Does Increasing Public Spending in Health Improve Health? Lessons from Constitutional Reform in Brazil

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Motivation

- Global spending on health more than doubled in real terms since the turn of the century.
- Currently stands at 9.8% of global GDP and is projected to increase substantially (World Health Organization, 2021; Dieleman et al., 2017).
- Most of the growth has been from public sources, especially in high-income countries.
- Perhaps surprisingly, little evidence on how effective public health expenditure is in improving health outcomes.
  - Micro evidence on cost-effectiveness related to specific treatments/resources (e.g. Cutler, 2007; Doyle et al., 2015).
  - Very scant on public spending, although majority of health spending is financed by taxes and administered by governments. None on mechanisms.
- Little evidence generally on health spending and health outcomes in developing world.

Motivation

- A common thread in the literature is that health spending **may** be sufficient to impact health.
- But this is certainly not a foretold conclusion.
  - For example, consider the RAND Health Insurance Experiment, Oregan HIE
  - "States that spend more per Medicare beneficiary are not states that provide higher quality care." Baicker and Chandra (2004)
- In principle, chain of causation depends on many interlinked steps: from inputs to outcomes.
- Involves state capacity in design/implementation/management, input complementarities, diversion due to corruption etc.
- Understanding how health spending propagates through this chain, and which (if any) steps break down is important given the magnitude of health spending.

This paper

We assess whether and how a public spending reform designed to increase health spending translates into micro-level improvements in health.

- The setting is Brazil, 1998-2010.
- 29th Constitutional Amendment enshrined municipal health spending of *at least* 15% of budget.
- Depending on health spending at baseline, municipalities are more or less exposed to the reform.
- We collect a remarkably rich set of data allowing us to understand the full chain of reform impacts:
  1. How does the reform affect spending patterns?

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  3. How does the reform affect individual access to health?
  4. How does the reform affect hard health outcomes?

◂ Further literature

Outline

Background

Data

Empirical Strategy

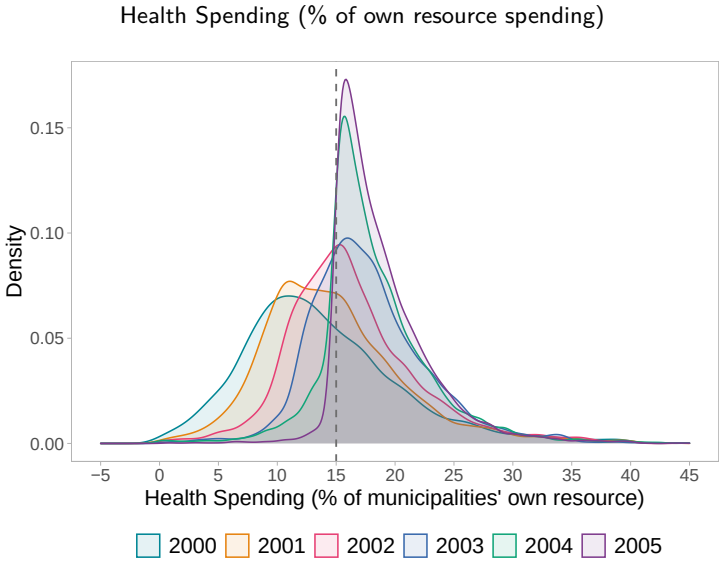
Results

Final Remarks

Background: Health Spending and the EC29/2000

- In Brazil in the '90s, most spending was centralised at level of Federal Government.
- Period of budget disputes and crises in health care financing.
- Reform efforts during the '90's resulted in the passage of the 29th Constitutional Amendment.
- In practice, enshrined a series of minimum spending floors for public health services:
  - Federal Government: 2000 – 5% of 1999 spending; 2001-2004 corrected by GDP.
  - States: 12% of tax income net of transfers.
  - Municipalities: 15% of tax income.

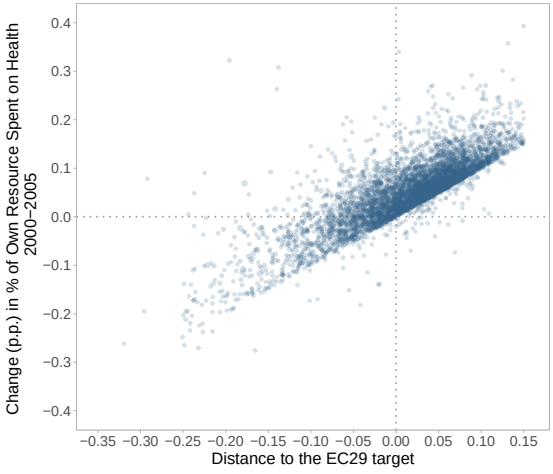
Descriptive Impact: Compression of the Spending Distribution I



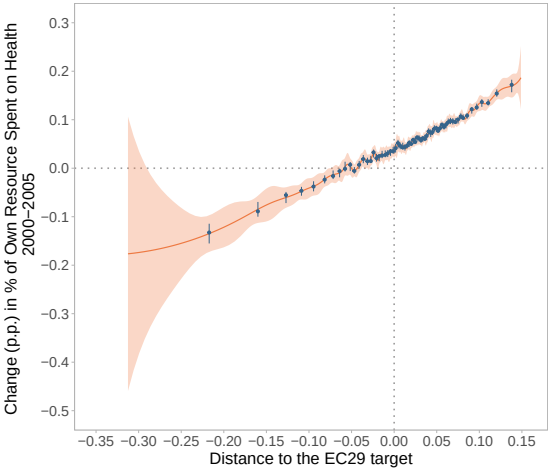
- Results in a large real increase in health spending ◂ Trends 1
- Mainly driven by own resources rather than federal transfers ◂ Trends 2
- Distance to the 15% threshold is geographically diverse ◂ Map

Descriptive Impact: Compression of the Spending Distribution II

Scatter Plot: Shifts in % of Own Resource Spent on Health



Binscatter Plot: Shifts in % of Own Resource Spent on Health



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Data

We generate a municipality-by-year panel covering 5,507 Brazilian municipalities from 1998-2010. Generate municipal aggregates over a number of dimensions from a range of administrative sources:

- **Local spending and resources**: Brazilian Finance System (FINBRA), Brazilian National System of Public Health Budget (SIOPS).
- **Health Inputs**: Brazilian National System of Information on Primary Care (Datasus/SIAB), Censal Medical-Sanitary Assistance Survey (AMS).
- **Health Access**: Brazilian National System of Information on Ambulatory Care (Datasus/SIA), Brazilian National System of Birth Records (Datasus/SINASC), National System of Information on Hospitalizations (Datasus/SIH).
- **Health Outcomes**: Brazilian National System of Mortality Records (Datasus/SIM).
- **Other Measures**: Controls for baseline socioeconomic level (census), time-varying GDP per capita (IBGE), *Bolsa Familia* transfers.

◂ Time Periods

Data

This data is rich, but high dimensional in nature. To focus on a common metric and avoid inflated rates of type I error we generate outcome indexes (Anderson, 2008).

- Four specific dimensions: spending, access, inputs, health outcomes. ◂ Definitions
- For further descriptive context, additionally separated into two further sub-indexes. ◂ Definitions
- Unless otherwise noted, effect sizes will be stated in terms of standard deviations of pre-reform measures.
- Full summary statistics. ◂ Link

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Empirical Strategy

We estimate a difference-in-difference (DiD) model with a continuous intention-to-treat variable of interest, exploiting within-municipality variation:

$$Y_{mts} = \tau Dist_{m,pre} \times Post_t + \delta_{st} + \delta_m + \theta Z_{m,pre} \times \delta_t + X'_{mts}\gamma + \varepsilon_{mts} \quad (1)$$

- Y_{mts} is an outcome in municipality m, state s, year t
- $Dist_{m,pre}$ is the baseline percentage points distance to EC/29 target in municipality m
- $Post_t$ is a dummy that equals one if the year is 2001 or later
- Municipal and state×year fixed effects included as baseline (importance of within state variation)
- $Z_{m,pre} \times \delta_t$ is an interaction between socioeconomic baseline controls and time
- X_{mts} are time-varying controls
- Consistently weight by population, and cluster standard errors at municipality level

Empirical Strategy – Extensions

Two key extensions: (a) considering the dynamics of impacts over time and (b) potential differential results for above and below threshold municipalities.

(a) Event Study Versions of (1)

$$\begin{aligned} Y_{mts} = & \sum_{i=1}^{I} \beta_{pre,i}\, Dist_{m,pre} \times EC29_{t+i} + \sum_{j=0}^{J} \beta_{post,j}\, Dist_{m,pre} \times EC29_{t-j} \\ & + \delta_{st} + \delta_m + \theta\, Z_{m,pre} \times \delta_t + \gamma\, X_{mts} + \varepsilon_{mts}. \end{aligned} \tag{2}$$

(b) Heterogeneity of (1) by Below vs Above Threshold Municipalities

$$\begin{aligned} Y_{mts} = & \alpha(Dist_{m,pre} \times Post_t) \cdot Above_{m,pre} + \\ & \gamma(Dist_{m,pre} \times Post_t) \cdot Below_{m,pre} + \\ & \delta_{st} + \delta_m + \theta\, Z_{m,pre} \times \delta_t + \gamma\, X_{mts} + \varepsilon_{mts}. \end{aligned} \tag{3}$$

Validity of the Research Design

- Identification is drawn from baseline distance to the (arbitrary) threshold.
- Adoption of EC29 is time-invariant (block adoption design).
- Time-invariant adoption means no concerned about bias owing to heterogenous effects over time.
- But, Callaway et al. (2021) highlight that DiD models with continuous treatment require stronger parallel trends assumptions.
- We argue that our setting is quasi-random and that is unlikely that municipalities chose their distance to the spending target based on expected increases in health spending per capita.
- Nevertheless, we estimate a binary version of (1), where 'Treatment' refers to below threshold municipalities.

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What are the Fiscal Responses to Health Spending Reforms?

Table: Health Spending Reforms and Fiscal Outcomes (Part A)

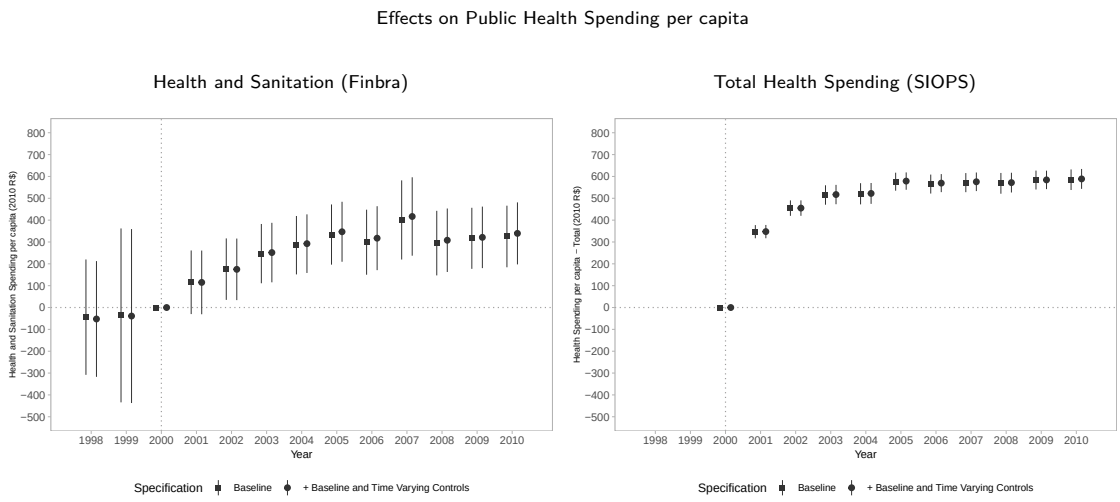
	ln(per capita spending)				Level
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Panel A: Finbra					
Total Revenues	-0.071	0.047	0.073	0.118	100.893
	(0.135)	(0.114)	(0.114)	(0.115)	(183.364)
Total Spending	0.002	0.112	0.137	0.133	171.998
	(0.137)	(0.115)	(0.116)	(0.115)	(166.261)
Health Spending	1.14***	1.249***	1.273***	1.273***	283.511***
	(0.255)	(0.237)	(0.239)	(0.238)	(81.907)
Non-Health Spending	-0.198	-0.093	-0.067	-0.08	-106.625
	(0.134)	(0.111)	(0.11)	(0.109)	(114.82)
Non-Health Social Spending	-0.128	-0.075	-0.054	-0.062	-38.931
	(0.18)	(0.15)	(0.149)	(0.148)	(91.763)
Non-Social Spending	-0.212	-0.061	-0.031	-0.042	-56.209
	(0.17)	(0.141)	(0.14)	(0.139)	(73.913)
Mun & Time-State FE	Y	Y	Y	Y	Y
Baseline Socioeconomic Controls×Time	N	Y	Y	Y	Y
Time-Varying Controls	N	N	Y	Y	Y
Fiscal Controls	N	N	N	Y	N

What are the Fiscal Responses to Health Spending Reforms?

Table: Health Spending Reforms and Fiscal Outcomes (Part B)

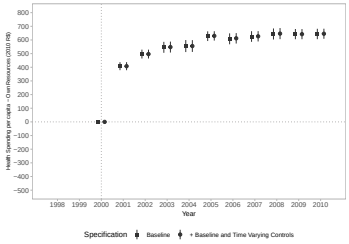
	ln(per capita spending)				Level
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
Panel B: Siops					
Total Health Spending	2.513***	2.586***	2.592***	2.605***	458.127***
	(0.204)	(0.164)	(0.165)	(0.165)	(44.708)
From Own Resources	5.799***	5.844***	5.851***	5.86***	420.212***
	(0.256)	(0.244)	(0.239)	(0.237)	(16.682)
From Other Resources	1.958	1.877	1.873	1.863	38.319
	(1.596)	(1.349)	(1.341)	(1.315)	(44.899)
Personnel	2.533***	2.559***	2.562***	2.467***	133.728***
	(0.443)	(0.378)	(0.379)	(0.368)	(29.22)
Investment	5.506***	5.249***	5.244***	5.301***	61.455***
	(1.126)	(0.813)	(0.808)	(0.807)	(6.768)
Outsourced (3rd party services)	1.534***	1.808***	1.815***	1.925***	48.837
	(0.524)	(0.44)	(0.437)	(0.416)	(33.801)
Admin, Management and Others	4.958***	4.793***	4.795***	4.847***	225.125***
	(1.095)	(0.997)	(0.997)	(0.968)	(31.45)
Mun & Time-State FE	Y	Y	Y	Y	Y
Baseline Socioeconomic Controls×Time	N	Y	Y	Y	Y
Time-Varying Controls	N	N	Y	Y	Y
Fiscal Controls	N	N	N	Y	N

Temporal Dynamics in Health Spending Paths

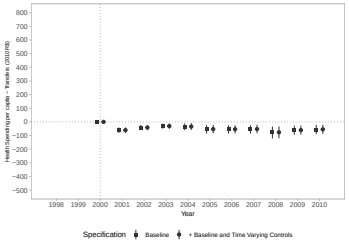


How Are Spending Changes Directed?

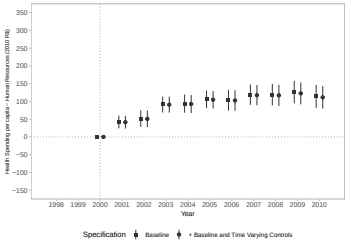
Health Spending - Own Resources



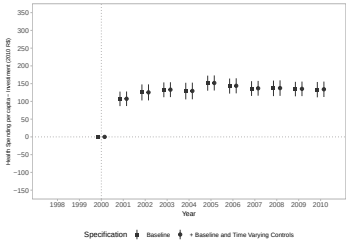
Health Spending - Transfers



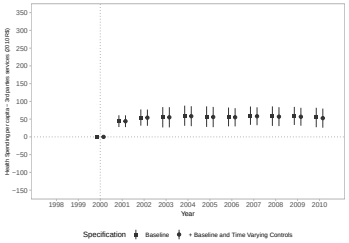
Human Resources



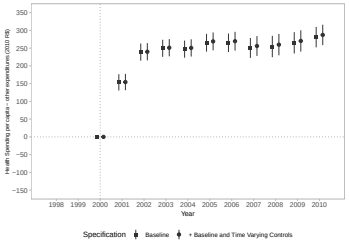
Investment



3rd parties services

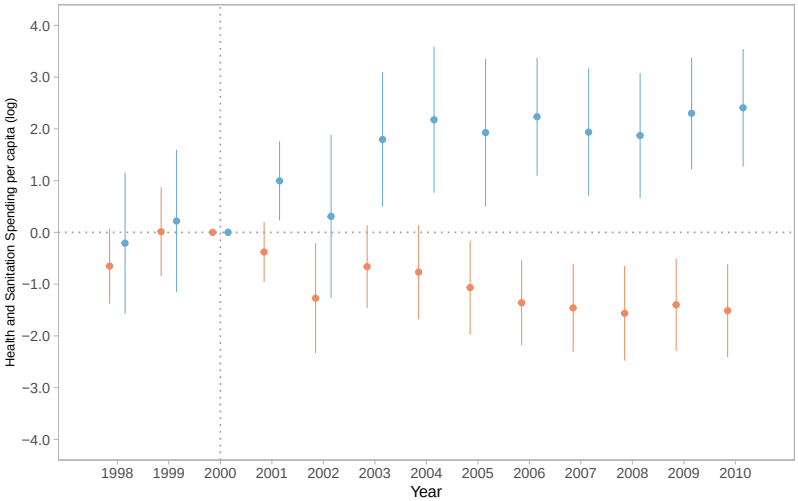


Other Expenditures



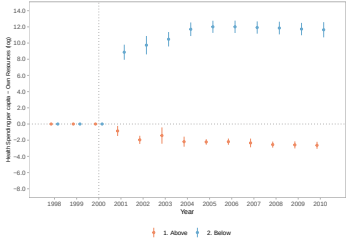
How Does the Spending Threshold Alter Municipal Spending?

Figure: Health and Sanitation Spending per Capita (Finbra)

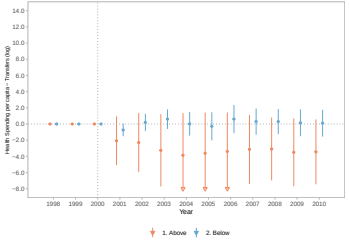


How Are Spending Increases and Cuts Made?

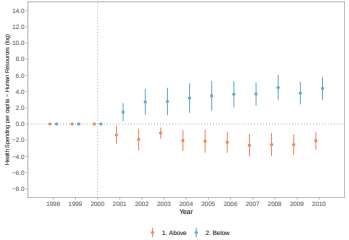
Health Spending - Own Resources



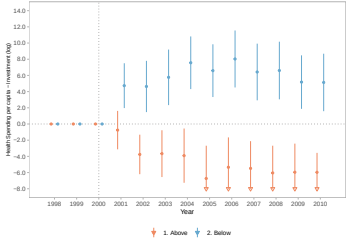
Health Spending - Transfers



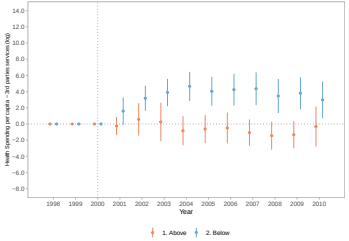
Human Resources



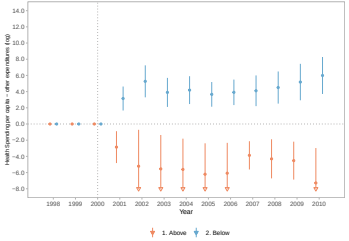
Investment



3rd parties services



Other Expenditures

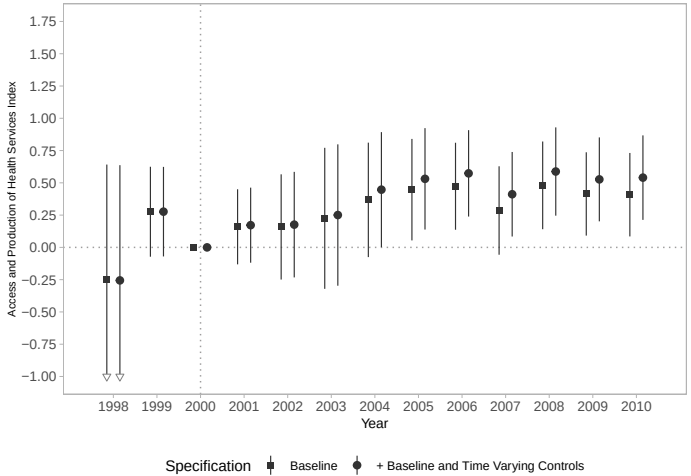


Downstream Effects of Health Spending – Summary Indexes

	(1)	(2)	(3)	(4)
Access and Production of Health Services	0.329*	0.398**	0.410**	0.408**
	(0.169)	(0.175)	(0.175)	(0.175)
Primary Care Access and Production	0.320**	0.404**	0.418**	0.417**
	(0.159)	(0.163)	(0.163)	(0.163)
Non-Primary Care Access and Production	0.079	0.066	0.071	0.069
	(0.149)	(0.15)	(0.15)	(0.149)
Health Inputs	0.678***	0.694***	0.698***	0.697***
	(0.172)	(0.171)	(0.171)	(0.171)
Human Resources	1.239***	1.202***	1.214***	1.209***
	(0.245)	(0.243)	(0.243)	(0.243)
Hospitals	0.581***	0.601***	0.604***	0.604***
	(0.172)	(0.171)	(0.171)	(0.171)
Birth Outcomes	0.004	0.082	0.082	0.082
	(0.083)	(0.077)	(0.077)	(0.077)
Infant Mortality	0.066	0.072*	0.074*	0.075*
	(0.05)	(0.044)	(0.043)	(0.043)
Others	0.017	0.106	0.102	0.101
	(0.177)	(0.17)	(0.17)	(0.17)
Municipalty & State× Year FEs	Y	Y	Y	Y
Socioeconomic controls		Y	Y	Y
GDP p.c. & *Bolsa Familia*			Y	Y
Fiscal controls				Y

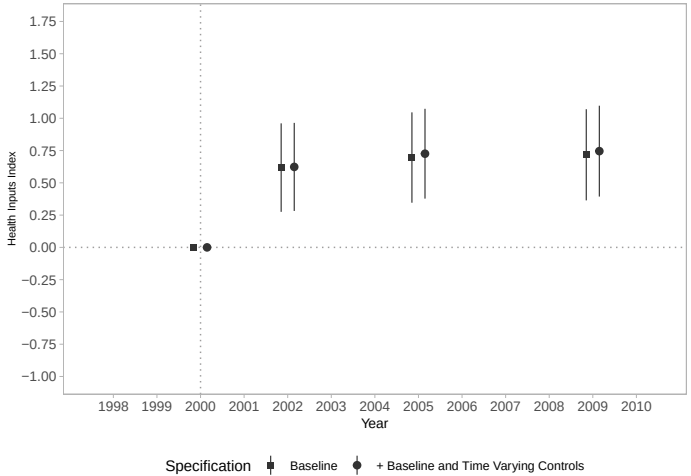
Downstream Effects of Health Spending – Temporal Effects (Access)

Figure: Access and Production of Health Service



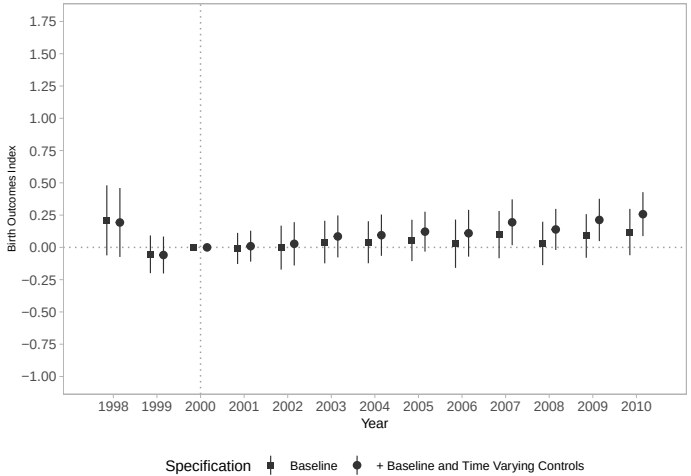
Downstream Effects of Health Spending – Temporal Effects (Inputs)

Figure: Health Inputs



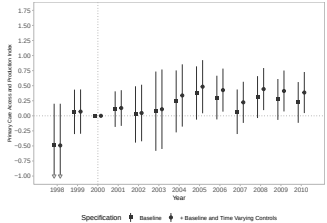
Downstream Effects of Health Spending – Birth Outcomes

Figure: Birth outcomes

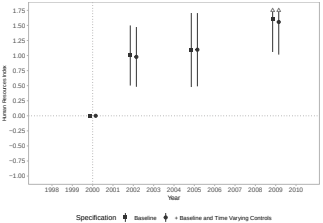


Downstream Effects of Health Spending – Subindexes

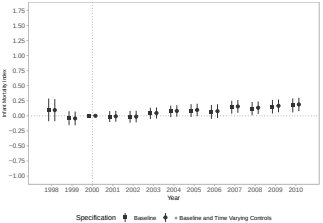
Primary Care



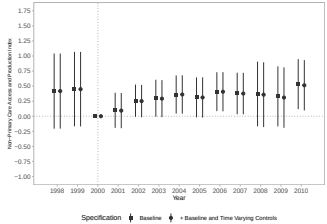
Human resources



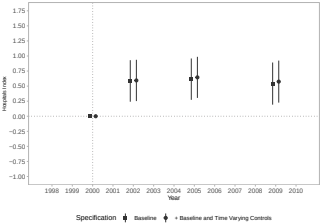
Infant mortality



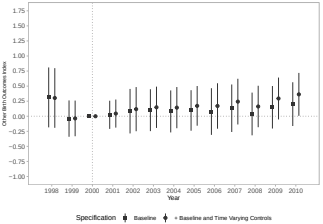
Non-Primary Care



Hospitals

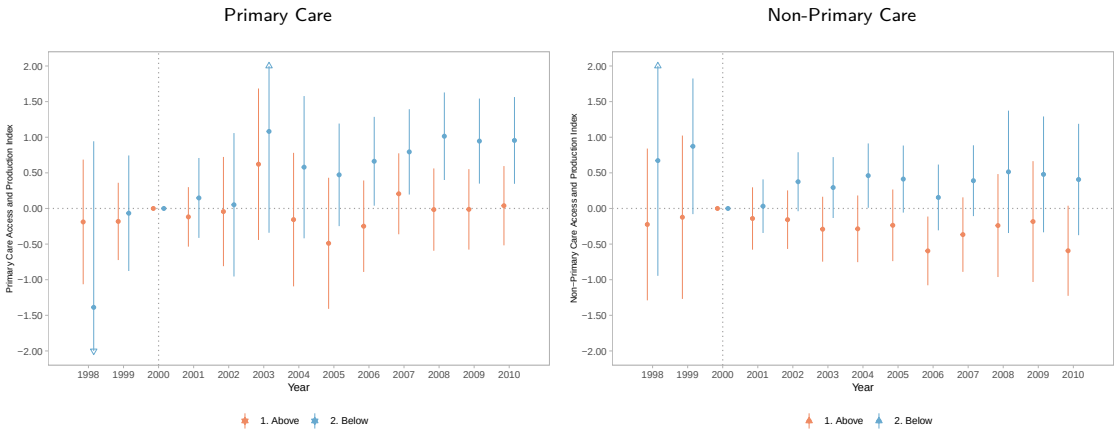


Other birth outcomes



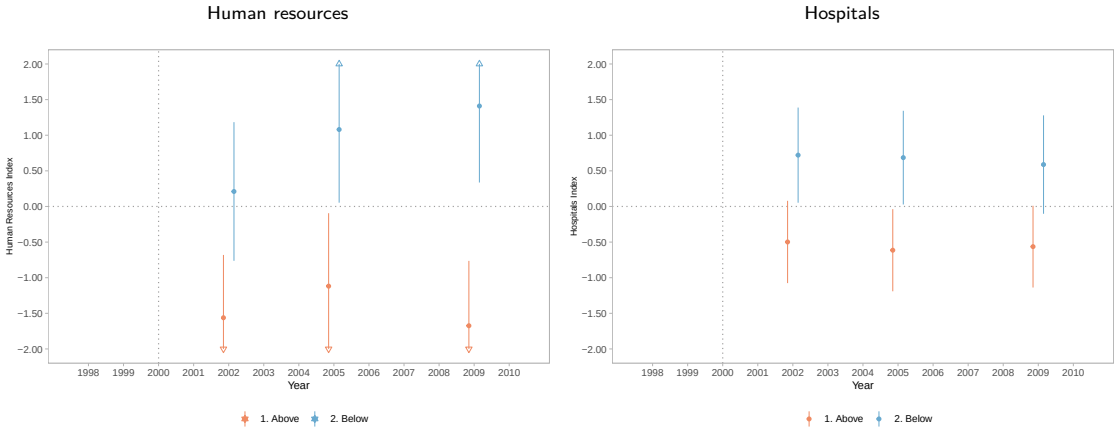
Distributional Effects on Downstream Health Outcomes (A)

Figure: Access and Production of Health Service



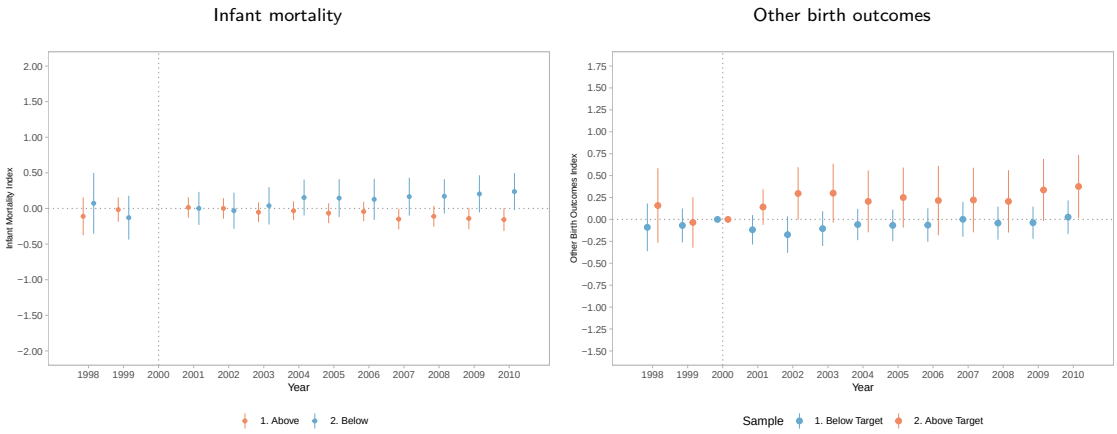
Distributional Effects on Downstream Health Outcomes (B)

Figure: Health Inputs

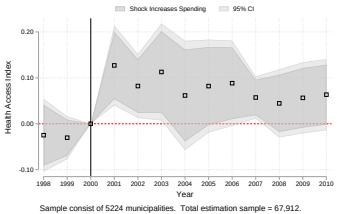


Distributional Effects on Downstream Health Outcomes (C)

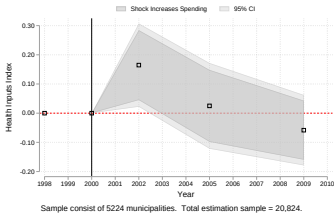
Figure: Birth Outcomes



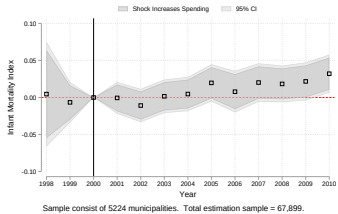
A Binary "Treatment" Set-up



Access Index



Inputs Index

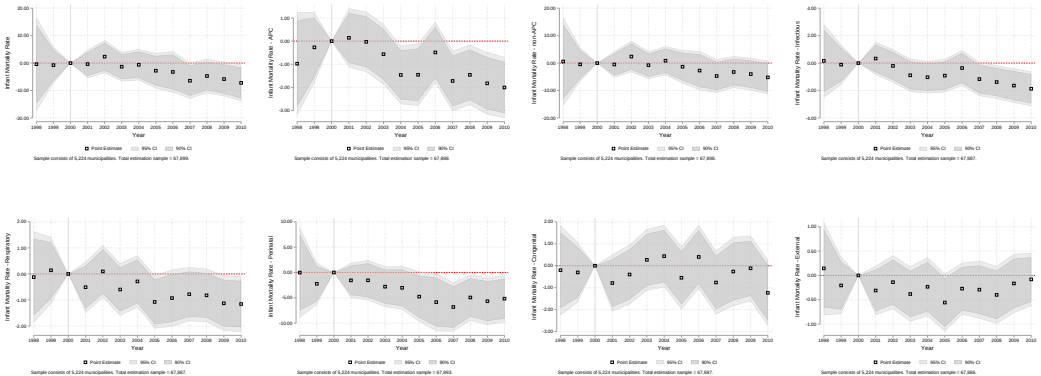


Infant Mortality

- Larger effects on access in outcomes classified as amenable to primary care
- Permanent effects observed in infrastructure inputs
- Temporary effects observed in human resources inputs
- Infant mortality changes observed in 'primary care-amenable' areas

Where do Infant Mortality Declines Occur? I

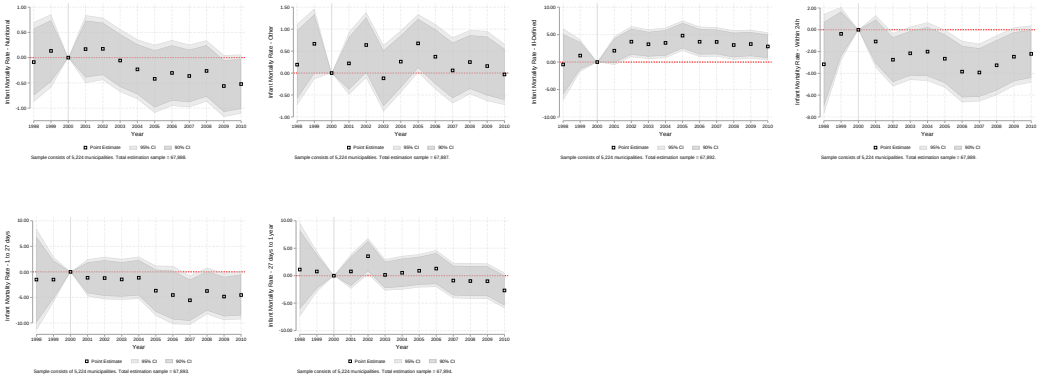
Figure: Continuous Event Studies, Variable by Variable – Infant Mortality



◂ Continuous

Where do Infant Mortality Declines Occur? II

Figure: Continuous Event Studies, Variable by Variable – Infant Mortality



◂ Continuous

Outline

Background

Data

Empirical Strategy

Results

Final Remarks

Final Remarks

- When Brazilian municipalities were induced to increase health spending, they did so by increasing spending on admin, followed by human resources and investments.
- Spending translated into increases in access and production of health services, health inputs, and moderate improvements in birth outcomes.
- Shifts in spending and inputs were associated with:
  - Greater number of administrative professionals, supply of municipal hospitals, and primary care coverage.
  - Small to moderate reductions in infant mortality rates, potentially related to improvements in primary care access and hospital care.
- Implied elasticity (infant mortality rate): total -0.06, amenable to primary care -0.14; but lower than what was found in previous studies (-0.3 to -1.1).

Final Remarks – Health Spending Implications

- Increases in spending are allocated to areas which are most important for targeting end-line health outcomes
- **Unintended spending consequences** given salience of 15% target
- Public spending cuts are potentially targeted to areas less influential for these types of health care outcomes

Thank You!

Comments and queries are very welcome.

michel.szklo@fgv.br (or via coauthors)

References I

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Background: descriptive statistics

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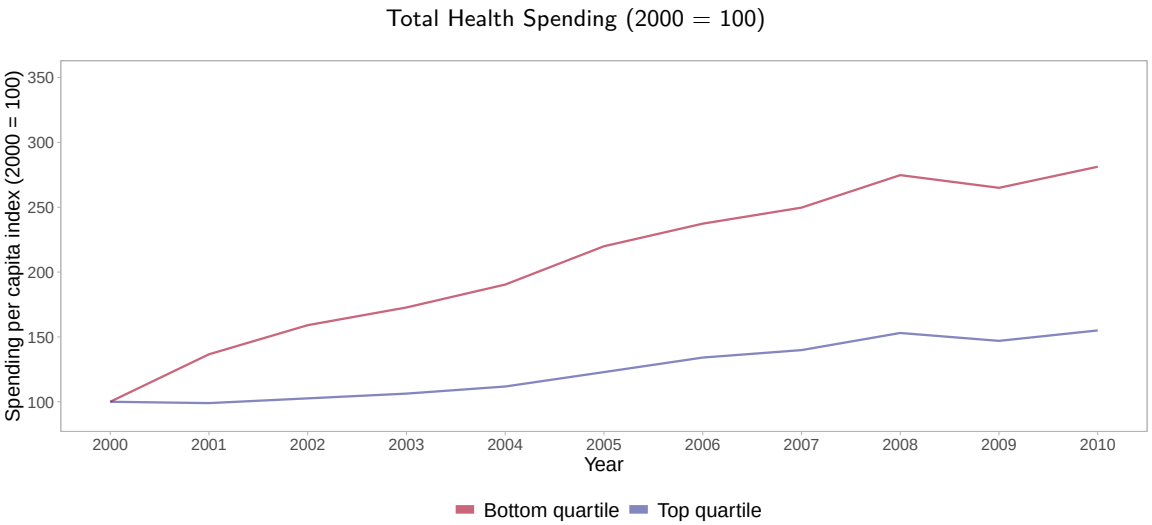
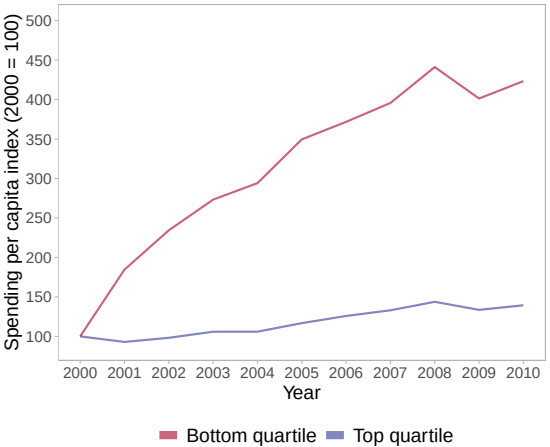


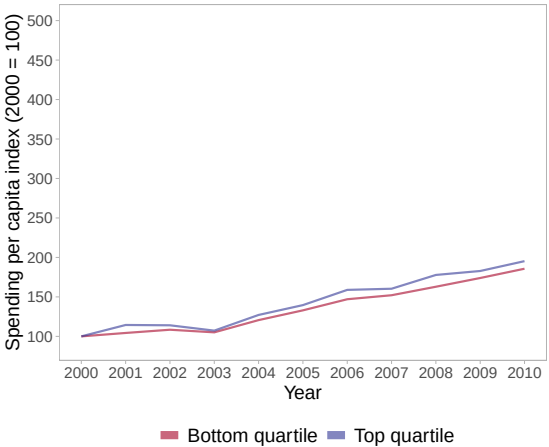
Background: descriptive statistics

Back

Health Spending from Own Resources (2000 = 100)

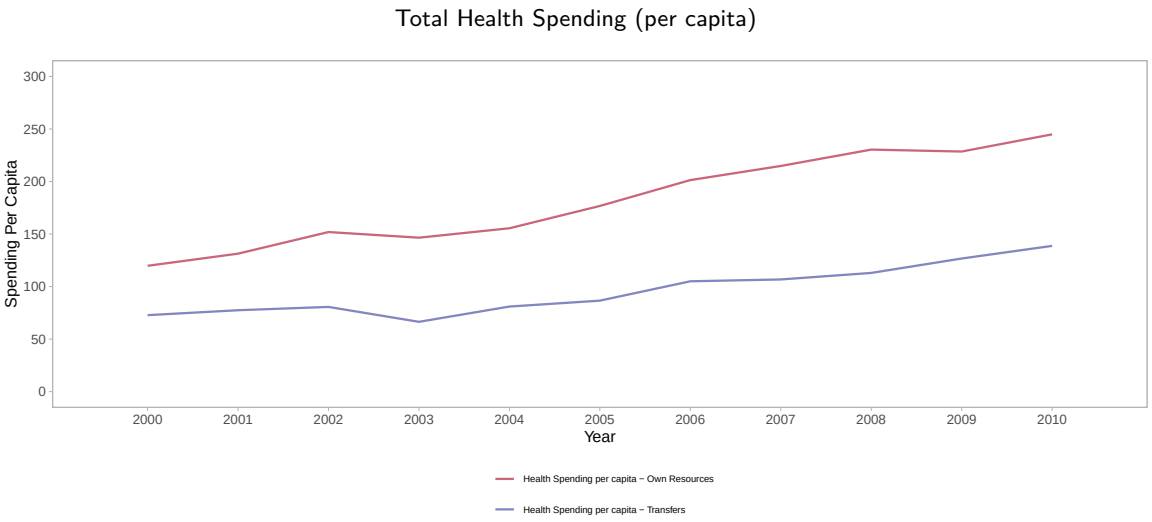


Health Spending from Transfers (2000 = 100)



Background: descriptive statistics

Back



Background: descriptive statistics

Back

EC/29 Compliance Geographic Variation

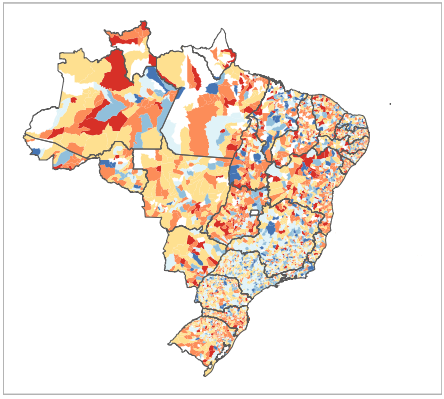


Table: Definitions of Indexes (I)

Index	Sub-Index	Variables
1. **Access & Production of Health Services Index**	1a. *Primary Care Access & Production Index*	Population covered by Community Health Agents
		Population covered by Family Health Agents
		N. of People Visited by Primary Care Agents (pc)
		N. of People Visited by Community Health Agents (pc)
		N. of People Visited by Family Health Agents (pc)
		N. of Household Visits and Appointments (pc)
		N. of Household Visits and Appointments from Community Health Agents (pc)
		N. of Household Visits and Appointments from Family Health Agents (pc)
		N. of Health Facilities with Ambulatory Service and ACS Teams (pc)
		N. of Health Facilities with Ambulatory Service and Community Doctors (pc)
		N. of Health Facilities with Ambulatory Service and ACS Nurses (pc)
		N. of Health Facilities with Ambulatory Service and PSF Teams (pc)
		N. of Health Facilities with Ambulatory Service and PSF Doctors (pc)
		N. of Health Facilities with Ambulatory Service and PSF Nurses (pc)
		N. of Health Facilities with Ambulatory Service and PSF Nursing Assistants (pc)
		N. Primary Care Outpatient Procedures (per capita)
		N. Low & Mid Complexity Outpatient Procedures (pc)
		Proportion of births with unknown prenatal care coverage
		Proportion of births with 0 prenatal visits‡
		Proportion of births with 1-6 prenatal visits‡
		Proportion of births with 7+ prenatal visits
		Maternal Hospitalization Rate
		Infant Hospitalization Rate - APC‡
	1b. *Non-Primary Care Access & Production Index*	N. Outpatient Procedures (per capita) (pc)
		N. High Complexity Outpatient Procedures (pc)
		Infant Hospitalization Rate - non-APC

Notes: Main indexes and sub-indexes consist of the variables listed here, in each case following Anderson (2008) in the construction of indices. The abbreviation pc refers to per-capita. Each variable is included in one and only one index, and one and only one sub-index. ‡ Variable has been multiplied by minus 1 such that higher values refer to 'better' outcomes. ◂ Back

Table: Definitions of Indexes (II)

Index	Sub-Index	Variables
2. **Health Inputs Index**	2a. *Human Resources Index*	N. of Doctors (pc) N. of Nurses (pc) N. of Nursing Assistants (pc) N. of Administrative Professionals (pc)
	2b. *Hospitals Index*	N. of Municipal Hospitals (pc) N. of Federal and State Hospitals (pc) N. of Private Hospitals (pc)
3. **Birth Outcomes Index**	3a. *Infant Mortality Index*	Infant Mortality Rate - APC‡ Infant Mortality Rate - non-APC‡
	3b. *Other Birth Outcomes Index*	1 Minute APGAR 5 Minute APGAR Proportion LBW (< 2.5kg)‡ Proportion premature births‡ Sex Ratio at Birth‡

Notes: Main indexes and sub-indexes consist of the variables listed here, in each case following Anderson (2008) in the construction of indices. The abbreviation pc refers to per-capita. Each variable is included in one and only one index, and one and only one sub-index. ‡ Variable has been multiplied by minus 1 such that higher values refer to 'better' outcomes.

◂ Back

Summary Statistics

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Table: Descriptive Statistics (at the baseline year)

	Mean	Std. Dev.	Min	Max	Obs.	Source of Data
EC 29 Variables						
Share of Municipality's Own Resource Spent in Public Health	0.138	0.068	0	0.802	5224	Datasus/SIOPS
Distance to the EC29 Target	0.012	0.068	-0.652	0.15	5224	Datasus/SIOPS
Public Revenue						
Total Revenue per capita	1225.274	2282.128	132.386	121105.017	5288	Finbra
Public Spending						
Total Spending per capita	1284.77	2395.06	129.735	127974.259	5304	Finbra
Spending by Category - per capita						
Health and Sanitation	217.08	276.14	0.037	12559.61	5286	Finbra
Transport	91.551	138.28	0	5865.789	5304	Finbra
Education and Culture	419.945	640.291	0	36319.154	5304	Finbra
Housing and Urban	116.052	301.25	0	19842.146	5304	Finbra
Social Assistance	84.052	253.836	0	13814.629	5304	Finbra
Other Categories	472.878	1201.128	32.002	65369.184	5304	Finbra
Public Health Spending						
Total Health Spending per capita	192.543	110.44	24.632	1397.575	5225	Datasus/SIOPS
Health Spending by Source - per capita						
Own Resources spending per capita	119.763	96.992	0	1232.875	5225	Datasus/SIOPS
Transfers Spending per capita	72.779	50.002	0	1099.097	5225	Datasus/SIOPS
Health Spending by Type - per capita						
Human Resources Spending per capita	71.337	61.87	0	1118.758	5225	Datasus/SIOPS
Investiments Spending per capita	14.567	26.899	0	361.969	5225	Datasus/SIOPS
3rd parties services Spending per capita	33.149	43.284	0	1041.135	5225	Datasus/SIOPS
Other Spendings per capita	73.49	52.755	0	602.699	5225	Datasus/SIOPS

Summary Statistics

Back

Table: Descriptive Statistics (at the baseline year) – *Cont.*

	Mean	Std. Dev.	Min	Max	Obs.	Source of Data
Primary Care Coverage						
Extensive Margin						
Population covered (share) by Community Health Agents	0.635	0.409	0	1	5507	Datasus/SIAB
Population covered (share) by Family Health Agents	0.311	0.383	0	1	5507	Datasus/SIAB
Intensive Margin						
N. of People Visited by Primary Care Agents (per capita)	0.271	0.285	0	2.798	5507	Datasus/SIAB
N. of People Visited by Community Health Agents (per capita)	0.121	0.18	0	1.518	5507	Datasus/SIAB
N. of People Visited by Family Health Agents (per capita)	0.15	0.252	0	1.834	5507	Datasus/SIAB
N. of Household Visits & Appointments (per capita)	1.876	2.541	0	88.85	5507	Datasus/SIAB
N. of Household Visits & Appointments by Community Health Agents (per capita)	1.072	2.156	0	85.989	5507	Datasus/SIAB
N. of Household Visits & Appointments by Family Health Agents (per capita)	0.8	1.505	0	43.389	5507	Datasus/SIAB
Health Human Resources						
N. of Health Professionals (per capita*1000)	5.104	4.825	0	187.904	5507	IBGE/AMS
N. of Doctors (per capita*1000)	1.529	2.385	0	95.132	5507	IBGE/AMS
N. of Nurses (per capita*1000)	1.159	1.636	0	95.097	5507	IBGE/AMS
N. of Nursing Assistants (per capita*1000)	1.26	1.456	0	22.009	5507	IBGE/AMS
N. of Administrative Professionals (per capita*1000)	1.155	1.251	0	36.599	5507	IBGE/AMS
Health Infrastructure						
N. of Municipal Hospitals (per capita*1000)	0.06	0.138	0	1.357	5507	IBGE/AMS
N. of Federal and State Hospitals (per capita*1000)	0.015	0.084	0	1.892	5507	IBGE/AMS
N. of Private Hospitals (per capita*1000)	0.03	0.058	0	0.609	5507	IBGE/AMS
N. of Health Facilities (per capita*1000) with Ambulatory Service	0.517	0.355	0	3.628	5493	Datasus/SIA
Primary Care Related Infrastructure and Human Resources						
Number of Health Facilities (per capita * 1000) with						
Ambulatory Service and ACS Teams	0.14	0.197	0	2.41	5493	Datasus/SIA
Ambulatory Service and Community Doctors	0.082	0.154	0	1.957	5493	Datasus/SIA
Ambulatory Service and ACS Nurses	0.072	0.156	0	2.41	5493	Datasus/SIA
Ambulatory Service and PSF Teams	0.083	0.159	0	2.41	5493	Datasus/SIA
Ambulatory Service and PSF Doctors	0.077	0.149	0	1.957	5493	Datasus/SIA
Ambulatory Service and PSF Nurses	0.075	0.149	0	2.41	5493	Datasus/SIA
Ambulatory Service and PSF Nursing Assistants	0.05	0.123	0	1.957	5493	Datasus/SIA
Ambulatorial Production						
N. Outpatient Procedures (per capita)	8.8	4.55	0	48.258	5507	Datasus/SIA
N. Primary Care Outpatient Procedures (per capita)	7.415	3.974	0	39.367	5507	Datasus/SIA
N. Low & Mid Complexity Outpatient Procedures (per capita)	9.467	5.801	0	171.126	5493	Datasus/SIA
N. High Complexity Outpatient Procedures (per capita)	0.005	0.052	0	2.58	5493	Datasus/SIA

Summary Statistics

Back

Table: Descriptive Statistics (at the baseline year) – *Cont.*

	Mean	Std. Dev.	Min	Max	Obs.	Source of Data
Infant Mortality Rate						
Total	23.069	26.163	0	1000	5507	Datasus/SIM
APC	2.097	7.101	0	333.333	5507	Datasus/SIM
non-APC	20.972	22.291	0	666.667	5507	Datasus/SIM
Fetal	0.003	0.078	0	3.571	5507	Datasus/SIM
Within 24h	5.554	10.146	0	333.333	5507	Datasus/SIM
1 to 27 days	13.727	15.891	0	333.333	5507	Datasus/SIM
27 days to 1 year	9.342	16.341	0	666.667	5507	Datasus/SIM
Infectious	1.999	7.03	0	333.333	5507	Datasus/SIM
Respiratory	1.515	4.454	0	142.857	5507	Datasus/SIM
Perinatal	11.041	16.32	0	666.667	5507	Datasus/SIM
Congenital	2.127	5.008	0	93.023	5507	Datasus/SIM
External	0.366	1.914	0	43.478	5507	Datasus/SIM
Nutritional	0.601	3.221	0	166.667	5507	Datasus/SIM
Other	0.87	3.597	0	142.857	5507	Datasus/SIM
Ill-Defined	4.551	10.684	0	142.857	5507	Datasus/SIM
Fertility						
Rates of Birth per Woman (10-49y)	0.055	0.017	0.002	0.169	5507	Datasus/SINASC
Birth Oucomes						
Apgar 1	8.183	0.903	1	9	5428	Datasus/SINASC
Apgar 5	8.663	0.885	1	9	5082	Datasus/SINASC
Low Birth Weight (<2.5k)	0.066	0.032	0	0.5	5507	Datasus/SINASC
Premature Birth	0.093	0.107	0	1	5507	Datasus/SINASC
Sex Ratio at Birth	1.074	0.247	0.154	5	5505	Datasus/SINASC

Summary Statistics

Back

Table: Descriptive Statistics (at the baseline year) – *Cont.*

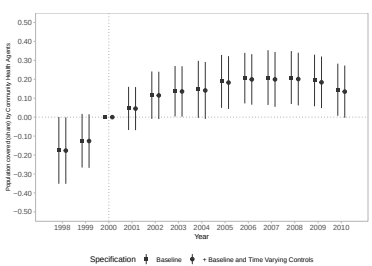
	Mean	Std. Dev.	Min	Max	Obs.	Source of Data
Controls						
Population (1,000)	29.773	178.831	0.711	9968.485	5507	IBGE/Census
GDP per capita (2010 R$)	9.531	11.231	1.365	271.779	5507	IBGE/Census
'Bolsa Familia' transfers per capita (2010 R$)	0	0	0	0	5507	IBGE/Census
Life Expectancy	68.385	3.962	57.46	77.24	5507	IBGE/Census
Expected Years of Study	8.337	1.794	2.29	13.02	5507	IBGE/Census
Illiteracy Rate (above 18y old)	23.626	13.516	1	63.01	5507	IBGE/Census
Income per capita	338.35	192.807	62.65	1759.76	5507	IBGE/Census
Share of Population Below Poverty Line	0.411	0.228	0.007	0.908	5507	IBGE/Census
Gini Coefficient	0.547	0.068	0.3	0.87	5507	IBGE/Census
Access to Sewage Network	0.251	0.302	0	0.993	5507	IBGE/Census
Access to Garbage Collection Service	0.535	0.271	0	1	5507	IBGE/Census
Access to Water Network	0.583	0.241	0	1	5507	IBGE/Census
Access to Electricity	0.869	0.165	0.081	1	5507	IBGE/Census
Urbanization Rate	0.602	0.227	0	1	5507	IBGE/Census
Average Neighbors Spending Health Spending per capita (2010 R$)	206.387	125.041	1.741	3298.403	5504	Finbra
Municipality's Spending in Human Resources (% of Total Revenue)	0.415	0.109	0	1.242	5304	Finbra

Notes: Authors' own tabulation. Statistics for IBGE/AMS data refer to the year 1999 and statistics for all remaining variables refer to the baseline year o 2000. Data sources indicated in the table.

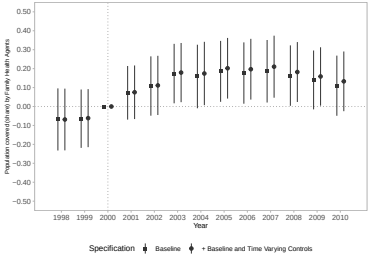
Access and Production of Health Service

Effects on Primary Care Coverage

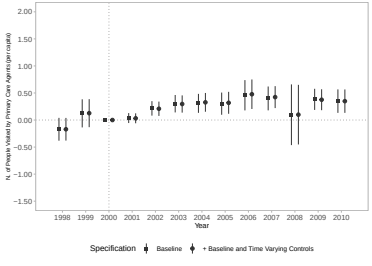
Population Covered by Community Health Agents



Population Covered by Family Health Agents



N. of People Visited



Where do Infant Mortality Declines Occur? I

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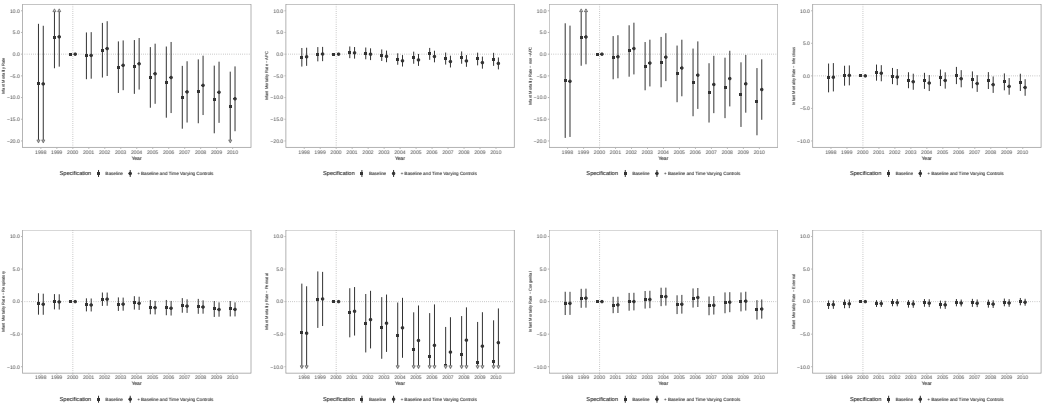
Figure: Continuous Event Studies, Variable by Variable – Infant Mortality



Where do Infant Mortality Declines Occur? II

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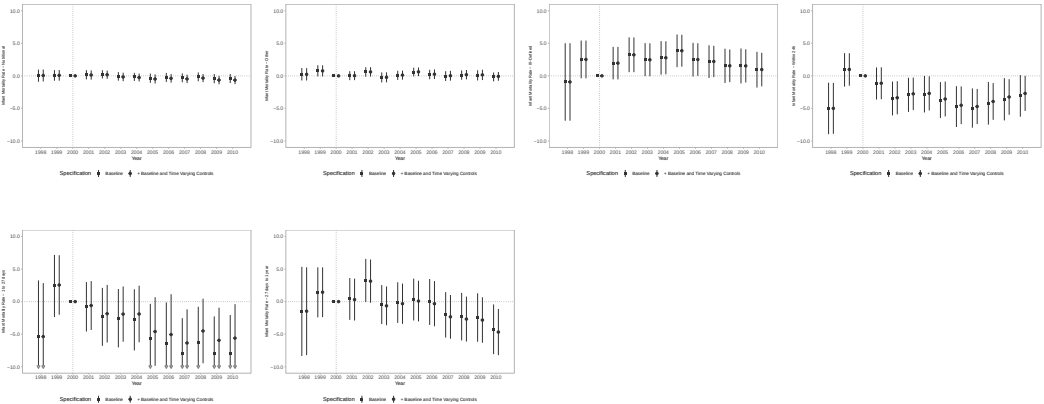
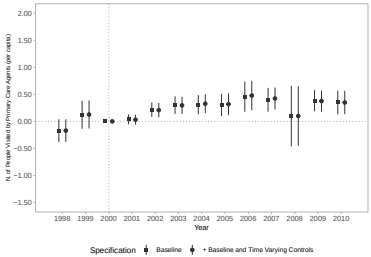
Figure: Continuous Event Studies, Variable by Variable – Infant Mortality



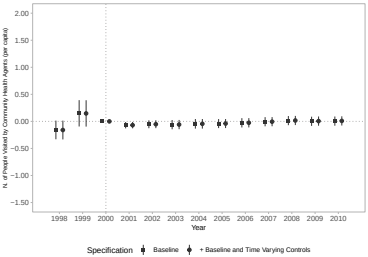
Access and Production of Health Service

Effects on Primary Care Coverage

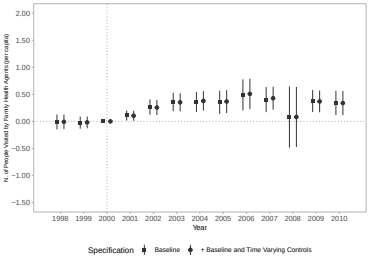
(a) N. of People Visited



(b) People Visited by CH Agents

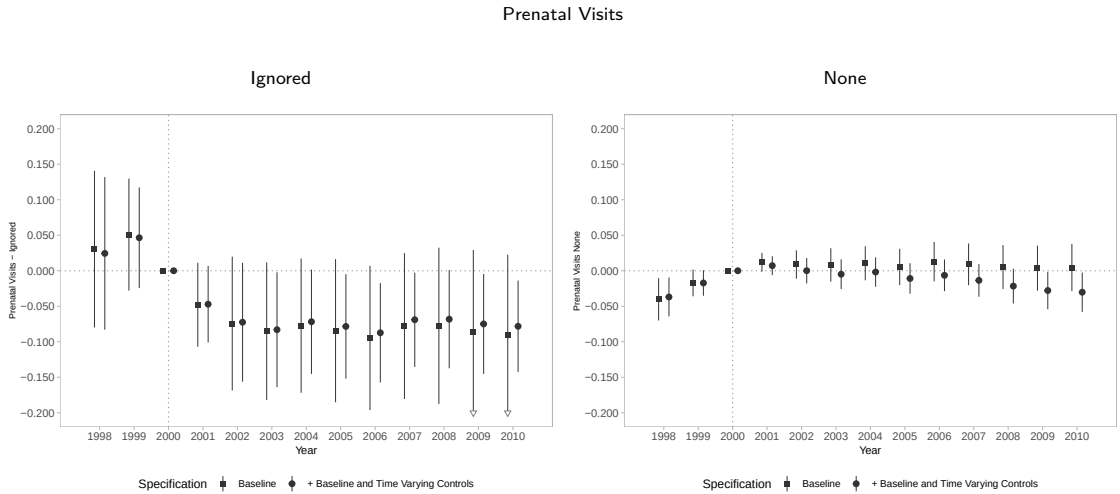


(c) People Visited by FH Agents

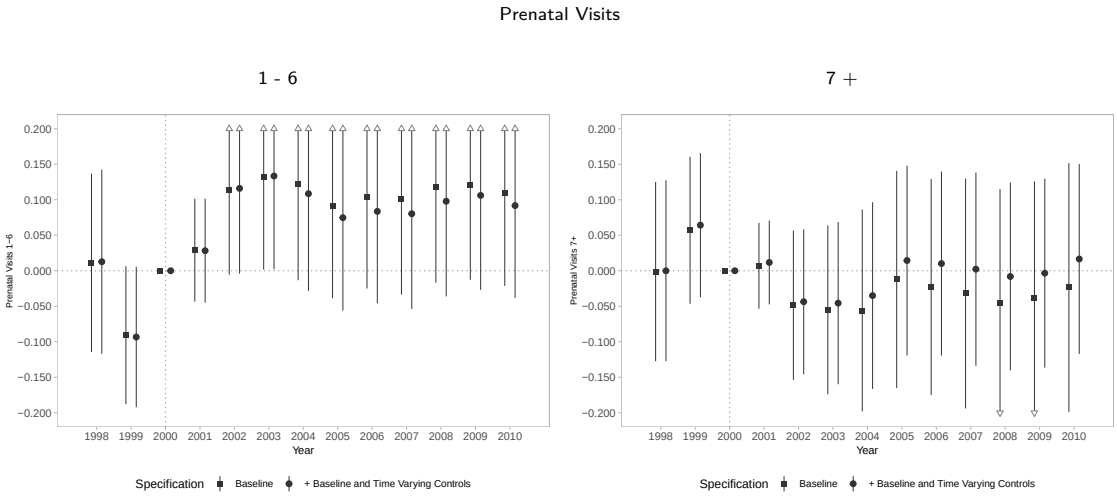


Access and Production of Health Service

Indexes



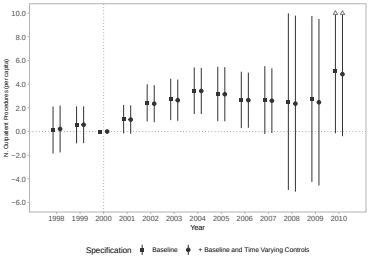
Access and Production of Health Service



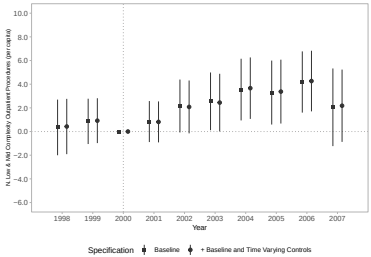
Access and Production of Health Service

Ambulatory Production

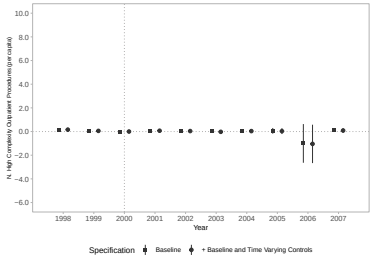
(a) Total



(b) Low and Mid Complexity



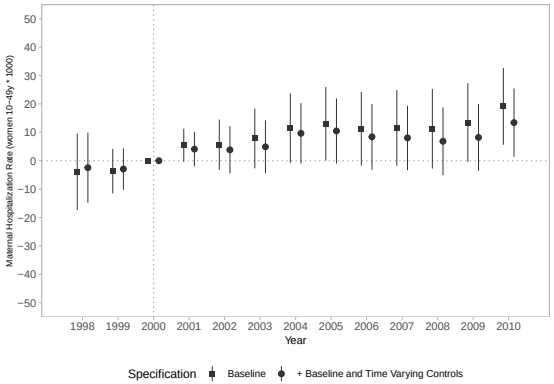
(c) High Complexity



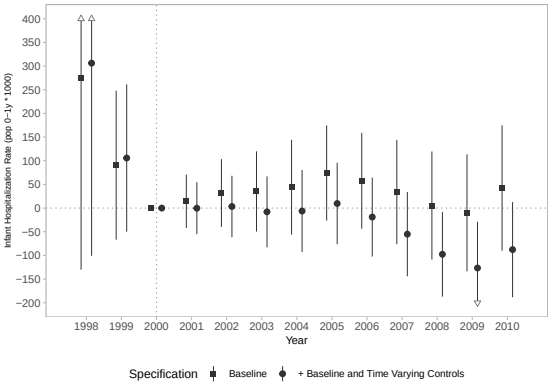
Access and Production of Health Service

Hospitalization Rates

Maternal (woman 10-49y * 1000)



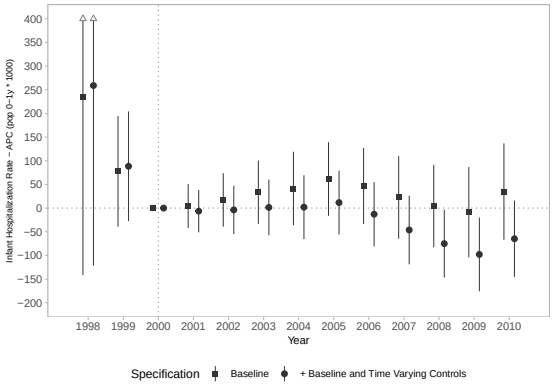
Infant (pop 0-1y * 1000)



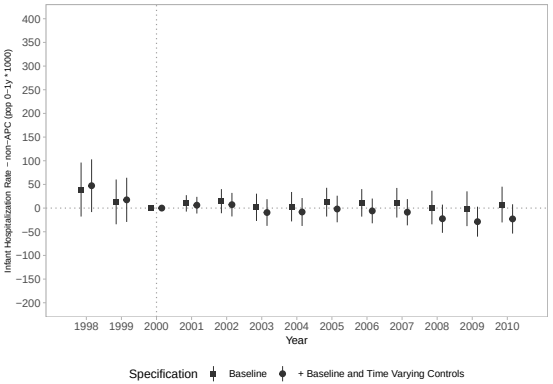
Access and Production of Health Service

Hospitalization Rates

Infant - APC (pop 0-1y * 1000)



Infant - non-APC (pop 0-1y * 1000)

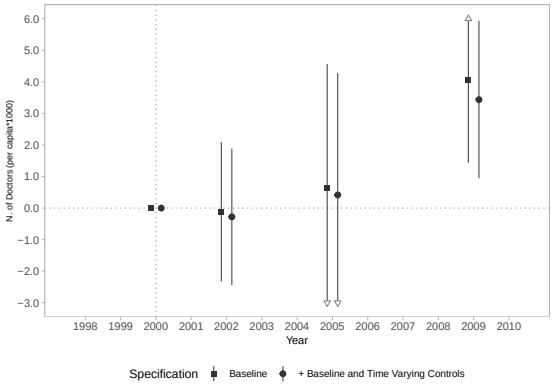


Health Inputs

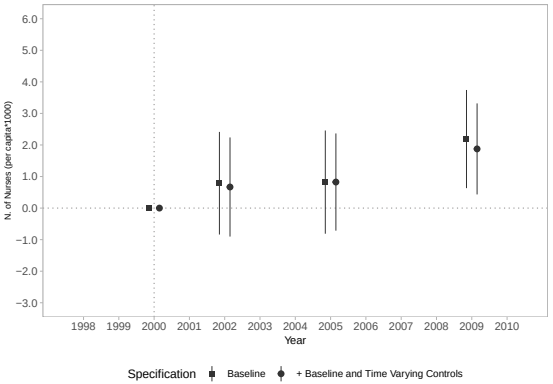
Indexes

Effects on Health Human Resources

Number of Doctors (per capita*1000)



Number of Nurses (per capita*1000)

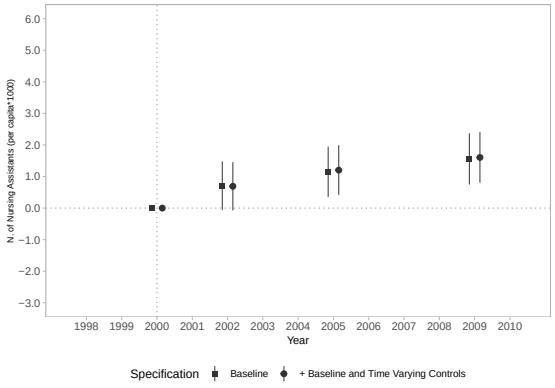


Health Inputs

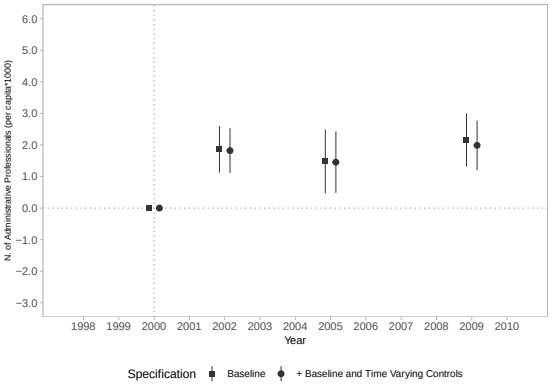
Indexes

Effects on Health Human Resources

Number of Nursing Assistants (per capita*1000)



Number of Administrative Professionals (per capita*1000)

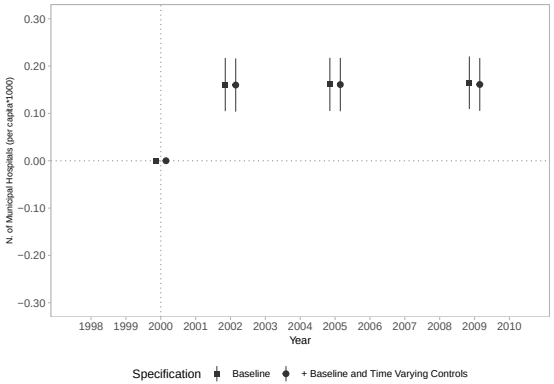


Health Inputs

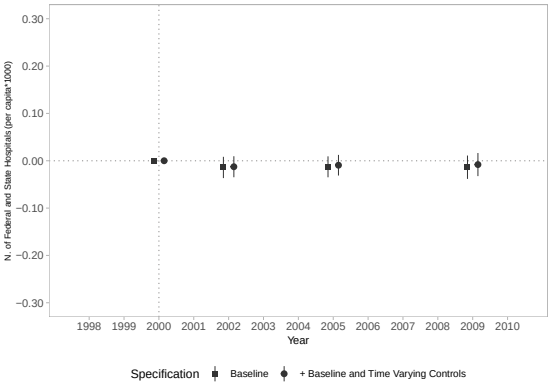
Indexes

Effects on Health Infrastructure

N. of Municipal Hospitals (per capita*1000)



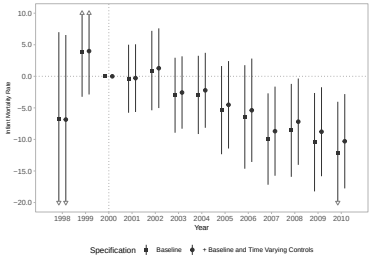
N. of Federal and State Hospitals (per capita*1000)



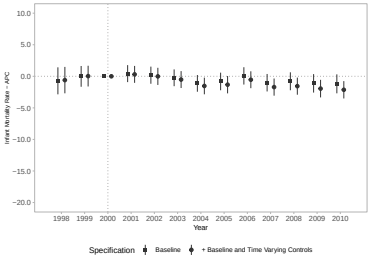
Birth Outcomes

Effects on Infant Mortality Rates

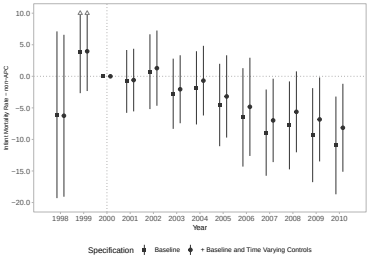
Total



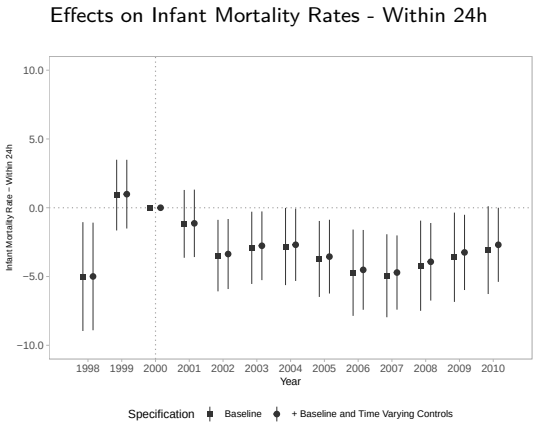
Amenable to Primary Care



Non-Amenable to Primary Care



Birth Outcomes

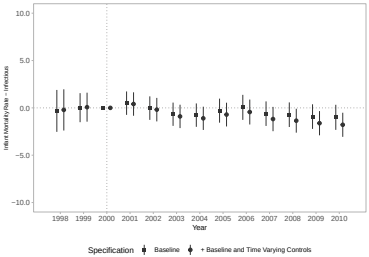


Birth Outcomes

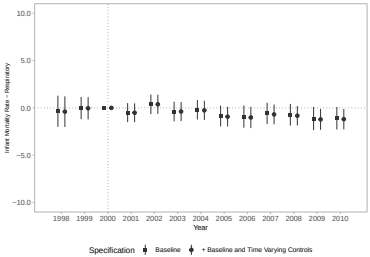
Indexes

Effects on Infant Mortality Rates

Infectious



Respiratory



Perinatal