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DO CERTIFICATE-OF-NEED LAWS INCREASE INDIGENT CARE?

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Abstract

Many states have certificate-of-need regulations, which prohibit hospitals, nursing homes, and ambulatory surgical centers from entering new markets or making changes to the existing capacity of medical facilities without first gaining approval from certificate-of-need regulators. These regulations purport to limit the supply of medical services and to induce regulated institutions to use the resulting economic profits to cross-subsidize indigent care. We document that these regulations do limit supply. However, we do not find strong evidence of higher levels of indigent-care provision in states that have certificate-of-need regulations as opposed to those that do not.

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Do Certificate-of-Need Laws Increase Indigent Care?

Thomas Stratmann and Jacob W. Russ

1. Introduction

Certificate-of-need (CON) programs prohibit hospitals, nursing homes, and ambulatory surgical centers from entering new markets or making changes to the existing capacity of medical facilities without first gaining approval from certificate-of-need regulators. During the period examined, 36 states and the District of Columbia had CON programs that reviewed applications for medical equipment and services (see the map on page 23).[1] These programs intend to create a quid pro quo in which the agencies increase the profitability of covered medical services by restricting competition and, in return, medical providers cross-subsidize specified amounts of indigent care, or medical services to the poor that are unprofitable to the provider (Banks, Foreman, and Keeler 1999; David et al. 2011).[2]

The theory of cross-subsidization is well established. Posner (1971) and Faulhaber (1975) outline how regulators can create "internal subsidies" within firms to encourage them to provide unprofitable, but socially desirable, services. If regulators restrict entry and limit firm output, profits for existing firms likely increase because of reduced competition. After regulation, firms have the monopoly profits with which to cover losses on unremunerated services.[3]

However, there is reason to question the willingness and ability of medical providers to comply with the subsidy scheme (David et al. 2011). First, because hospitals can claim to offer

[1] CON programs vary significantly in the stringency of the review process and the services and equipment covered. At the extremes, in 2011, Ohio's CON program only regulated long-term acute care, while as many as 30 categories of medical services and equipment are reviewable in Vermont (AHPA 2012).

[2] For example, Virginia's CON statute explicitly grants the state health commissioner the discretion to include indigent care as a condition of approving a CON permit (Virginia Dept. of Health 2004).

[3] We take the claim of cross-subsidization at face value, but note that firms may view such regulation as part of their profit maximizing strategy (i.e., regulatory capture). Two papers that directly hypothesize that hospitals desire CON regulations are Payton and Powsner (1980) and Wendling and Werner (1980).

subsidized service through one of many channels, regulators cannot monitor the hospitals effectively. Without effective monitoring, hospitals have little incentive to subsidize indigent care. Second, because technological change, the rise of managed care organizations, reduced federal payment rates to Medicare, and deregulation have made the health care industry more competitive since the 1980s, medical providers have lower profits and less ability to provide cross-subsidies (Santerre and Pepper 2000; Frakt 2011, 2014).

CHALLENGE OF VERIFY

Several state-specific studies, however, do find evidence of cross-subsidization among hospitals and nursing homes (Dranove 1988; Campbell and Fournier 1993; Ford and Kaserman 1993; Fournier and Campbell 1997; Troyer 2002; David et al. 2011). Most of this evidence comes from the 1980s.

In this paper, we provide new evidence on the cross-subsidization hypothesis and contribute to the literature on the economics of regulation (Stigler 1971; Peltzman 1976; Becker 1983). We use two state-level measures of indigent care, covering the entire United States: uncompensated care from 2007 to 2010 and Medicaid patient days from 2000 to 2010.[4] Further, we create a comprehensive database on state CON regulations. This dataset allows us to capture differences in regulatory authority among state CON programs.

We do not find evidence associating CON programs with an increase of indigent care. The effect of CON programs on indigent care shows no clear pattern using either direct or indirect measures of indigent care. However, consistent with the existing literature, our results suggest that CON programs restrict entry and limit the provision of regulated medical services. For example, CON states have about 13 percent fewer hospital beds per 100,000 persons than non-CON states.

[4] The only other large-scale study of CON programs is Zhang (2008), which uses data from 17 states. Zhang finds that both for-profit and nonprofit hospitals increase their provision of uncompensated care in response to CON laws.

In section 2 we provide background on CON regulations and discuss the above justification and a different one. In section 3 we describe our data and outline our empirical strategy. Section 4 presents our results. We then discuss these results and conclude our analysis in section 5.

2. Background

New York introduced CON regulation to the United States in 1964 to contain health care costs.[5] Proponents thought unregulated market competition created incentives for medical providers to overinvest in facilities and equipment. Regulators could lower the growth rate of health care costs by restricting market expansion to expenditures for which the medical provider could demonstrate a clear public need. The early studies of these laws generally found evidence neither of reduced investment by hospitals (Hellinger 1976; Salkever and Bice 1976) nor of cost control (Sloan and Steinwald 1980; Sloan 1981; Joskow 1980; Joskow 1981).

The results of more recent research are mixed: Conover and Sloan (1998) find that while CON laws appear to have a modest cost-control effect, their removal in several states was not associated with a surge in hospital spending. The "Big Three" automakers, Chrysler, Ford, and General Motors, released internal studies showing that health care costs in a handful of non-CON states were higher than in Michigan, New York, Missouri, and Kentucky, each of which has CON laws (DaimlerChrysler Corporation 2002; Ford Motor Company 2000; General Motors Corporation 2002). A study by Rivers, Fottler, and Frimpong (2010) finds no evidence that CON laws are associated with reduced hospital costs, but does find evidence that stringent CON programs increase costs by 5 percent. Most recently, Rosko and Mutter (2014), using stochastic frontier analysis, find that states with CON laws show increased cost efficiency.

STUDIES ARE ALL OVER THE PLACE.

[5] Simpson (1985) provides a brief and comprehensive history of CON legislation.

Campbell and Fournier (1993) and Fournier and Campbell (1997) propose that regulators have a different primary justification for CON programs: cross-subsidizing indigent care. Using CON application data in Florida, they find evidence of a quid pro quo. Hospitals that provided the most indigent care had a higher probability of winning CON approval.[6] Several other state-specific studies also find evidence of cross-subsidization among hospitals and nursing homes. Dranove (1988) argues hospitals in Illinois raised prices on privately paying patients in response to a drop in Medicaid payments in the 1980s—an example of cross-subsidization.[7] Troyer (2002) finds evidence of cross-subsidies among nursing home patients in Florida. Self-paying nursing home patients appear to pay more than do comparable Medicaid patients. Troyer concludes that this cross-subsidy is intertemporal: nursing homes charge more at the beginning of a patient's care cycle in anticipation of switching to the lower-paying Medicaid system later. Finally, David et al. (2011) find that hospitals in Arizona and Colorado changed their product mix in response to the entry of specialty hospitals. As competition increased, hospitals provided fewer unprofitable services and more profitable services. Their results show that competition limits hospitals' ability to cross-subsidize.

Recent papers, however, do not find evidence of cross-subsidization. Frakt (2011, 2014) surveys the literature and concludes that although in the 1980s it was possible for hospitals to shift much of their costs between patient groups (Cutler 1998), the market is now too competitive to allow them to do so to a significant extent (Wu 2010; Dranove, Garthwaite, and Ody 2013; White 2013; White and Wu 2014).

EVOLVING TREND

[6] Miller and Hutton (2004) cite court documents as additional evidence that uncompensated care provision leads to favorable treatment during the application process.

[7] Dranove uses the term "cost-shift" when describing the process of raising private prices in response to changes in public prices. While we recognize that cross-subsidization and cost-shifting are not interchangeable in the literature, both are examples of price discrimination. Because the underlying mechanism is the same, forces that affect a firm's ability to price discriminate will influence both of these processes. Therefore, we reference studies in the cost-shifting literature here. However, to ease exposition, we will only refer to cross-subsidization throughout this paper.

3. Data and Empirical Strategy

3.1. *Data*

The dependent variables used in this paper come from three sources. The most direct measure of indigent care, uncompensated care, comes from the Healthcare Cost Report Information System (HCRIS).[8] HCRIS defines uncompensated care as the sum of charity care and bad debt (CMS 2014). We use HCRIS figures from fiscal years 2007 to 2010.[9] We aggregate hospital-level data to create state-level observations. These data include the number of beds from the reporting hospitals, which allows us to standardize our uncompensated care measure on a per-bed basis.

Second, we use data from two American Hospital Association (AHA) sources: *Hospital Statistics 2013* and the AHA subsidiary Health Forum's Medicaid statistics. We glean two indirect measures of indigent care: ratios of Medicaid patient days to total patient days and of Medicaid admissions to total patient discharges. *Hospital Statistics*, compiled from the AHA's Annual Survey of Hospitals, contains state-level summary data from 1994 to 2011. This source provides information on facilities and services, utilization rates, personnel, and financial aggregates.

We use other data from the AHA to examine whether CON laws restrict hospital capacity. Data include state-level summaries of total patient admissions, discharges, and inpatient days. These data distinguish between hospitals and nursing homes as well as between Medicare and Medicaid status. They cover separate measures of health care capacity based on the number of hospitals that report providing each of the following medical services: computed tomography (CT) scanning, magnetic resonance imaging (MRI), optical colonoscopy, and virtual colonoscopy. These hospitals also report the number of operating indigent-care clinics and rural

[8] HCRIS data are collected by the Centers for Medicare & Medicaid Services (CMS 2014).
[9] For example, fiscal year 2007 began on October 1, 2006, and ended on September 30, 2007.

health clinics, the total number of hospital beds in a state, and the number of beds for hospitals that reported data to the AHA.

Certificate-of-need program data come from our third source, the American Health Planning Association (AHPA). The AHPA publishes its annual survey of state CON programs in annual national directories. From these directories we assembled the most comprehensive dataset on state CON regulations to date, covering 1992 through 2011.[10] Classifying data by AHPA's state-by-state surveys allows us to create variables that evaluate the stringency of CON programs by state.

The first of these variables equals one if there is CON regulation in a state. Second, from the directories' 28 standardized categories[11] for equipment and services regulated by CON programs, we create a variable counting the number of categories by state and year. We also create binary measures for each of the categories. These variables capture the fact that although a state may have a CON regulation agency, this agency may or may not regulate a particular service or type of equipment. For example, in 2011 Delaware had a CON program, but its agency did not review psychiatric services or MRIs.

The control variables we use in our study come from a variety of sources. We collect state-level demographic information from the Census Bureau on the total population, the poverty level, and the percentages of white, black, and Hispanic citizens. From the census data we also calculate, for three population groups, measures likely to be correlated with an increased use of hospital facilities and with indigent care: the proportion of the population below age 18, above

[10] AHPA has published its national directories from 1990 to 2012, but we do not use the two earlier surveys because AHPA did not report its survey data by state.

[11] The AHPA surveys actually cover 31 categories. Because they do not report three of these categories consistently for the entire period, we omit them to keep our count of regulated services uniform. Business computers started as a reported category, but as of the 2008 directory no state claimed to regulate this category and in the 2009 directory it was removed completely. Hospice was added as a category as part of the 2006 directory, and nursing home bed regulation was separated from long-term acute care and given its own category as part of the 2007 directory.

age 65, and female and of child-bearing age (15–44). We collect nominal per capita state income from the Bureau of Economic Analysis and convert it to real income using the consumer price index from the Bureau of Labor Statistics. We use 2011 as our base year. Our state-level unemployment-rate data also come from the Bureau of Labor Statistics. Finally, we get the age-adjusted percentage of adults (persons 18 and over) with diagnosed diabetes from the Centers for Disease Control and Prevention. We include diabetes as an additional control variable to capture poor health outcomes that may not be captured by the other control variables. Diabetes is known to increase the risk of heart disease and strokes (NDIC 2014).

We show summary statistics for each of our measures in table 1 (page 24). The second column reports the number of observations per variable. These numbers range from a low of four surveyed years and 204 observations for optical colonoscopy to a high of eleven years and 561 observations for emergency room visits. The mean of our CON indicator is 73 percent, and on average each state regulates 10.1 medical services. If we restrict the sample to states that have CON programs, the average count of regulated services increases to about 14. In the analysis that follows we only include in our models the category-specific CON indicators that are relevant to the dependent variable in question. Thus, in table 1 we only report the indicators that appear in our model specifications. As two examples, with these indicators we report that only 27 percent of our state-year observations have CT scanner regulation, and 54 percent of our sample regulates acute hospital beds.

3.2. *Empirical Strategy*

If state CON programs grant medical providers a degree of market power, we should expect to see evidence of capacity restrictions in the states with CON programs. Only monopoly power

allows providers to raise prices, giving them excess profits to potentially use to cross-subsidize indigent services. Without market power, providers are unlikely to have the capital with which to cross-subsidize indigent care, as mandated in some of the CON regulations.

We estimate a set of models such as

$$Health\ care\ capacity_{st} = \alpha(CON_{st}) + \delta X_{st} + \vartheta_t + \varepsilon_{st}, \quad (1)$$

in each of which we use several measures of health care capacity. These measures include the number of hospital beds per 100,000 persons and the number of hospitals that report the use of CT scanners, MRI machines, optical colonoscopy, and virtual colonoscopy. To compare across states, we scale each of these measures to the number of hospitals offering any particular medical service per 500,000 persons. For these regressions, the coefficient of interest is α. A negative indicates that CON regulations correlate with restricted health care capacity.

As with previous studies, we measure CON_{st} as a binary variable for the presence or absence of a CON program. But because this variable implicitly assumes that all states' CON programs are identical, we introduce additional variation into our CON regulation measure. We include specifications where CON_{st} counts the number of regulated-service categories in a state. This variable potentially allows us to differentiate between stringent CON programs and programs that intervene less. For example, Louisiana's CON program only regulated three categories in 2011, while its neighbor Mississippi regulated 18 of the 28 categories. In other specifications, we include the category-specific indicator for regulation in the area relevant for our dependent variable. For example, in some of our MRI services regressions, we include an indicator for both the presence of a CON program and MRI regulation because not all CON programs regulate MRI machines.

The matrix X_{st} includes our control variables for state s in year t. We also include year indicators ϑ_t. We do not include state fixed effects because the CON binary variable is constant for 36 states and the District of Columbia.

Having determined whether CON laws restrict capacity, we estimate several specifications to test whether CON programs influence the provision of indigent care:

$$Indigent\ care_{st} = \beta(CON_{st}) + \delta X_{st} + \vartheta_t + \varepsilon_{st}. \quad (2)$$

We use two measures of indigent care: uncompensated care and the ratio of Medicaid patient days to total patient days. For these regressions, a positive coefficient β indicates that CON programs correlate with greater provision of indigent care.

4. Results

This section presents two sets of results. We first show the effect of CON programs on several measures of hospital capacity. We then estimate the effect of CON programs on the provision of uncompensated care.

4.1. *Certificate-of-Need Regulation and Hospital Capacity*

Table 2 (page 25) shows estimates for the effect of CON programs on the number of hospital beds in a given state. Columns 1–4 use hospital beds per 100,000 persons and columns 5 and 6 use the log of this measure. All specifications reported in table 2 and subsequent tables present robust standard errors clustered by state.

Our coefficients of interest, the state CON program measures, are all negative and statistically significant in most specifications. This suggests that CON programs correlate with fewer hospital beds. Throughout the United States there are, on average, 362 hospital beds per

100,000 persons. Controlling for demographics and year-specific effects, the presence of a state CON program is associated with 99 fewer hospital beds per 100,000 persons. As we discussed earlier, not every state CON program regulates acute hospital beds. If we control for the effect of regulation of acute hospital beds, the reduction increases to about 131 fewer hospital beds per 100,000, as shown in column 3.

Our results in column 4 of table 2 show that the stringency and effectiveness of CON programs vary by state. When we measure stringency by the number of services regulated in a state, we find 4.7 fewer hospital beds per 100,000 persons for each additional regulated service. Recall that among states with CON programs, the average number of regulated services is about fourteen, the minimum, one, and the maximum, twenty-eight. Because the average CON program reduces the number of beds per 100,000 by about 66, as shown in column 4, we would expect to see roughly 132 fewer hospital beds in states that regulate the maximum number of services. Our log specifications produce similar magnitudes, and the −13 percent estimate in column 5 closely resembles the −12.3 percent estimate that Eichmann and Santerre (2011) present.

Table 3 (page 26) shows the effect of CON programs on the number of hospitals that offer MRI services. The estimated coefficients on the CON measures are negative across all specifications and statistically significant in all but one specification. An average of six hospitals per 500,000 persons offer MRI services. CON programs reduce MRI provision by between one and two hospitals per 500,000 persons. As expected, if a CON program regulates MRI machines, the effect increases in absolute value, to 2.5 fewer hospitals. The effects in columns 4, 5, and 6 are similar.

Table 4 (page 27) reports the effect of CON programs on the number of hospitals with CT scanners per 500,000 persons. All specifications show a negative effect of CON programs on

availability of CT scanners. About half of the estimated coefficients are statistically significant. In the average state, nine hospitals per 500,000 individuals offer CT scans. The presence of a CON program in a state is associated with about 2.5 to 3.5 fewer hospitals offering CT scans. If a CON program specifically regulates CT scanners, the reduction increases roughly 25 percent in absolute value, from −3.41 to −4.27. Our estimated coefficient for CON regulation per covered service, −0.16, implies that for the average CON program, which regulates 14 services, 2.24 fewer hospitals per 500,000 persons offer CT scanning.

We can compare the effects on MRI machines and CT scanners, which are potential substitutes for hospitals. Since we estimate that CON programs reduce MRI provision by one to two hospitals per 500,000 persons and reduce CT scanners by 2.5 to 3.5 hospitals, it appears that CON programs have a larger effect on CT-scan services than on MRI services. When these estimates are compared to their standard deviations, the effect on MRIs is slightly larger. CON regulation decreases the availability of each of these services by about one standard deviation.

According to the Technology Price Index from Modern Healthcare and the ECRI Institute (2014), MRI machines are more expensive than CT scanners. As of January 2014, the average MRI machine costs $1.6 million and the average CT scanner is priced at $913,000. In terms of CON regulations, MRI machines are regulated in 42 percent of our state-year observations, as compared to 29 percent for CT scanners.

That MRI machines are the more expensive capital investment and are regulated more frequently than CT scanners suggests that CON regulations exert tighter control over MRI machines. Thus, hospitals have an incentive to invest in more CT scanners than MRI machines, and the effect of CON regulation on MRI machines should be larger than the effect on CT scanners. The figures we report in table 1 show that more hospitals offer CT scanning than

MRIs. The mean number of hospitals offering CT scans is nine hospitals per 500,000 persons, as compared to only six hospitals for MRIs, though the standard deviation for CT scanners is also higher—that is, 5.2 and 2.7 for CT scanners and MRI machines, respectively. This evidence is not conclusive, but is consistent with our expectation that hospitals invest in CT scanners at the margin.

The estimated effect of CON programs on the provision of optical colonoscopy, shown in table 5 (page 28), is negative in all specifications and statistically significant in four of the six models. The mean number of hospitals offering optical colonoscopy is about 5.5 per 500,000 persons. Between the count measure of CON regulation and the indicator variable for CON presence, the results show that CON regulations reduce the number of hospitals offering optical colonoscopy by between 1.4 and 2.8 per 500,000 persons.

We hypothesize that hospitals are more likely to provide optical colonoscopies where ambulatory surgical centers are restricted because optical colonoscopies are typically classified as an outpatient surgery, and ambulatory surgical centers can perform them away from hospital facilities. In table 5, column 3, we include an indicator for regulation of ambulatory surgery centers. We do not find evidence for this conjecture: the estimated effect is negative, small, and not statistically different from zero.

The majority of the coefficients on variables of interest in our estimates for the effect of CON regulation on virtual colonoscopy are negative, as shown in table 6 (page 29). Two coefficients are statistically significant. Like optical colonoscopy, virtual colonoscopy is an outpatient surgery. The key difference between the two procedures is that for virtual colonoscopy a CT scanner is used to make the surgery less invasive. Thus, in addition to our binary variable for the presence of a CON program and the count of regulated services, we also include dummies

for ambulatory surgical centers and CT scanner regulation. These coefficients are both small and statistically insignificant.

In line with the previous tables, CON regulations correlate with fewer hospitals offering virtual colonoscopy. On average, about 1.5 hospitals per 500,000 persons provide virtual colonoscopy. CON programs reduce this number by roughly a third, the specifics depending on the indicator of CON regulation.

4.2. *Certificate-of-Need Regulation and Indigent Care*

We calculate our measure of uncompensated care as the sum of hospital-level uncompensated care in a state divided by the number of beds in the reporting hospitals. Table 7 (page 30) shows the effect of CON programs on uncompensated care. For the years 2007 to 2011, the average annual level of uncompensated care was about $100,000 per reporting hospital bed.

UNCOMPENSATED CARE

The results in table 7 suggest that CON programs do not have an effect on indigent care, as measured by uncompensated care. The estimated effect is negative in half of the specifications and positive in the other half. Additionally, the coefficients are small relative to the standard deviation, and none are statistically significant.

Of the 37 CON programs, 13 have made charity care a requirement in the CON application process. To measure the impact of these requirements on reported uncompensated care, we include an indicator that tracks the presence of these requirements.[12] The estimated effect of charity care requirements is positive, but is never statistically significant. For those

[12] The CON programs that have these requirements, and the years when these requirements were added to state statutes, are Connecticut in 2007, Delaware in 2005, the District of Columbia in 1996, Florida in 1987, Georgia in 2008, Illinois in 2009, Iowa in 1991, Nebraska in 1997, North Carolina in 1983, Ohio in 2009, Virginia in 1991, Washington in 1979, and West Virginia in 1977.

regressions where we estimate a negative effect of CON programs, the net effect, taking into account charity care requirements, is smaller but would still be negative.

We have tested two other variations of uncompensated care but do not report the results. Because the results of these tests were nearly identical to those reported in table 7, we avoid unnecessary duplication. In the first case, we divide uncompensated care by the population in the state. One problem with this straight per capita metric is that the number of reporting hospitals changes from year to year, which means the variation in measured uncompensated care per capita may be driven by changes in the number of reporting hospitals, not by changes in actual uncompensated care rates.

To address this issue, we use a second per capita measure, in which we multiply the straight per capita measure by the fraction of reporting beds in a state. For example, suppose a state has 10,000 hospital beds and the number of beds in reporting hospitals in that state was 6,000 in a given year. We would divide the aggregate total of uncompensated care by 60 percent of the population in that state. Here we assume that population is distributed in the same manner that hospitals file cost reports. While this assumption is strong, we use it as an attempt to account for the year-to-year changes in reporting hospitals.

Our per-bed metric inaccurately measures provision of uncompensated care if larger hospitals were more likely both to file a cost report and to provide different amounts of uncompensated care. Still, averaging uncompensated care by the number of reporting beds seemed to be the most accurate way to scale this measure.

We also investigate several other measures of indigent care. Taken together, our regression results show little evidence of a cross-subsidy for Medicaid patients. Since Medicaid is the largest source of funding for health care for low-income groups in the United States

(O'Neill 2014), we test two measures related to Medicaid patients. Medicaid is an insurance program that reimburses hospitals for health care services, but some studies show that Medicaid patients often have higher patient costs and lower reimbursement rates (Miller 2014). The results of those studies lead us to test whether there is evidence that the hypothetical indigent-care cross-subsidy goes toward providing increased access to Medicaid patients.

In table 8 (page 31) we report the results for the percentage of inpatient days for Medicaid patients. The coefficients on the CON variables are positive, but the estimated effects are small, and only one of the four is statistically significant. Approximately 17 percent of all inpatient days are accounted for by Medicaid patients. CON programs correlate with an increase in Medicaid patient days of between 0.3 and 1.3 percentage points, a range whose maximum is about one-third of the standard deviation. In column 4 the coefficient for count of regulated services is 0.001 and is statistically significant. For the average CON program, with 14 regulated services, this amounts to an increase of 0.014 patient days, a nearly identical magnitude to the effect reported in column 3.

We also tested, but do not report in our tables, regressions with the percentage of admissions by Medicaid patients. The descriptive statistics are similar to inpatient days, with the same mean, 17 percent, and a correlation coefficient between these measures of 0.61. The results of these specifications were similar to those in table 8, with one exception. The sign on the binary CON-program variable switched to negative, −0.002, in the specification that includes the dummy for acute hospital beds.

4.3. *Limitations and Alternative Interpretations*

A major limitation of this study is that while we are able to present correlations, we do not have an identification strategy that allows us to give a causal interpretation to our results.

Future studies should address this concern by identifying a causal mechanism for how CON regulations are able to enforce the cross-subsidy. Because CON programs often report their decisions for individual applications, with hospital-level data it may be possible to identify the effect directly.

Other limitations of this study relate to our measurement of indigent care. We use uncompensated-care data because this measure is the closest available metric for measuring indigent care, and its widespread use in health economics suggests the profession agrees. However, one could argue that an increase in uncompensated care may not represent a true increase in indigent care. If regulators focus on uncompensated care to monitor the provision of indigent care, this may simply incentivize hospitals to provide more unnecessary, but billable, services to the same number of patients as before. Costs will have increased, but indigent care will not have increased in a meaningful sense.

In light of the weaknesses of our study, we do not place undue weight on any single measure. Our empirical strategy is to look for an increase in indigent care across multiple measures and draw our conclusions on the basis of the overall patterns.

5. Discussion and Conclusion

This paper analyzes the connection between CON laws and cross-subsidization in the health care industry. We consider CON laws as a mechanism for financing a subsidy to the medically indigent.

The theory of cross-subsidization requires that CON programs do two things: First, they must act as an entry barrier to reduce the competitiveness of regulated medical sectors and increase the profitability of existing providers. Accomplishing that, these regulations must also

force firms to provide the cross-subsidy. CON laws must provide incentives for the regulated to use their profits to provide more indigent services than they otherwise would.

We investigated indigent care with state-level hospital data and put together the most comprehensive CON-regulation database to date. We do not find any evidence of an increase in indigent care. Our coefficients are small in magnitude, not statistically different from zero, and the direction of the effect changes across specifications. Our evidence is consistent with previous studies in showing that CON programs are effective at restricting the supply of regulated medical services. It appears, however, that CON programs do not induce cross-subsidization. Since we lack measures of hospital profitability, our data do not allow us to make conclusions about whether this is because supply restrictions have not increased hospital profits, or because indigent care provision is not sufficiently enforced by the states that have these provisions.

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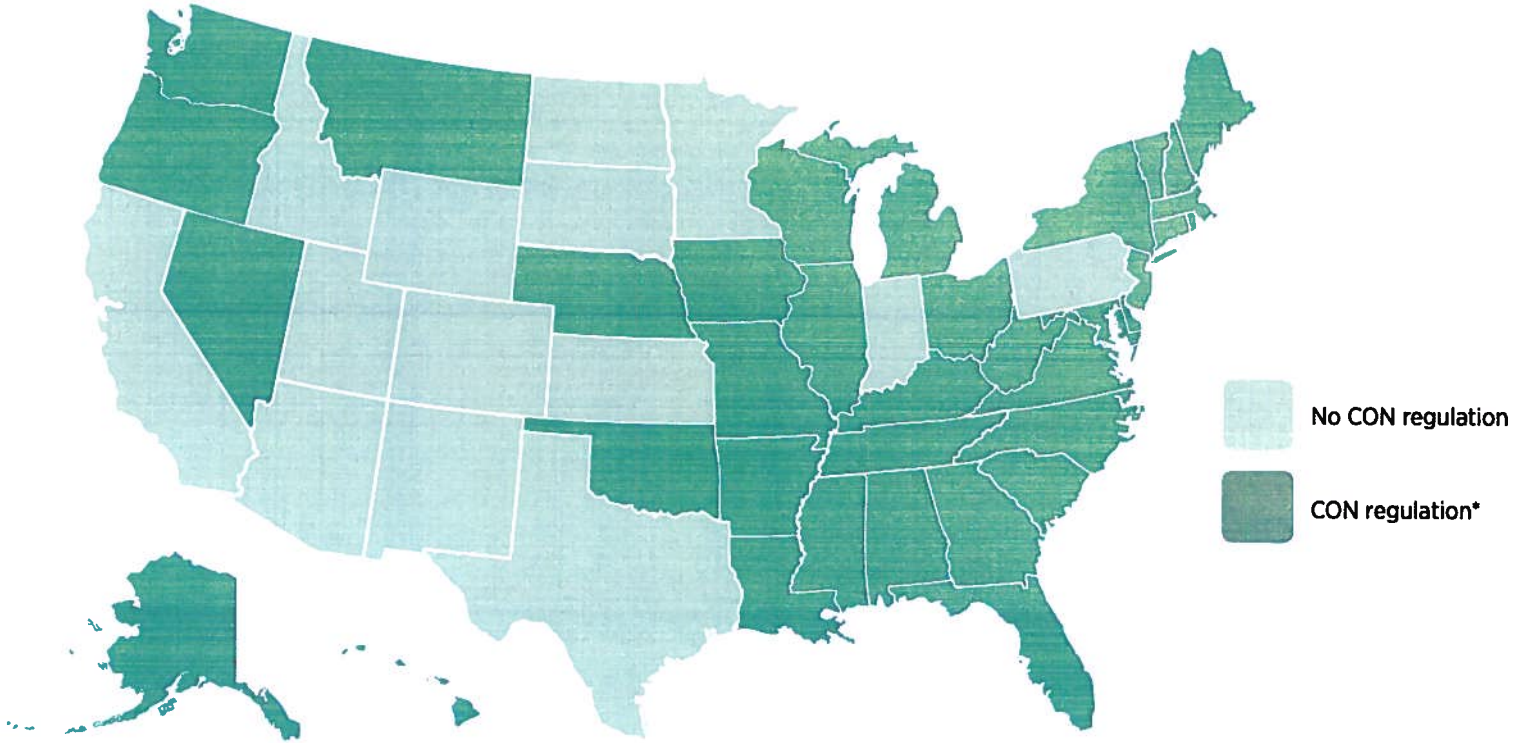
Certificate-of-Need (CON) Regulation in the United States



* As of 2011, after the period covered in this study, Wisconsin has repealed its CON regulations.
Source: AHPA (2012).

Table 1. Summary Statistics for Hospital Capacity, Certificate of Need, and Indigent Care

Statistic	*N*	Mean	Stan. dev.	Min	Median	Max
Hospital beds (per 100,000 population)	561	362.05	121.80	208.80	327.60	906.60
Hospitals with MRI services (per 500,000 population)	561	5.87	2.69	1.91	5.12	17.21
Hospitals with CT scanner (per 500,000 population)	561	9.00	5.20	2.55	7.37	26.27
Hospitals with optical colonoscopy (per 500,000 population)	153	5.41	3.55	1.17	4.24	17.86
Hospitals with virtual colonoscopy (per 500,000 population)	306	1.44	1.11	0.00	1.12	6.82
Uncompensated care (dollars per capita)	204	247.40	410.10	53.30	206.40	5,773.00
Uncompensated care (dollars per capita, adjusted)	204	517.40	879.40	144.50	409.20	12,549.00
Uncompensated care (per reporting bed)	204	109,346	103,841	27,234	91,440	1,306,574
Hospital inpatient days: percentage Medicaid	561	0.16	0.04	0.08	0.16	0.31
Facility admissions: percentage Medicaid	561	0.17	0.03	0.09	0.17	0.29
State certificate-of-need regulation (yes = 1)	561	0.73	0.45	0	1	1
Count of certificate-of-need regulated services	561	10.13	9.02	0	9	28
Acute hospital bed regulation (yes = 1)	561	0.54	0.50	0	1	1
Ambulatory surgical center regulation (yes = 1)	561	0.53	0.50	0	1	1
CT scanner regulation (yes = 1)	561	0.27	0.44	0	0	1
MRI regulation (yes = 1)	561	0.39	0.49	0	0	1
Certificate-of-need application: charity care required (yes = 1)	561	0.19	0.39	0	0	1
Unemployment rate (seasonally adjusted)	561	5.52	1.98	2.30	5.10	13.80
State real per capita income (2011 dollars)	561	30,875	7,917	16,501	30,166	67,634
Population (× 1,000)	561	5,802	6,472	494	4,101	37,267
Adult diagnosed diabetes percentage (18+, age adjusted)	561	7.25	1.41	4.60	7.10	11.30
Youth percentage (under 18)	561	0.25	0.02	0.17	0.25	0.32
Elderly percentage (65 and over)	561	0.12	0.02	0.05	0.12	0.17
Women of child-bearing age percentage (15–44)	561	0.21	0.01	0.18	0.21	0.27
White percentage	561	0.81	0.14	0.26	0.84	0.97
Black percentage	561	0.11	0.11	0.00	0.08	0.61
Hispanic percentage	561	0.09	0.09	0.01	0.06	0.46

Table 2. Hospital Beds

	Hospital beds (per 100,000 population)				Logged hospital beds	
	(1)	(2)	(3)	(4)	(5)	(6)
State certificate-of-need regulation (yes = 1)	−2.78	−99.00***	−61.47*		−0.13	
	(41.02)	(31.19)	(36.02)		(0.09)	
Acute hospital bed regulation (yes = 1)			−70.07***		−0.17**	
			(25.87)		(0.07)	
Count of certificate-of-need regulated services				−4.66***		−0.01***
				(1.45)		(0.00)
Unemployment rate (seasonally adjusted)		−4.06	−1.21	−4.85	−0.01	−0.02
		(2.96)	(6.55)	(6.98)	(0.02)	(0.02)
Real income (2011 dollars)		0.000	0.004	0.002	0.000	0.000
		(0.002)	(0.003)	(0.003)	(0.000)	0.000
Population (logged)		−48.67***	−55.37***	−55.21***	−0.11***	−0.11***
		(13.76)	(12.69)	(15.31)	(0.03)	(0.04)
Adult diagnosed diabetes percentage (18+, age adjusted)		13.25	29.71***	27.24**	0.08***	0.08**
		(9.15)	(10.70)	(12.50)	(0.03)	(0.03)
Youth percentage (under 18)		30.95	−158.70	−148.70	0.07	0.21
		(1,218.00)	(1,078.00)	(1,175.00)	(2.74)	(3.05)
Elderly percentage (65 and over)		3,402.00***	2,686.00**	2,851.00**	6.35**	6.89**
		(1,291.00)	(1,209.00)	(1,322.00)	(3.05)	(3.38)
Women of child-bearing age percentage (15–44)		3,286.00*	1,693.00	3,393.00*	1.03	5.03
		(1,807.00)	(1,801.00)	(2,049.00)	(4.97)	(5.62)
White percentage		−11.62	−11.59	−25.92	−0.003	−0.03
		(98.97)	(80.73)	(81.51)	(0.18)	(0.19)
Black percentage		401.90**	387.90**	255.10	0.95**	0.66
		(188.40)	(164.40)	(178.00)	(0.39)	(0.42)
Hispanic percentage		−310.00***	−301.90***	−279.40***	−0.89***	−0.84***
		(110.20)	(105.40)	(94.64)	(0.26)	(0.25)
Constant	364.50***	−351.90	0.33	−336.40	5.29***	4.45**
	(36.54)	(746.70)	(630.80)	(706.80)	(1.74)	(1.98)
Year indicators?	No	No	Yes	Yes	Yes	Yes
N	561	561	561	561	561	561
R^2	0.0001	0.60	0.64	0.59	0.62	0.56
Adjusted R^2	−0.002	0.59	0.63	0.57	0.60	0.54

Notes: 561 observations are the 50 states and the District of Columbia observed from the year 2000 to the year 2010. Values in parentheses are standard errors, clustered by state; * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.

Table 3. Hospitals with Magnetic Resonance Imaging (MRI) Services

	Hospitals with MRI services (per 500,000 population)				Logged hospital MRI services	
	(1)	(2)	(3)	(4)	(5)	(6)
State certificate-of-need regulation (yes = 1)	−1.28	2.10***	−1.85**		−0.26**	
	(0.98)	(0.76)	(0.87)		(0.11)	
MRI regulation (yes = 1)			−0.64		−0.07	
			(0.55)		(0.09)	
Count of certificate-of-need regulated services				−0.10***		−0.01***
				(0.03)		(0.00)
Unemployment rate (seasonally adjusted)		−0.10	−0.12	−0.18	−0.02	−0.03
		(0.07)	(0.11)	(0.11)	(0.02)	(0.02)
Real income (2011 dollars)		0.00	−0.00	−0.00	−0.00**	−0.00**
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Population (logged)		−1.26***	−1.25***	−1.30***	−0.18***	−0.19***
		(0.31)	(0.36)	(0.38)	(0.05)	(0.05)
Adult diagnosed diabetes percentage (18+, age adjusted)		0.33**	0.35	0.40	0.04	0.05
		(0.17)	(0.28)	(0.28)	(0.04)	(0.04)
Youth percentage (under 18)		−4.93	−13.50	−14.14	−2.73	−3.20
		(21.58)	(19.62)	(19.58)	(3.04)	(3.02)
Elderly percentage (65 and over)		−3.93	−8.89	−12.65	−1.16	−2.01
		(25.90)	(29.38)	(31.76)	(4.04)	(4.23)
Women of child-bearing age percentage (15–44)		−70.97	−57.59	−44.24	−2.82	−0.98
		(36.04)	(55.79)	(55.85)	(7.50)	(7.52)
White percentage		4.24***	4.00***	3.58***	0.61***	0.54***
		(1.21)	(1.31)	(1.32)	(0.16)	(0.16)
Black percentage		4.82	3.81	2.11	0.48	0.21
		(3.21)	(2.75)	(2.76)	(0.42)	(0.43)
Hispanic percentage		−7.29***	−7.89***	−6.59***	−1.42***	−1.28***
		(2.54)	(2.51)	(2.26)	(0.38)	(0.36)
Constant	6.80***	29.73**	30.21*	28.11*	4.59**	4.45**
	(0.92)	(14.62)	(16.96)	(17.03)	(2.29)	(2.26)
Year indicators?	No	No	Yes	Yes	Yes	Yes
N	561	561	561	561	561	561
R^2	0.04	0.56	0.57	0.56	0.60	0.60
Adjusted R^2	0.04	0.56	0.56	0.54	0.58	0.58

Notes: 561 observations are the 50 states and the District of Columbia observed from the year 2000 to the year 2010. Values in parentheses are standard errors, clustered by state; * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.

Table 4. Hospitals with Computed Tomography (CT) Scanners

	Hospitals with CT scanners (per 500,000 population)				Logged hospital CT scanners	
	(1)	(2)	(3)	(4)	(5)	(6)
State certificate-of-need regulation (yes = 1)	−2.45	−3.41**	−3.01*		−0.26*	
	(1.92)	(1.56)	(1.70)		(0.15)	
CT scanner regulation (yes = 1)			−1.26		−0.10	
			(0.87)		(0.09)	
Count of certificate-of-need regulated services				−0.16**		−0.01***
				(0.06)		(0.01)
Unemployment rate (seasonally adjusted)		−0.26**	−0.39	−0.47*	−0.04	−0.04*
		(0.12)	(0.24)	(0.24)	(0.03)	(0.03)
Real income (2011 dollars)		−0.00	−0.00	−0.00	−0.00**	−0.00**
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Population (logged)		−2.25***	−2.23***	−2.32***	−0.20***	−0.21***
		(0.61)	(0.64)	(0.68)	(0.07)	(0.07)
Adult diagnosed diabetes percentage (18+, age adjusted)		0.26	0.27	0.48	0.02	0.05
		(0.37)	(0.51)	(0.52)	(0.05)	(0.05)
Youth percentage (under 18)		16.44	1.93	1.13	−2.47	−2.95
		(48.74)	(47.05)	(49.20)	(4.73)	(4.81)
Elderly percentage (65 and over)		17.57	5.27	−1.12	−2.21	−3.13
		(52.65)	(56.03)	(60.46)	(5.61)	(5.85)
Women of child-bearing age percentage (15–44)		−144.60*	−132.40	−110.10	−6.42	−4.66
		(77.47)	(102.40)	(102.70)	(10.61)	(10.57)
White percentage		8.27***	7.43***	7.48***	0.85***	0.83***
		(2.68)	(2.69)	(2.53)	(0.21)	(0.19)
Black percentage		9.93	8.21	5.50	0.54	0.28
		(6.72)	(5.99)	(6.35)	(0.60)	(0.62)
Hispanic percentage		−13.82**	−14.14**	−12.50**	−1.79***	−1.69***
		(5.55)	(5.58)	(4.89)	(0.59)	(0.55)
Constant	10.77***	49.08	52.94	48.13	6.18*	5.97*
	(1.79)	(30.74)	(32.97)	(33.34)	(3.40)	(3.36)
Year indicators?	No	No	Yes	Yes	Yes	Yes
N	561	561	561	561	561	561
R^2	0.04	0.58	0.59	0.58	0.60	0.60
Adjusted R^2	0.04	0.57	0.57	0.56	0.59	0.58

Notes: 561 observations are the 50 states and the District of Columbia observed from the year 2000 to the year 2010. Values in parentheses are standard errors, clustered by state; * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.

Table 5. Hospitals with Optical Colonoscopy

	Hospitals with optical colonoscopy (per 500,000 population)				Logged optical colonoscopy	
	(1)	(2)	(3)	(4)	(5)	(6)
State certificate-of-need regulation (yes = 1)	−2.27*	−2.80***	−2.03**		−0.19	
	(1.32)	(1.07)	(0.99)		(0.12)	
Ambulatory surgical center regulation (yes = 1)			−0.43		−0.19*	
			(0.67)		(0.12)	
Count of certificate-of-need regulated services				−0.10**		−0.01**
				(0.04)		(0.01)
Unemployment rate (seasonally adjusted)		−0.16*	−0.65***	−0.68***	−0.12***	−0.13***
		(0.09)	(0.20)	(0.19)	(0.04)	(0.04)
Real income (2011 dollars)		0.00	−0.00	−0.00	−0.00	−0.00
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Population (logged)		−1.54***	−1.20***	−1.25***	−0.17***	−0.17**
		(0.39)	(0.40)	(0.43)	(0.06)	(0.07)
Adult diagnosed diabetes percentage (18+, age adjusted)		0.37	0.28	0.31	0.06	0.06
		(0.35)	(0.34)	(0.31)	(0.05)	(0.04)
Youth percentage (under 18)		4.21	−15.13	−16.87	−6.97	−6.36
		(33.13)	(35.59)	(34.71)	(5.03)	(4.64)
Elderly percentage (65 and over)		22.11	7.89	7.26	−5.57	−4.26
		(38.36)	(41.50)	(39.17)	(6.25)	(5.61)
Women of child-bearing age percentage (15–44)		−65.68	−29.58	−6.44	−1.01	2.63
		(49.13)	(49.35)	(49.11)	(8.17)	(8.52)
White percentage		6.99***	7.42***	7.17***	1.80***	1.78***
		(2.04)	(2.05)	(1.82)	(0.21)	(0.21)
Black percentage		2.69	2.51	0.12	0.53	0.21
		(4.59)	(4.31)	(4.56)	(0.65)	(0.71)
Hispanic percentage		−7.78**	−6.66*	−5.80**	−1.35***	−1.23***
		(3.48)	(3.45)	(2.84)	(0.48)	(0.46)
Constant	7.06***	19.95	20.84	16.85	4.85	3.75
	(1.25)	(18.56)	(19.81)	(19.02)	(2.99)	(2.83)
Year indicators?	No	No	Yes	Yes	Yes	Yes
N	153	153	153	153	153	153
R^2	0.08	0.60	0.66	0.64	0.69	0.67
Adjusted R^2	0.08	0.57	0.62	0.61	0.66	0.64

Notes: 153 observations are the 50 states and the District of Columbia observed from the year 2008 to the year 2010. Values in parentheses are standard errors, clustered by state; * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.

Table 6. Hospitals with Virtual Colonoscopy

	Hospitals with virtual colonoscopy (per 500,000 population)				Logged virtual colonoscopy	
	(1)	(2)	(3)	(4)	(5)	(6)
State certificate-of-need regulation (yes = 1)	−0.38	−0.71*	−0.65*		−0.18*	
	(0.42)	(0.37)	(0.34)		(0.11)	
Ambulatory surgical center regulation (yes = 1)			−0.16		−0.08	
			(0.30)		(0.10)	
CT scanner regulation (yes = 1)			−0.01		0.02	
			(0.27)		(0.10)	
Count of certificate-of-need regulated services				−0.04**		−0.01**
				(0.02)		(0.01)
Unemployment rate (seasonally adjusted)		−0.06*	−0.04	−0.05	−0.02	−0.03
		(0.04)	(0.07)	(0.07)	(0.03)	(0.03)
Real income (2011 dollars)		0.00**	0.00	0.00	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Population (logged)		−0.32**	−0.36**	−0.37**	−0.08	−0.08
		(0.14)	(0.17)	(0.18)	(0.05)	(0.06)
Adult diagnosed diabetes percentage (18+, age adjusted)		0.04	0.13	0.15	0.04	0.04
		(0.12)	(0.20)	(0.19)	(0.06)	(0.05)
Youth percentage (under 18)		−16.17	−15.40	−16.22	−5.12	−5.40
		(10.71)	(11.40)	(11.05)	(3.77)	(3.63)
Elderly percentage (65 and over)		−20.11	−22.17	−23.07	−6.85	−6.94
		(15.66)	(16.26)	(16.17)	(5.38)	(5.28)
Women of child-bearing age percentage (15–44)		−42.67*	−50.87*	−44.28	−14.05*	−11.90
		(24.79)	(27.50)	(27.87)	(7.96)	(8.32)
White percentage		2.08***	2.15***	2.05**	0.75***	0.70***
		(0.75)	(0.76)	(0.80)	(0.25)	(0.24)
Black percentage		2.14	1.91	1.12	0.51	0.24
		(1.80)	(1.56)	(1.70)	(0.51)	(0.56)
Hispanic percentage		−1.92*	−2.02*	−1.80*	−1.02***	−0.97***
		(1.07)	(1.05)	(0.92)	(0.33)	(0.30)
Constant	1.71***	16.53*	17.33*	16.30*	5.22*	4.88*
	(0.40)	(8.99)	(9.10)	(8.98)	(2.76)	(2.69)
Year indicators?	No	No	Yes	Yes	Yes	Yes
N	306	306	306	306	306	306
R^2	0.02	0.42	0.43	0.42	0.41	0.40
Adjusted R^2	0.02	0.40	0.40	0.39	0.38	0.37

Notes: 306 observations are the 50 states and the District of Columbia observed from the year 2005 to the year 2010. Values in parentheses are standard errors, clustered by state; * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.

Table 7. Hospital Uncompensated Care (per reported bed)

	Uncompensated care (per reported bed)				Logged uncomp. care	
	(1)	(2)	(3)	(4)	(5)	(6)
State certificate-of-need regulation (yes = 1)	6,976.00	−9,380.00	−13,661.00		0.07	
	(20,713.00)	(13,507.00)	(14,868.00)		(0.12)	
Acute hospital bed regulation (yes = 1)			−2,548.00		0.07	
			(15,490.00)		(0.14)	
Count of certificate-of-need regulated services				−557.20		0.01
				(1,944.00)		(0.01)
Charity care required (yes = 1)		4,183.00	7,286.00	4,715.00	0.005	0.01
		(11,722.00)	(14,030.00)	(15,252.00)	(0.10)	(0.09)
Unemployment rate (seasonally adjusted)		1,617.00	6,236.00	5,707.00	0.06*	0.06*
		(3,419.00)	(4,536.00)	(4,967.00)	(0.03)	(0.03)
Real income (2011 dollars)		−2.00	−0.73	−0.79	−0.00	−0.00
		(1.75)	(1.55)	(1.52)	(0.00)	(0.00)
Population (logged)		2,432.00	−1,349.00	−1,546.00	0.07	0.07
		(6,878.00)	(7,710.00)	(7,932.00)	(0.05)	(0.05)
Adult diagnosed diabetes percentage (18+, age adjusted)		−5,163.00	−2,106.00	−2,124.00	−0.02	−0.03
		(6,016.00)	(5,805.00)	(6,282.00)	(0.05)	(0.05)
Youth percentage (under 18)		−1,813,548.00***	−1,631,841.00***	−1,631,525.00**	−9.28**	−7.71*
		(624,266.00)	(597,637.00)	(705,266.00)	(4.45)	(4.13)
Elderly percentage (65 and over)		−144,962.00	−95,372.00	−81,954.00	−4.03	−2.96
		(649,204.00)	(659,800.00)	(784,602.00)	(4.80)	(4.94)
Women of child-bearing age percentage (15–44)		3,478,053.00***	2,912,567.00**	3,102,963.00***	14.03*	12.97*
		(763,924.00)	(1,161,876.00)	(1,162,779.00)	(7.29)	(6.63)
White percentage		−239,766.00***	−242,538.00***	−241,099.00***	−0.92***	−0.81**
		(34,516.00)	(40,308.00)	(59,311.00)	(0.30)	(0.33)
Black percentage		−316,800.00**	−319,635.00**	−333,778.00***	−2.59***	−2.40***
		(135,418.00)	(129,620.00)	(122,349.00)	(0.76)	(0.75)
Hispanic percentage		140,975.00*	132,950.00**	139,983.00**	1.20***	1.32***
		(72,481.00)	(66,176.00)	(63,587.00)	(0.40)	(0.39)
Constant	104,285.00***	166,064.00	186,748.00	146,400.00	11.70***	11.26***
	(17,706.00)	(417,738.00)	(436,178.00)	(529,704.00)	(2.64)	(2.78)
Year indicators?	No	No	Yes	Yes	Yes	Yes
N	204	204	204	204	204	204
R^2	0.001	0.25	0.26	0.26	0.42	0.43
Adjusted R^2	−0.004	0.21	0.20	0.20	0.37	0.39

Notes: 204 observations are the 50 states and the District of Columbia observed from the year 2007 to the year 2010. Values in parentheses are standard errors, clustered by state; * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.

Table 8. Percentage of Hospital Inpatient Days for Medicaid Patients

	Percentage of hospital inpatient days for Medicaid patients			
	(1)	(2)	(3)	(4)
State certificate-of-need regulation (yes = 1)	0.003	0.01	0.01	
	(0.01)	(0.01)	(0.01)	
Acute hospital bed regulation (yes = 1)			0.003	
			(0.01)	
Count of certificate-of-need regulated services				0.001**
				(0.0004)
Unemployment rate (seasonally adj.)		0.003***	0.003	0.003
		(0.001)	(0.003)	(0.003)
Real income (2011 dollars)		0.00	−0.00	−0.00
		(0.00)	(0.00)	(0.00)
Population (logged)		−0.003	−0.002	−0.002
		(0.003)	(0.004)	(0.003)
Adult diagnosed diabetes percentage (18+, age adj.)		0.005*	0.001	−0.001
		(0.003)	(0.004)	(0.004)
Youth percentage		0.12	0.07	0.25
		(0.25)	(0.29)	(0.29)
Elderly percentage		0.09	0.17	0.33
		(0.41)	(0.44)	(0.42)
Women of child-bearing age percentage (15–44)		0.65	1.02	1.00
		(0.55)	(0.68)	(0.63)
White percentage		−0.06*	−0.07*	−0.06
		(0.03)	(0.04)	(0.04)
Black percentage		−0.10*	−0.10*	−0.07
		(0.06)	(0.06)	(0.06)
Hispanic percentage		0.08**	0.08**	0.10***
		(0.03)	(0.03)	(0.03)
Constant	0.16***	−0.003	−0.04	−0.11
	(0.01)	(0.21)	(0.23)	(0.22)
Year indicators?	No	No	Yes	Yes
N	561	561	561	561
R^2	0.001	0.20	0.22	0.25
Adjusted R^2	−0.001	0.18	0.19	0.22

Notes: 561 observations are the 50 states and the District of Columbia observed from the year 2000 to the year 2010. Values in parentheses are standard errors, clustered by state; * significant at the 10 percent level; ** significant at the 5 percent level; *** significant at the 1 percent level.