

Rural Hospital Closures and Local Economic Decline

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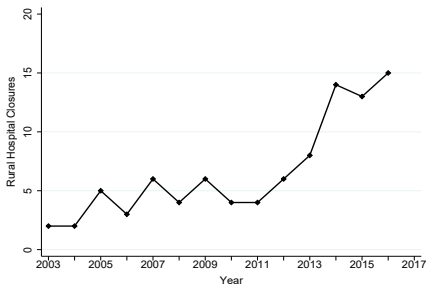
December 31, 2020

Introduction

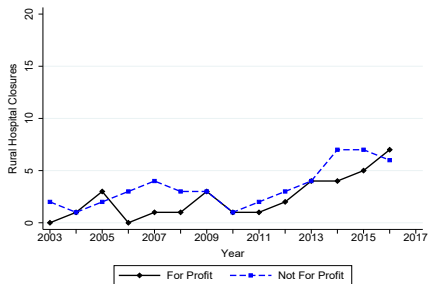
- Much of the rural United States has experienced declining population and economic activity over the last several decades
 - Cromartie, 2018; Brown et al., 2019
- Research highlights “pull factors” to urban areas: higher wages and productivity, desirable amenities
 - Glaeser et al., 2001; Diamond, 2016; Acemoglu and Restrepo, 2019
- Less work evaluates how negative local labor shocks and amenity losses affect rural communities (“push-factors”)
- This paper examines what happens to rural communities after a local hospital closes

Trends in Rural Hospital Closures

(a) Total Hospital Closures



(b) Closures by Ownership



Notes: The above figure shows the number of rural hospital closures from 2003-2016. Data from AHA Annual Survey. Counties are classified as "rural" if (1) less than 50 percent of the population live in an urban area or (2) the population density is under 64 per square mile for the entire county (10 acres per person) and the total population of the county is less than 50,000.

New York Times 10/29/2018

TheUpshot

THE NEW HEALTH CARE

A Sense of Alarm as Rural Hospitals Keep Closing

The potential health and economic consequences of a trend associated with states that have turned down Medicaid expansion.



NPR 4/7/2019

HEALTH INC.

Economic Ripples: Hospital Closure Hurts A Town's Ability To Attract Retirees

▶ 3 MINUTE LISTEN



April 7, 2019 · 7:33 AM ET
Heard on Weekend Edition Sunday

BLAKE FARMER

FROM

NASHVILLE
PUBLIC RADIO



- Unique shock that impacts labor demand *and* supply
 - Hospitals produce many jobs, consume local goods and services
 - Serve as an important quality-of-life amenity
- DiD design exploits county-level variation in closures from 2003-2017
- Develop spatial equilibrium model of rural economies
 - Provides theoretical structure for the estimated effects
 - Characterize welfare impacts among different residents in the economy

Preview of Results

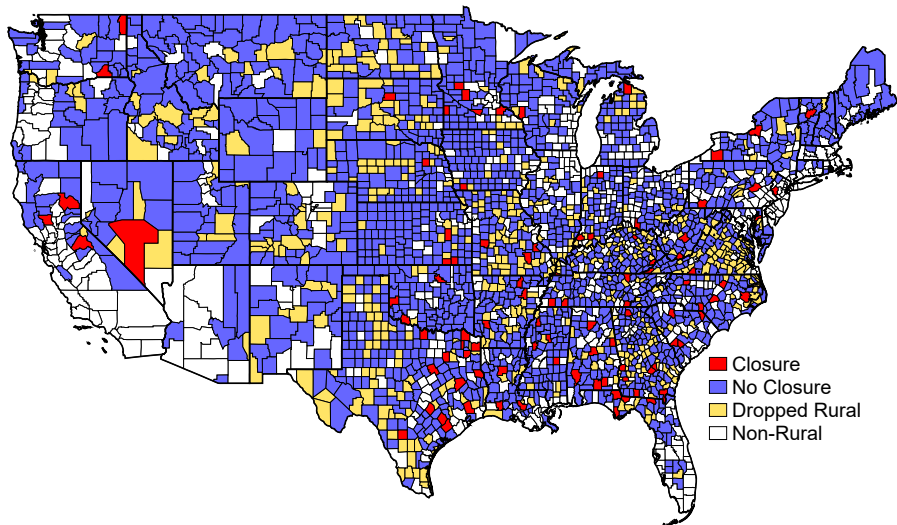
- **Local Economy:** Closures adversely impact employment, income, unemployment rates, labor force participation, establishments, population, and rental prices
 - No evidence of differences in trends between treatment and control
 - Non-transitory shock; impacts tend to *grow* over time
- **Heterogeneity:** Effects largest in counties that lose sole hospital and in counties where hospitals compose a larger share of the labor market
- **Spillovers:** Closures decrease non-hospital employment by 1.8 percent (40% of the total employment reduction)
- **Welfare:** Larger welfare reductions for older residents, but total welfare loss is smaller than operating costs

- Hospital data from the American Hospital Association Annual Survey
 - Associated facilities, ownership, services, employment, payroll, and reimbursement structures
 - Includes list of all hospital closures in U.S.
- **Local Economy:**
 - Per-capita wage earnings, employment, establishments (QCEW)
 - Labor force participation, unemployment rate (LAUS-BLS)
 - Median Rental Prices (HUD)
- **Population**
 - Total and age-specific population (SEER-CDC)

Sample Construction

- Rural classification follows Albouy et al (2018)
 - (1) More than 50 percent of the population live in a rural area
 - (2) Population density under 64 per square mile for the entire county and the total population less than 50,000
- Exclude specialized, prison, and military hospitals
- Drop counties with zero hospitals and include only *first* closure

Location of Rural Hospital Closures



Notes: The above map shows county urban and rural classifications. Counties are classified as “rural” if (1) more than 50 percent of the population live in a rural area or (2) the population density is under 64 per square mile for the entire county (10 acres per person) and the total population of the county is less than 50,000. (Albouy et al., 2018)

Identification

- Casual interpretation requires the outcomes would have evolved smoothly in the absence of closure
- Challenges to identification:
 - 1 **Confounding Trends:** Closures may tend to occur in areas experiencing economic downturns
 - 2 **OVB:** Unobserved shock correlated with closure and economics outcomes
 - 3 **Anticipation Bias:** Hospitals may anticipate local economic conditions that determine staying open or closing
- Results consistent with literature that cite low reimbursement rates, operating inefficiency, and management as causes of closure
 - Lindrooth et al. (2003); Ciliberto and Lindrooth (2007); Garthwaite et al., (2018); Duggan et al. (2019) [Sum Stats](#)

Estimate Event Study and pooled DiD models

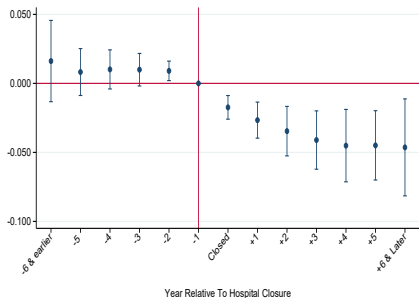
$$y_{ct} = \alpha_c + \delta_{st} + \sum_{k=-5}^{+5} \beta_k I\{t = h_c + k\} + \bar{\beta} I\{t < h_c - 6\} + \underline{\beta} I\{t > h_c + 6\} + \beta \mathbf{X}_{ct} + \epsilon_{ct}$$

$$y_{ct} = \alpha_c + \delta_{st} + \beta_1 \text{Closure}_{ct} + \beta \mathbf{X}_{ct} + \epsilon_{ct}$$

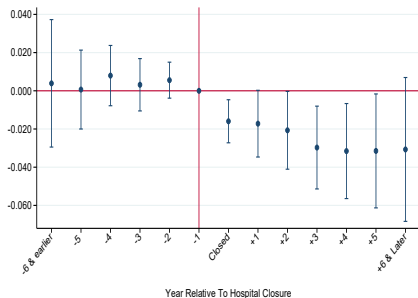
- y_{ct} : Outcome in county c in year t
- h_c : Year of hospital closure in county c
- Closure_{ct} : Binary variable for hospital closure in county c after time t
- α_c : County fixed effects
- δ_{st} : State-by-year fixed effects
- \mathbf{X}_{ct} : Time-varying county characteristics (age, gender, race, and ethnic makeup)
- ϵ_{ct} : Errors clustered at county-level

Income and Employment Effects of Rural Hospital Closures

(a) Log Employment



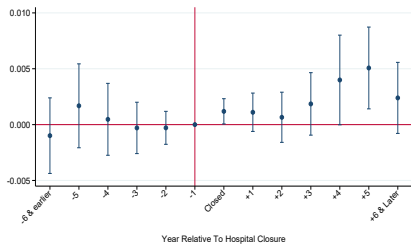
(b) Log Per Capita Income



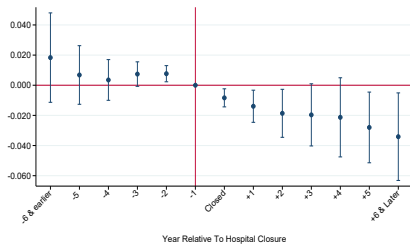
Notes: The above figures show event study plots of county-level economic effects of rural hospital closures. The sample includes rural counties for 2003-2017. The longest vertical line indicates the end of the year before a hospital closure. Bands indicate 95 percent confidence intervals. All specifications include county and state-by-year fixed effects. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level.

Unemployment, LFP, and Establishment Effects of Rural Hospital Closures

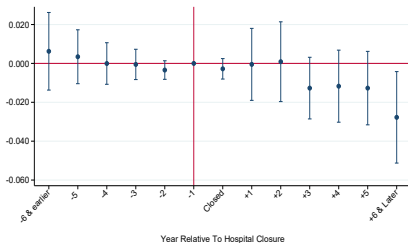
(a) Unemployment Rate



(b) Log Labor Force Participation

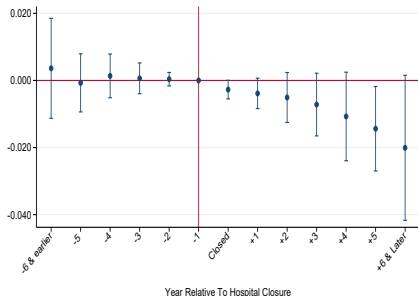


(c) Log Establishments

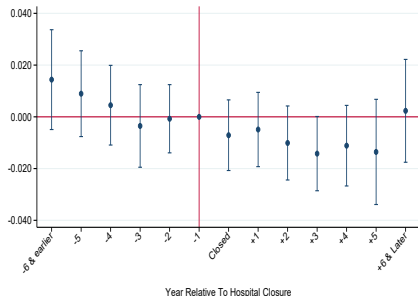


Population and Housing Effects of Rural Hospital Closures

(a) Log Total Population



(b) Log Median Rents



Notes: The above figures show event study plots of county-level population and rental effects of rural hospital closures. The sample includes rural counties for 2003-2017. The longest vertical line indicates the end of the year before a hospital closure. Bands indicate 95 percent confidence intervals. All specifications include county and state-by-year fixed effects. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level.

County Income and Employment Effects of Rural Hospital Closures

	<i>Log Employment</i>		<i>Log Per Capita Income</i>		<i>Unemployment Rate</i>		<i>Log Labor Force</i>		<i>Log Total Establishments</i>	
	<i>Baseline</i>	<i>Controls</i>	<i>Baseline</i>	<i>Controls</i>	<i>Baseline</i>	<i>Controls</i>	<i>Baseline</i>	<i>Controls</i>	<i>Baseline</i>	<i>Controls</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Hospital Closure	-0.044*** (0.010)	-0.043*** (0.010)	-0.029*** (0.011)	-0.026*** (0.010)	0.002* (0.001)	0.002* (0.001)	-0.029*** (0.011)	-0.028*** (0.010)	-0.011 (0.009)	-0.010 (0.008)
<i>Mean Dependent Variable</i>		10,473		10,680		0.075		15,421		769
Controls	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	1830	1829	1829	1829	1830	1829	1830	1829	1830	1829
Observations	27444	27429	27429	27429	27448	27433	27448	27433	27448	27433

Notes: This table shows estimated impacts of rural hospital closures using data from the AHA Annual Survey between the years 2003 and 2017. All specifications include county and state-by-year fixed effects. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level. *, **, and *** indicate significance levels of .10, .05, and .01., respectively.

County Population and Housing Effects of Rural Hospital Closures

	<i>Log Total Population</i>	<i>Log 0-19 Population</i>	<i>Log 20-64 Population</i>	<i>Log 65 + Population</i>	<i>Log Median Rents</i>
	(1)	(2)	(3)	(4)	(5)
Hospital Closure	-0.012** (0.005)	-0.013*** (0.005)	-0.012** (0.005)	-0.015** (0.006)	-0.013** (0.011)
<i>Mean Dependent Variable</i>	33,109	8,354	19,329	5,021	641
Controls	Yes	Yes	Yes	Yes	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes
Clusters	1829	1829	1829	1829	1819
Observations	27435	27435	27435	27435	26968

Notes: This table shows estimated impacts of rural hospital closures using data from the AHA Annual Survey between the years 2003 and 2017. All specifications include county and state-by-year fixed effects. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level. *, **, and *** indicate significance levels of .10, .05, and .01., respectively.

Robustness and Alternative Specification

1 **Diff-in-Diff Decomposition** [Table](#)

2 **Controls For Industry Mix** [Table](#)

3 **Population Weighted** [Table](#)

4 **Balanced Panel** [Table](#)

5 **County Specific Trends** [Table](#)

6 **P-score Reweighting** [Overlap](#) [Table](#)

7 **County Borders** [Border Pairs](#) [Exclude adjacent](#)

8 **Urban Counties** [Table1](#) [Table2](#)

- I explore heterogeneity in two ways:
 - ① **Effects by number of hospitals in county after closure**
 - ② **Effects by hospital's share of county employment**

Heterogeneity by Number of Hospitals After Closure

	<i>Log Employment</i>	<i>Log Per Capita Income</i>	<i>Unemployed Rate</i>	<i>Log Labor Force</i>	<i>Log Total Estabs.</i>	<i>Log Total Population</i>	<i>Log Median Rents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
0 Hospitals After Closure	-0.073*** (0.017)	-0.050*** (0.017)	0.002 (0.002)	-0.043** (0.019)	-0.029*** (0.011)	-0.019** (0.007)	-0.026*** (0.010)
> 0 Hospitals After Closure	-0.024** (0.010)	-0.011 (0.011)	0.002 (0.001)	-0.018* (0.010)	0.003 (0.011)	-0.007 (0.006)	-0.005 (0.007)
<i>Mean 0 Hospitals</i>	5,251	8,348	0.086	9,437	417	21,408	619
<i>Mean > 0 Hospitals</i>	14,725	12,516	0.067	20,361	1,056	42,856	656
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	1829	1829	1829	1829	1829	1829	1819
Observations	27429	27429	27433	27433	27433	27435	26968

Notes: This table shows estimated impacts of rural hospital closures by whether a county loses its sole hospital. Data from the AHA Annual Survey between the years 2003 and 2017. All specifications include county and state-by-year fixed effects. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level. *, **, and *** indicate significance levels of .10, .05, and .01., respectively.

Heterogeneity by Share of Employment

	<i>Log Employment</i>	<i>Log Per Capita Income</i>	<i>Unemployed Rate</i>	<i>Log Labor Force</i>	<i>Log Total Estabs.</i>	<i>Log Total Population</i>	<i>Log Median Rents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Above Median Emp. Share	-0.106*** (0.015)	-0.065*** (0.016)	0.003 (0.002)	-0.057*** (0.018)	-0.050*** (0.010)	-0.033*** (0.007)	-0.019** (0.009)
Below Median Emp. Share	0.006 (0.011)	0.005 (0.013)	0.002 (0.001)	-0.003 (0.012)	0.016 (0.013)	0.005 (0.007)	-0.011 (0.008)
<i>Mean Above Median</i>	4,631	8,222	0.084	7,495	385	17,744	600
<i>Mean Below Median</i>	14,824	11,880	0.069	21,969	1,064	48,273	686
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	1829	1829	1829	1829	1829	1829	1819
Observations	27429	27429	27433	27433	27433	27435	26968

Notes: This table shows estimated impacts of rural hospital closures by whether a closed hospital lies above or below the median contribution to the local economy. Data from the AHA Annual Survey between the years 2003 and 2017. All specifications include county and state-by-year fixed effects. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level. *, **, and *** indicate significance levels of .10, .05, and .01., respectively. Median employment=2.19 percent.

- Important to understand whether closures generate spillovers into other sectors of the local economy
- I next:
 - ① **Estimate effects net of the hospital industry**
 - ② **Estimate effects separately for private goods-producing and service-providing sectors**

Effects Net Of Hospitals

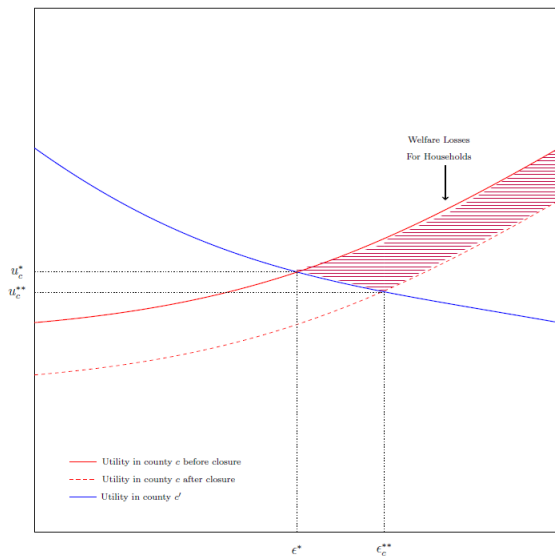
	<i>Log Employment</i>	<i>Log Total Estabs</i>	<i>Log Employment</i>	<i>Log Total Estabs</i>	<i>Log Employment</i>	<i>Log Total Estabs</i>
	(1)	(2)	(3)	(4)	(5)	(6)
	All Non-Hospital		Private Service		Private Goods	
Hospital Closure	-0.018** (0.009)	-0.007 (0.008)	-0.025** (0.011)	-0.009 (0.010)	-0.004 (0.020)	0.002 (0.011)
<i>Mean Dependent Variable</i>	10,094	767	4,686	552	2,543	156
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	1829	1829	1829	1829	1829	1829
Observations	27416	27433	27361	27431	27320	27425

Notes: This table shows estimated impacts of rural hospital closures on the non-hospital sector using data from the AHA Annual Survey between the years 2003 and 2017. All specifications include county and state-by-year fixed effects. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level. *, **, and *** indicate significance levels of .10, .05, and .01., respectively.

Spatial Equilibrium Model

- Framework follows Kline and Moretti (2014)
- Key features of the model:
 - 1) many locations, each a small economy
 - 2) economy populated by households and landowners
 - 3) heterogeneous location preferences
 - 4) two household types: workers and older residents
 - Different incomes and mobility frictions

Illustrated Change in Household Welfare



Notes: The above figure illustrates how the utility of households change after a rural hospital closure in location c . The x-axis represents marginal preferences of living in location c . The y-axis represents the utility of each household in location c . Preferences for location c are increasing from left to right.

Welfare Estimates

(1) **Household Type:** $\underbrace{-0.004}_{\text{Change for workers}} \quad (0.003) \quad \underbrace{-0.009}_{\text{Change for older residents}} \quad (0.004)$

(2) **Total Household:**

$$\Delta V^H = \underbrace{-0.003}_{\text{Weighted } \Delta \text{ for workers}} \quad (0.001) + \underbrace{-0.002}_{\text{Weighted } \Delta \text{ for older residents}} \quad (0.001) = -0.005\% \quad (0.002\%)$$

(3) **Landowners:** welfare changes = change in profits

$$\Delta V^L = \underbrace{-0.013}_{\text{Change in rental price}} \quad (0.006) + \underbrace{-0.012}_{\text{Change in occupied units}} \quad (0.005) = -2.5\% \quad (1.1\%)$$

(4) **Total Loss:** \$1.5 mil annually per county (operating cost \approx \$5 mil)

Policy Implications and Conclusions

- 30 percent of rural hospitals are currently at “high financial risk” of closing (Corcoran, 2019)
- Impacts of closures are not limited to economic outcomes
 - Research shows hospital closures cause higher mortality rates (Buchmueller et al., 2005; Carroll, 2019; Song and Saghafian, 2019)
- Can and should policy interventions take place that keep these hospitals open?

Policy Implications and Conclusions

- Research has found federal and state health policies have been very effective at reducing the probability of closure
 - Lindrooth et al. (2018) and Duggan (2019) find the ACA Medicaid expansion reduced the likelihood of closure for rural hospitals
 - Similar findings for programs that provide higher payments to rural hospitals (e.g. Medicare CAH)
- These programs are expensive compared to estimated welfare reductions
- Results suggest targeting hospitals where closures will have largest economic effects (e.g. sole hospital in county)
- Thank You!

Summary Statistics: Closures vs. Non-Closures

Variable	Closed Hospitals	Never Closed Hospitals
Total Number of Beds	53.53 (68.23)	80.36 (85.06)
Admissions per 100,000 pop.	4,888.30 (7,115.41)	6,538.30 (7,575.65)
Inpatient Days per 100,000 pop.	38,504.38 (70,493.70)	58,685.71 (100,205.30)
Full Time Personnel	177.69 (358.65)	424.27 (541.15)
Full Time Personnel per Beds	3.70 (1.77)	5.96 (4.03)
Expenses Per Inpatient Days	3,547.48 (4,792.86)	5,793.85 (40,030.74)
<i>Number of Hospitals</i>	97	2701

Notes: The table shows means and standard deviations (in parenthesis). Data From AHA Annual Survey for the years 2003-2017.

Difference-in-Differences Decomposition

	<i>Log Employment</i>	<i>Log Per Capita Income</i>	<i>Unemployed Rate</i>	<i>Log Labor Force</i>	<i>Log Total Estabs.</i>	<i>Log Total Population</i>	<i>Log Median Rents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Timing Comparisons	-0.024 [0.022]	-0.019 [0.022]	0.001 [0.022]	-0.007 [0.022]	0.008 [0.022]	-0.001 [0.022]	-0.004 [0.022]
Always vs. Timing	-0.142 [0.001]	-0.110 [0.001]	0.009 [0.001]	-0.119 [0.001]	0.009 [0.001]	-0.009 [0.001]	0.017 [0.001]
Never vs. Timing	-0.049 [0.938]	-0.045 [0.938]	0.002 [0.938]	-0.031 [0.938]	-0.018 [0.938]	-0.008 [0.938]	-0.003 [0.938]
Always vs. Never	-1.024 [0.000]	2.605 [0.000]	0.224 [0.000]	0.384 [0.000]	-0.291 [0.000]	0.294 [0.000]	-1.765 [0.000]
Within Comparisons	0.094 [0.039]	0.415 [0.039]	0.003 [0.039]	0.048 [0.039]	0.190 [0.039]	-0.111 [0.039]	-0.276 [0.039]
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	27429	27429	27433	27433	27433	27435	26968

Notes: The above table shows results from a Bacon diff-in-diff estimator decomposition. Each row corresponds to a 2x2 estimator with corresponding weights reported in brackets below the estimates.

Robustness: Controls for County Industry Mix

	<i>Log Employment</i>	<i>Log Per Capita Income</i>	<i>Unemployed Rate</i>	<i>Log Labor Force</i>	<i>Log Total Estabs.</i>	<i>Log Total Population</i>	<i>Log Median Rents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hospital Closure	-0.039*** (0.009)	-0.035*** (0.008)	0.002** (0.001)	-0.026*** (0.008)	-0.004 (0.009)	-0.010** (0.005)	-0.009 (0.006)
<i>Mean Dependent Variable</i>	10,919	11,074	0.074	15,800	794	34,243	650
Demographic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Mix Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	1712	1712	1712	1712	1712	1712	1701
Observations	23291	23291	23289	23289	23291	23291	22909

Notes: This table shows estimated impacts of rural hospital closures using data from the AHA Annual Survey between the years 2003 and 2017. All specifications include county and state-by-year fixed effects. Controls for industry mix include the fraction of county employment and earnings for the following industries: education and health, business, natural resources, construction, manufacturing, trade, finance, and leisure. Demographic controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level. *, **, and *** indicate significance levels of .10, .05, and .01., respectively.

Robustness: Population Weighted

	<i>Log Employment</i>	<i>Log Per Capita Income</i>	<i>Unemployed Rate</i>	<i>Log Labor Force</i>	<i>Log Total Estabs.</i>	<i>Log Total Population</i>	<i>Log Median Rents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hospital Closure	-0.038*** (0.009)	-0.018** (0.009)	0.001 (0.001)	-0.034*** (0.010)	-0.009 (0.009)	-0.020*** (0.007)	-0.012* (0.006)
<i>Mean Dependent Variable</i>	22,726	12,772	0.067	33,679	1,668	69,553	716
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	1829	1829	1829	1829	1829	1829	1819
Observations	27429	27429	27433	27433	27433	27435	26968

Notes: This table shows estimated impacts of rural hospital closures using data from the AHA Annual Survey between the years 2003 and 2017. All specifications include county and state-by-year fixed effects. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level. Regressions and mean dependent variables weighted by county population. *, **, and *** indicate significance levels of .10, .05, and .01., respectively.

[Return](#)

Robustness: County Specific Trends

	<i>Log Employment</i>	<i>Log Per Capita Income</i>	<i>Unemployed Rate</i>	<i>Log Labor Force</i>	<i>Log Total Estabs.</i>	<i>Log Total Population</i>	<i>Log Median Rents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hospital Closure	-0.038*** (0.008)	-0.025*** (0.009)	0.002* (0.001)	-0.019*** (0.007)	-0.002 (0.007)	-0.008** (0.003)	-0.012** (0.005)
<i>Mean Dependent Variable</i>	10,473	10,680	0.075	15,421	769	33,109	641
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County-Specific Trends	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	1829	1829	1829	1829	1829	1829	1819
Observations	27429	27429	27433	27433	27433	27435	26968

Notes: This table shows estimated impacts of rural hospital closures using data from the AHA Annual Survey between the years 2003 and 2017. All specifications include county fixed effects, state-by-year fixed effects, and county-specific trends. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level. *, **, and *** indicate significance levels of .10, .05, and .01., respectively.

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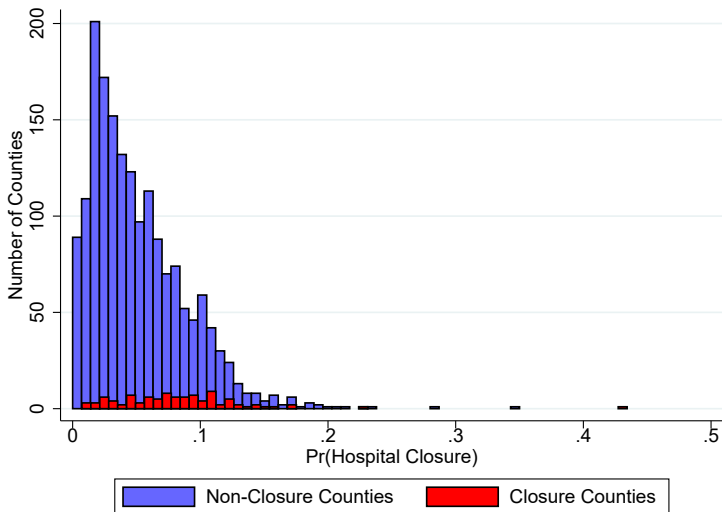
Robustness: Balanced Panel

	<i>Log Employment</i>	<i>Log Per Capita Income</i>	<i>Unemployed Rate</i>	<i>Log Labor Force</i>	<i>Log Total Estabs.</i>	<i>Log Total Population</i>	<i>Log Median Rents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hospital Closure	-0.041*** (0.016)	-0.024* (0.014)	0.003** (0.001)	-0.024 (0.016)	-0.011 (0.011)	-0.011 (0.007)	-0.016** (0.007)
<i>Mean Dependent Variable</i>	10,898	12,423	0.064	15,685	820	32,803	650
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	1770	1770	1770	1770	1770	1770	1760
Observations	26544	26544	26548	26548	26548	26550	26083

Notes: This table shows estimated impacts of rural hospital closures using data from the AHA Annual Survey between the years 2003 and 2017. All specifications include county and state-by-year fixed effects. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level. *, **, and *** indicate significance levels of .10, .05, and .01., respectively.

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Propensity Score Overlap



Notes: The above figures illustrate the histograms of the propensity scores for rural closure and non-closure counties.

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Robustness: Propensity Score Reweighting

	<i>Log Employment</i>	<i>Log Per Capita Income</i>	<i>Unemployed Rate</i>	<i>Log Labor Force</i>	<i>Log Total Estabs.</i>	<i>Log Total Population</i>	<i>Log Median Rents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hospital Closure	-0.045*** (0.008)	-0.035*** (0.008)	0.003*** (0.001)	-0.025*** (0.008)	-0.007 (0.007)	-0.007* (0.004)	-0.010* (0.005)
<i>Mean Dependent Variable</i>	10,962	11,272	0.072	15,870	800	34,664	643
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	1738	1738	1738	1738	1738	1738	1730
Observations	26066	26066	26068	26068	26070	26070	25633

Notes: This table shows estimated impacts of rural hospital closures using data from the AHA Annual Survey between the years 2003 and 2017. All specifications include county and state-by-year fixed effects. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level. Regressions and mean dependent variables weighted by $T + (1 - T) \times \frac{P}{(1-p)}$, where T is an indicator for treatment and p is the estimated propensity score. *, **, and *** indicate significance levels of .10, .05, and .01., respectively.

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Robustness: County Border-Pair Design

	<i>Log Employment</i>	<i>Log Per Capita Income</i>	<i>Unemployed Rate</i>	<i>Log Labor Force</i>	<i>Log Total Estabs.</i>	<i>Log Total Population</i>	<i>Log Median Rents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hospital Closure	-0.039*** (0.008)	-0.024** (0.010)	0.002*** (0.001)	-0.024*** (0.007)	-0.004 (0.007)	-0.007* (0.004)	-0.009 (0.006)
<i>Mean Dependent Variable</i>	10,869	11,347	0.072	15,801	780	34,611	667
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Border-Pair x Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	378	378	378	378	378	378	378
Observations	11334	11334	11340	11340	11340	11340	11238

Notes: This table shows estimated impacts of rural hospital closures using data from the AHA Annual Survey between the years 2003 and 2017. All specifications include county fixed-effects, state-by-year fixed effects, and county border-pair-by-year fixed effects. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are two-way clustered at the county and border-pair levels. Regressions and mean dependent variables weighted by number of county appearances in the sample. *, **, and *** indicate significance levels of .10, .05, and .01., respectively.

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Robustness: Excluding Adjacent Counties

	<i>Log Employment</i>	<i>Log Per Capita Income</i>	<i>Unemployed Rate</i>	<i>Log Labor Force</i>	<i>Log Total Estabs.</i>	<i>Log Total Population</i>	<i>Log Median Rents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hospital Closure	-0.042*** (0.010)	-0.023** (0.010)	0.002* (0.001)	-0.028*** (0.011)	-0.011 (0.009)	-0.014*** (0.005)	-0.012** (0.006)
<i>Mean Dependent Variable</i>	10,829	10,719	0.072	15,971	791	33,925	666
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	1497	1497	1497	1497	1497	1497	1487
Observations	22452	22452	22453	22453	22453	22455	22038

Notes: This table shows estimated impacts of rural hospital closures using data from the AHA Annual Survey between the years 2003 and 2017. All specifications include county and state-by-year fixed effects. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level. *, **, and *** indicate significance levels of .10, .05, and .01., respectively.

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Robustness: Urban Counties (Baseline)

	<i>Log Employment</i>	<i>Log Per Capita Income</i>	<i>Unemployed Rate</i>	<i>Log Labor Force</i>	<i>Log Total Estabs.</i>	<i>Log Total Population</i>	<i>Log Median Rents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hospital Closure	-0.009 (0.006)	-0.005 (0.006)	-0.001** (0.001)	0.007 (0.006)	0.003 (0.006)	-0.006 (0.006)	-0.006 (0.006)
<i>Mean Dependent Variable</i>	156,884	20,781	0.063	173,703	9,828	344,517	894
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	682	682	682	682	682	682	660
Observations	10230	10230	10218	10218	10230	10230	9833

Notes: This table shows estimated impacts of urban hospital closures using data from the AHA Annual Survey between the years 2003 and 2017. All specifications include county and state-by-year fixed-effects. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level. *, **, and *** indicate significance levels of .10, .05, and .01., respectively.

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Robustness: Urban Counties (Reweighted)

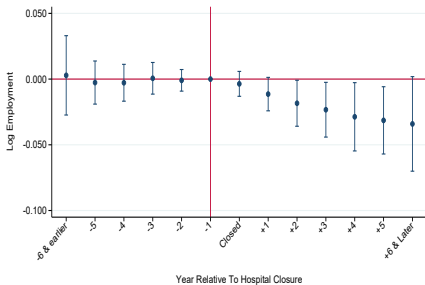
	<i>Log Employment</i>	<i>Log Per Capita Income</i>	<i>Unemployed Rate</i>	<i>Log Labor Force</i>	<i>Log Total Estabs.</i>	<i>Log Total Population</i>	<i>Log Median Rents</i>
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hospital Closure	-0.003 (0.006)	-0.002 (0.006)	-0.001 (0.001)	0.007 (0.006)	0.001 (0.006)	0.001 (0.005)	0.003 (0.006)
<i>Mean Dependent Variable</i>	225,177	23,664	0.065	234,610	13,413	462,801	944
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State x Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clusters	639	639	639	639	639	639	616
Observations	9585	9585	9573	9573	9585	9585	9197

Notes: This table shows estimated impacts of urban hospital closures using data from the AHA Annual Survey between the years 2003 and 2017. All specifications include county and state-by-year fixed-effects. Controls include the county population percentages of the 1 to 19, 20 to 39, 40 to 64, and over 65 years age ranges, the county population percentages of two racial groups (white, non-white), the county population percentages of males, and the county population percentages of Hispanics. Standard errors are clustered at the county level. Regressions and mean dependent variables weighted by $T + (1 - T) \times \frac{P}{(1-p)}$, where T is an indicator for treatment and p is the estimated propensity score. *, **, and *** indicate significance levels of .10, .05, and .01., respectively.

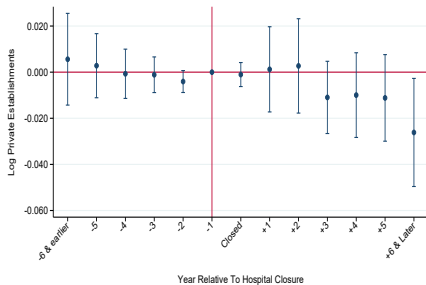
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Effects Net of Hospitals

(a) Log Employment



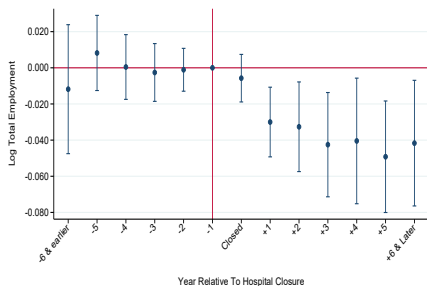
(b) Log Private Establishments



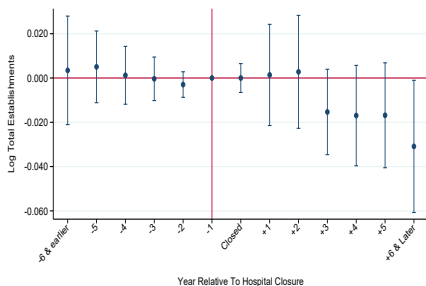
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Spillovers into Private Service Sector

(a) Log Employment



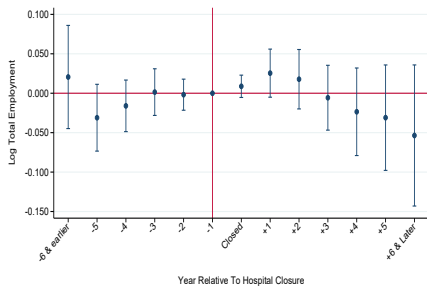
(b) Log Establishments



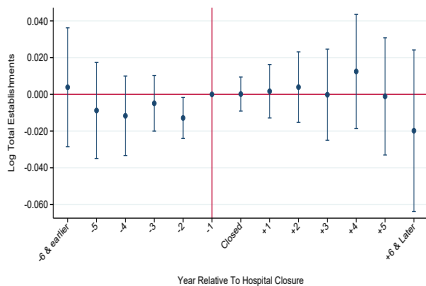
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Spillovers into Private Goods Sector

(a) Log Employment



(b) Log Establishments



Return