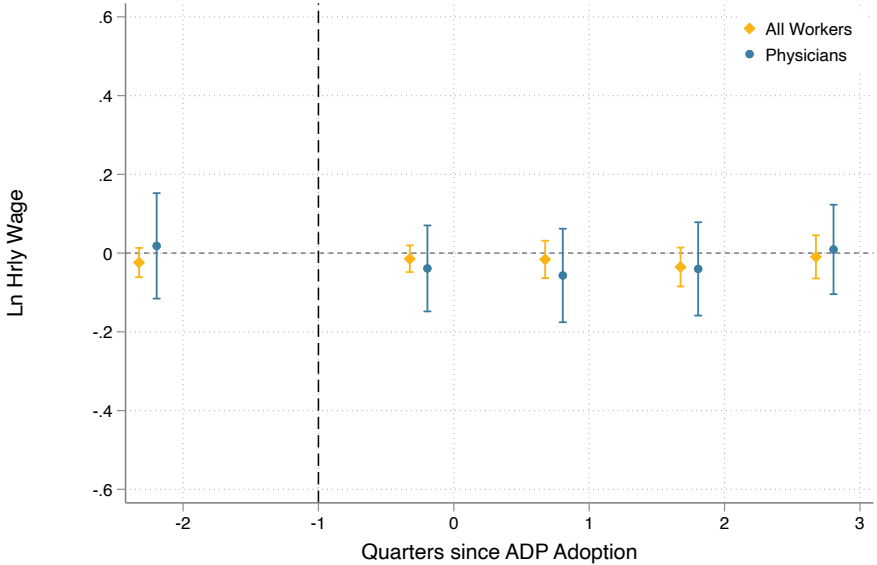
Death rates in close public hosp. did not increase

Back



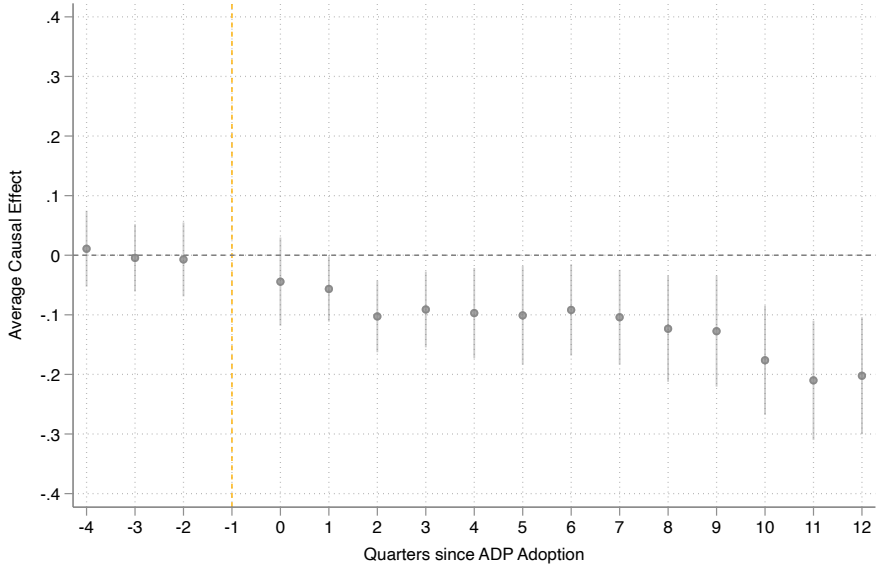
Personnel Outcomes: Hourly Wages

Back



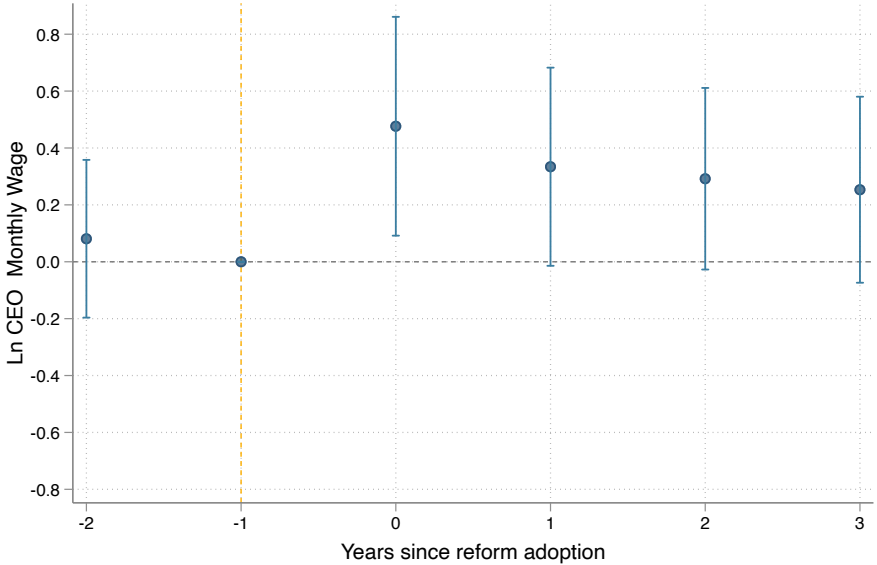
Unconfoundedness with Hospital Autonomy Reform

‣ Back



Wage effects

▸ Back



Model: setting

- Two periods:
  - Period 1: a manager decides to apply for a hosp. CEO position with a posted wage of w and faces an application cost $c > 0$. Application involves going through a selection process that leads to a score $s_i = v_i + \mu$, where v_i is the manager quality and $\mu \sim \text{CDF}H$
  - Period 2: the manager can receive an offer with probability $\rho \in (0, 1]$. The government can make an offer to anyone for whom $s_i > t$, where s_i is some signal and t captures the employability *threshold*. Then, the probability of being made an offer is $\rho(v) = 1 - H(t - v_i)$ which is increasing in v_i
- Individuals differ in their quality v. They know v, which comes from a distribution $F(v)$. Thus, whether the individual finds the job attractive in period 2 depends on the reservation utility given by $v + \epsilon$ (which they know as of period 2) where ϵ is some idiosyncratic shock distributed according to $G(\epsilon)$

Model: solution by backward induction

- If offered a job in period 2, a candidate with realized outside opportunity $v + \epsilon$ (private market pays marginal productivity) will accept the job whenever $v + \epsilon < w$, which for a candidate of quality v happens with probability $G(w - v)$
- In period 1, entry decisions depend on the relationship between v and $\rho(v)$
- The applicant i will enter the pool if the $E[U_{\text{applying}}] > E[U_{\textit{not}\ \text{applying}}]$:

$$\begin{aligned} -c + G(w - v_i)\left\{\rho(v_i)w + (1 - \rho(v_i))(v + E[\epsilon \mid \epsilon < w - v_i])\right\} \\ + [1 - G(w - v_i)](v + E[\epsilon \mid \epsilon > w - v_i]) > v_i + E[\epsilon] \end{aligned}$$

Model: solution by backward induction

- Let's rewrite $E[U_{\text{applying}}]$ as:

$$
\begin{aligned}
E[U_{\text{applying}}] = & -c + G(w - v_i) \left\{ \rho(v_i) w + (1 - \rho(v_i)) \left[v + \int_{-\infty}^{w - v_i} \frac{\epsilon g(\epsilon)}{G(w - v_i)} d\epsilon \right] \right\} \\
& + [1 - G(w - v_i)] \left[v + \int_{w - v_i}^{\infty} \frac{\epsilon g(\epsilon)}{1 - G(w - v_i)} d\epsilon \right] \\
= & -c + G(w - v_i) \{ \rho(v_i) w + (1 - \rho(v_i)) v \} + (1 - \rho(v_i)) \int_{-\infty}^{w - v_i} \epsilon g(\epsilon) d\epsilon \\
& + [1 - G(w - v_i)] v + \int_{w - v_i}^{\infty} \epsilon g(\epsilon) d\epsilon
\end{aligned}
$$

Model: takeaways

- Is $E[U_{\text{applying}}]$ increasing in manager quality v?
- Does $E[U_{\text{applying}}]$ increase by more than $E[U_{\text{not applying}}]$ with v? Higher quality candidates would have more incentives to apply given the selection policy if:

$$\frac{\partial E[U_{\text{applying}}]}{\partial v} > \frac{\partial E[U_{\text{not applying}}]}{\partial v} = 1$$

Model: discussion

Back

- We can do this for the candidate of quality $v_i = \bar{v}$ (the one that is indifferent) to then derive conditions over the optimal policy $\rho(v_i)$
  - E.g., Dal Bó et al. derives conditions in terms of the elasticity of $\rho(.)$: how much the selection probably responds to quality.

- Notice that the result is not obvious (so interesting) since higher quality candidates do well in the outside option. Naturally higher wages also help to select better candidates.

- Under functional form assumptions, and some calibration, we could simulate the impact of counterfactual selection policies $\rho(.)$ on workers' quality