HOSPITALS AS INSURERS OF LAST RESORT*

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Abstract

American hospitals are required to provide emergency medical care to the uninsured. We use previously confidential hospital financial data to study the resulting uncompensated care, i.e. medical care for which no payment is received. Using both across- and within-state variation in health insurance coverage rates, we find that each additional uninsured person costs hospitals approximately $600. That increase in costs is concentrated in private, non-profit hospitals with an emergency department (ED). For-profit hospitals and hospitals without an ED are largely unaffected. We next study how the burden of providing uncompensated care is shared across hospitals. To do so, we focus on the closure of one hospital in a local market. Using an event-study framework, we find that hospital closures increase the uncompensated care costs of nearby hospitals, with total uncompensated care in the local area remaining largely unchanged. Taken together, our results demonstrate that private, non-profit hospitals are "insurers of last resort" whose finances depend on the demand and supply of uncompensated care in the local market.

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1. INTRODUCTION

Over the last decade, roughly 15 percent of Americans had no health insurance at any one time (US Census, 2013). Even after the full implementation of the Affordable Care Act (ACA), approximately 10 percent of the population will remain uninsured (CBO, 2013). In addition, many of the newly insured may be underinsured because their coverage includes large deductibles that exceed their available liquidity (Goodnough and Pear, 2014). This lack of universal coverage is, in part, the result of deliberate policy decisions. The ACA excludes undocumented immigrants from its benefits. Similarly, many state governments have decided not to implement the ACA's expansion of Medicaid.

Those policy decisions were often justified based on the estimated cost to the *government* of covering the uninsured.[1] Those estimates, however, are incomplete and misleading, because they do not incorporate the full cost of the uninsured, an economically meaningful cost that is borne by many parties. For example, Finkelstein, Hendren, and Luttmer (2014) estimate that half of every dollar spent on Medicaid is actually a transfer from the government to private parties, primarily physicians and hospitals.

Those transfers arise because the uninsured still demand health care and, due to a variety of factors, hospitals are mandated to treat them. For example, the Emergency Medical Treatment and Active Labor Act (EMTALA) requires Medicare participating hospitals to provide emergency medical treatment to all patients regardless of whether they can pay. Additionally, hospitals organized as non-profit firms must provide a community benefit in order to maintain their tax benefits. Beyond such legal requirements, medical ethics require that physicians treat certain patients regardless of ability to pay (Annas, 1985).

As a result of such factors, Medicaid provides financial protection both to its enrollees and to the providers they visit. If it were not for Medicaid, millions of hospital visits would be uncompensated. In this paper, we argue that such an arrangement exists because hospitals serve as "insurers of last resort." Due to that role, the costs of private hospitals are partially a function of the *local supply* and *local demand* of uncom-

[1] For example, Virginia Governor Bob McDonnell commented, "Virginia simply cannot afford to become the bank for a federally designed expansion of Medicaid." Similarly, Georgia Governor Nathan Deal stated, "I did not judge it prudent to expand the eligible population of an entitlement program… since our state is already spending approximately $2.5 billion in state taxpayer funds annually." Regarding immigration, former Speaker of the House, Nancy Pelosi, argued: "[i]t is stated very clearly in the Affordable Care Act, [and] it is our position in the immigration bill: no access to subsidies in the Affordable Care Act. Secondly, no access to Medicaid; *no cost to the taxpayer*. That has always been the Democratic position" [emphasis added].

pensated care.[2] To demonstrate that, we study the determinants of hospital uncompensated care costs. First, we estimate how shifts in the *demand* for uncompensated care – arising from changes in the uninsured population – affect hospital uncompensated care. We find that increases in the uninsured population raise hospital uncompensated care costs. Second, we study how shifts in the *supply* of uncompensated care – arising from hospital closures – affect total uncompensated care. We find that when a hospital closes, nearly all of that hospital's uncompensated care costs spill over onto neighboring hospitals. However, we find an incomplete spillover of compensated care from treating insured patients.

To examine how hospital uncompensated care depends on the demand for that care, we use 28 years of previously confidential, hospital-level financial data. The data were compiled by the American Hospital Association and made available to us through a data-use agreement. Using both cross-sectional and state-level panel-data methods, we document a strong and statistically significant increase of $600 in uncompensated care costs for each newly uninsured person. This association is remarkably robust to a variety of alternative specifications, such as the inclusion of time-varying state economic controls, region-by-year fixed effects, and state-specific linear time trends.

We find that an increase in the uninsured population increases uncompensated care costs primarily at private, non-profit hospitals with an emergency department (ED). By contrast, non-profit hospitals without an ED and for-profit hospitals (both with and without an ED) are largely unaffected by changes in the uninsured population. This pattern suggests that a combination of EMTALA and non-profit community-benefit standards induce non-profit hospitals to provide uncompensated care.

One concern with those state-level estimates is that they may be subject to omitted-variables bias or reverse causality. To address that concern, we complement the state-level panel results with two case studies of large-scale public health insurance disenrollments. The two disenrollments both occurred in 2005, in Mis-

[2] Policymakers have recognized the unique nature of the health care sector in that hospitals often provide services without compensation. As a result, policymakers have created funding streams to compensate hospitals for uncompensated care costs. Perhaps the most important of these funding streams are Disproportionate Share (DSH) payments. DSH payments are intended to compensate hospitals for providing care to low-income populations, and states are given broad latitude in how to spend the funds. In practice, though, DSH payments are much lower than the cost of uncompensated care provided by hospitals. According to the Kaiser Family Foundation in 2012, Medicaid DSH Payments amounted to approximately $17 billion, while hospitals provided $46 billion in uncompensated care costs that year). Hospitals also receive other forms of government assistance, but most of these are not directly tied to the amount of uncompensated care that the hospitals provide and instead provide general support for the variety of services hospitals provide to the community. As a result, they do not directly compensate hospitals when the hospital faces more uninsured patients. For example, when states reduce the generosity of Medicaid benefits there is no corresponding increase in the value of these local tax benefits.

souri and Tennessee. Estimates from these reforms isolate the effect of sudden, plausibly exogenous changes in the share-insured on hospital uncompensated care costs.

The reduction in coverage in Missouri primarily affected a traditional Medicaid population – low-income families with children – that is similar to the source of variation in our main state-level panel-data estimates. We find that the Missouri disenrollment increased uncompensated care provided by Missouri hospitals. The magnitude of the change is broadly similar to the state-level panel results, suggesting that state-level panel estimates capture the causal effect of health insurance coverage on uncompensated care costs.[3]

The Tennessee disenrollment primarily affected non-disabled childless adults, a group that has historically been ineligible for public health insurance but is an intended target of the ACA. We find that the TennCare disenrollment increased uncompensated care costs in the state. Additionally, we exploit within-state variation in exposure to the reform and show that the changes in uncompensated care costs were largest in the regions with the greatest increases in share uninsured. We also find evidence of increases in charity-care admissions for patients residing in the most-exposed Tennessee counties.

We then focus on the local supply of uncompensated care and exploit variation in the number of hospitals. In particular, we measure how hospital closures affect uncompensated care at neighboring hospitals. Defining the local market as either the county or the hospital service area (HSA), we estimate a decline in total uncompensated care provided after a closure. However, this decline likely results from an overly strict geographic market definition. Supporting this argument, when we define the local market more broadly, using commuting zones (Autor and Dorn, 2012), we estimate that total uncompensated care in a local hospital market remains largely unchanged after one hospital closes. This spillover of uncompensated care to the remaining hospitals suggests that the care demanded by the uninsured is relatively non-discretionary and not tied to a single hospital. Rather, all hospitals in a local market, as a whole, have to provide that care. In that sense, the results suggest that uncompensated care is relatively inelastic and represents a market-level fixed cost. The results also suggest that commuting zones may be a useful market definition when studying the health care consumption of non-elderly adults or the uninsured.

[3] The similarity between the state-level panel results and the Missouri-based estimates is unsurprising. As we show below, our state-level panel results are highly robust to alternative specifications: including a full set of region-year fixed effects, controlling for state-specific linear time trends, and including state-level controls for unemployment rate and demographics.

We also find that revenue from insured patients spills over from closing hospitals to other hospitals. That is, after one hospital closes, nearby hospitals treat more insured patients. In contrast to uncompensated care, however, we estimate that total hospital revenue in a local market *decreases* after a hospital closure.[4] That is, not all revenue from insured patients transfers from the closing hospital to neighboring hospitals. As a result, we estimate that the average hospital closure decreases the net profits of the local market's remaining hospitals. This stands in stark contrast to other product markets, where incumbents typically benefit from the closure of a rival. We argue that the unfunded mandate requiring hospitals to provide uncompensated care is a key factor in generating such an unusual pattern.

Taken together, our results provide evidence that hospitals serve as "insurers of last resort." The cost of this informal insurance is nontrivial. To provide some context, in 2012 the costs of uncompensated care provided by hospitals was approximately $46 billion. This amounts to approximately one-quarter of the *total* Medicaid payments to hospitals in that year. That amount is also large relative to the industry's profits; holding all else constant, if hospitals only served paying customers, their profits would have been approximately 70 percent larger in 2012 (Becker Hospital Review, 2014).

It is important to note that this costly informal insurance is not simply the unintended result of a firm choosing to accept social insurance payments or the fact that the service provided is necessary for the survival of its customers. Both of these are characteristics of grocery stores, for example, which sell a vital product that is partially financed by food stamps. And yet, grocery stores that accept food stamps as a form of payment are not also required to provide "uncompensated food" for individuals who are either ineligible for food stamps or have exhausted their monthly benefits.

Instead, this unique role of hospitals as insurers of last resort results from several deliberate policy decisions. For example, we estimate that the decision to insure 25 million more Americans under the ACA will reduce the uncompensated care costs of hospitals by $19 billion, or approximately 40 percent of the total uncompensated care costs in 2012. Additionally, hospitals in states that do not implement the ACA's Medicaid expansion will face higher uncompensated care costs than those in states which implement the expan-

[4]Such a pattern is consistent with insured patients reducing their consumption of health care at hospitals after a closure. That is, if the uninsured primarily consume non-discretionary medical services while the marginal care consumed by the insured is discretionary, then insured health care consumption might fall.

sion. We calculate that the money states will save from not expanding Medicaid is nearly equal to the hospital uncompensated care costs generated by those who will be uninsured as a result. Our estimates thus suggest that the decision not to implement the ACA's Medicaid expansion achieves fiscal savings primarily through increased costs for local hospitals.

This paper contributes to several areas of existing research. First, previous work has suggested that non-profit and for-profit hospitals behave quite similarly, leading Weisbrod (1988) to refer to non-profit hospitals as simply "for-profits in disguise." Our findings suggest that non-profit hospitals fill the gaps in the existing social health insurance system to a degree that is not true of for-profit hospitals. This finding contributes to work that examines behavioral differences between non-profit and for-profit hospitals (Weisbrod 1988; Sloan and Vraciu 1983; Duggan, 2001; Dranove, Garthwaite, and Ody 2014; Norton and Staiger, 1994).

Additionally, our results suggest a considerable amount of crowdout from government-funded public health insurance. This finding relates to a large literature on how government spending crowds out private charity. Previous work has focused on how government policies during the Great Depression and following the 1996 Welfare Reform affected the private provision of charity (Hungerman 2004; Gruber and Hungerman 2005). Consistent with most of the papers in that literature, our work demonstrates a large degree of substitution between private charity and public spending.

Our paper is also broadly related to the use of third parties in social insurance programs. For example, the Internal Revenue Service has worked closely with professional tax-preparation firms to increase participation in the Earned Income Tax Credit (Kopczuk and Pop-Eleches, 2007). Recently, the state of Florida has used private recruiters to encourage eligible individuals to participate in the Supplemental Nutrition Assistance Program (Saslow, 2013). Most closely related to our work is research which studies hospitals encouraging the take-up of social insurance by setting up internal departments to enroll eligible persons in Medicaid (Cutler and Gruber, 1997). In contrast to this work, we emphasize the role of hospitals themselves as actual providers of social insurance to the uninsured.

Finally, our paper contributes to a broader understanding of the industrial organization of health care markets. Ho and Town (2014) summarize the literature on the structure of these markets with a focus on the

welfare effects of changes in firm concentration. However, they do not discuss the role of uncompensated care on firm decisions. Our results demonstrate that changes in the structure of the local market can have meaningful negative effects on firm profits. This can have several implications for research in this area. For example, a complete analysis of the benefits of increased market power from a smaller number of facilities in a local market must account for the increased uncompensated care costs per hospital that accompany this reduction.[5]

The remainder of the paper proceeds as follows. Section 2 discusses the relevant institutional details on the provision of hospital uncompensated care. Section 3 discusses the hospital-level data used in the analysis. Section 4 focuses on the demand for uncompensated care, presenting state-panel estimates and supporting evidence from two case studies in Missouri and Tennessee. Section 5 examines the supply of uncompensated care, presenting evidence of spillovers of uncompensated care across hospitals after a hospital closure. Section 6 concludes.

2. WHY DO HOSPITALS PROVIDE UNCOMPENSATED CARE?

In most economic settings, firms only provide goods and services to paying customers.[6] But in the health care sector, hospitals routinely provide care to patients who are unable or unwilling to pay. In 2010, US hospitals provided services costing approximately $40 billion or 5.8 percent of total expenses without payment. Figure 1 shows annual uncompensated care as a percentage of operating costs from 1984–2011. Over that time, the absolute amount of uncompensated care has steadily increased and has varied between 5.4 and 6.4 percent of expenses from 1984–2010. To place this number in context, consider that from 1992-2010 hospital operating margins ranged from a low of 2.0 percent to a high of 5.5 percent. Panel A shows annual percentages overall, while Panel B shows percentages by type of hospital: non-profit, for-profit, and government. Perhaps unsurprisingly, government hospitals have the highest share of uncompensated care costs,

[5] Importantly this would only apply to mergers or other decisions that involve closing local facilities and not those that simply involve a change in the corporate structure of the two entities.
[6] Firms often provide services prior to actual payment, and some consumers do default on their debts. But, in such cases, the firms are not forced to continue to do business with people who do not pay.

followed by private non-profits and then for-profit hospitals. In addition to this year-to-year variation, there is also a good deal of variation within and across states, as shown in Figure 2.

Given that private hospitals are large and sophisticated firms, the inability to secure payment for services rendered is not just an operational inefficiency. Why do they provide services worth billions of dollars without compensation? Some of these costs are the result of true bad debt that firms in all sectors face, services the hospital expected to be compensated for but for which they were unable to collect payment. However, a large portion stems from charity care, services that the hospital provided without expecting compensation.[7] There are likely a variety of reasons that hospitals provide these services. In this paper we consider two of the most discussed reasons: (1) federal regulations and (2) preferential tax treatment.

There are many regulations that govern how hospitals treat patients that do not pay. Perhaps the most important of these regulations is the Emergency Medical Treatment and Labor Act (EMTALA), which requires that hospitals treat all individuals requiring emergency care regardless of their insurance status. Passed as part of the Consolidated Budget Reconciliation Act in 1985, EMTALA was a federal statute that expanded on a number of state laws requiring hospitals to treat all patients regardless of their ability or willingness to pay. The statute established three main responsibilities for hospitals that participate in the Medicare program. Such hospitals must provide a medical screening exam to any patient who presents themselves at the hospital requesting treatment. If that patient is determined to have an emergency medical condition, they are required to provide the necessary treatment to stabilize the patient. Finally, if they are unable to stabilize the patient, they must transfer the patient to an appropriate facility for treatment. Hospitals must also accept transfers if they are the appropriate facility for treatment and report any inappropriate transfers. Of particular importance in our setting, these actions must not be delayed to inquire about the insurance status of the patient, and hospitals cannot deny services to people based on their ability to pay (GAO, 2001).[8]

[7] The line between bad debt and charity care is often unclear. For instance, some hospitals may classify care as bad debt when they expected the patient not to pay. The determination of uncompensated care as either bad debt or charity care is imprecise and varies across hospitals and over time. As a result, for the majority of this paper, we focus on aggregate uncompensated care.

[8] If hospitals violate these requirements they are subject to a variety of financial penalties with the ultimate sanction being the disbarment from participating in the Medicare program – a sanction imposed thirteen times from 1986–2001 (Zibulewsky, 2001). The implementation of the regulations surrounding EMTALA evolved over time. It was not until 1994 that the Center for Medicare and Medicaid Services (CMS) published final regulations for the statute. Additional guidance was provided in subsequent regulations. For instance, CMS advised hospitals not to inform patients that they may be charged prior to the patient being stabilized. For the purpose of defining a patient's arrival at a hospital, CMS defined a hospital campus to be anything within 250 yards of its main buildings (GAO, 2001). Given the slow evolution of the regulatory structure around EMTALA, it is difficult to pinpoint the

Beyond EMTALA, the health care sector is also unique in the large share of non-profit, private-sector firms. Over seventy percent of private hospitals are non-profit organizations. In exchange for being exempt from federal, state, and local taxes, these firms are expected to provide a community benefit. While there are many factors that contribute to a community benefit, such as medical research and teaching, perhaps the most discussed and easily quantified is uncompensated care (Nicholson et al., 2000).[9] As a result, hospitals provide medical services to patients without compensation even if they do not enter the hospital through the ED. This explains why many non-profit hospitals without an ED still provide relatively large amounts of services without compensation as compared to private firms in other sectors.

Previous work has not consistently identified a causal relationship between changes in public insurance eligibility and uncompensated care costs for hospitals. A series of studies have noted correlations between these outcomes (TK). LoSasso and Seamster (2007) find a small association between public health insurance generosity and uncompensated care during the 1990s. That study, however, focuses on Medicaid expansions that were primarily aimed at children. The paucity of other studies is likely driven by the lack of publicly available data on the finances of hospitals.

3. DATA

Our primary data on hospital uncompensated care costs consist of confidential proprietary financial data obtained through a partnership with the American Hospital Association (AHA). These data are collected as part of the annual AHA survey, which is the most complete measure of the structure and finances of American hospitals.[10] We obtained survey data from 1984-2011. The survey asks hospitals the amount of medical care that they provide without any compensation. Hospitals provide uncompensated care through two primary

exact date when the law was binding. Perhaps for this reason, there has been no comprehensive study to document the effects of EMTALA.

[9] Prior to 1969, IRS regulations required that hospitals provide charity care in order to qualify for their federal tax exemption. However, new regulations in that year broadened the criteria to include other activities that benefited the community (GAO, 2005).

[10] One concern is that – because the survey is handled by a trade association – hospitals may provide inaccurate information. Appendix Figure TK compares uncompensated care data from the AHA and from reports for the Tennessee Joint Annual Report – a mandated reporting system in that state. These data are remarkably consistent showing that reports that the AHA, at least in Tennessee, are quite similar to those to the state regulatory body.

channels: charity care and bad debt.[11] Charity care represents services for which a hospital never intended to collect payment, whereas bad debt represents services for which a hospital attempted to collect payment but was not paid (American Hospital Association, 2010). The methods of classifying uncompensated medical costs across these two categories vary greatly by provider and over time. For example, Rundall et al. (1988) state that investor-owned for-profit hospitals are more likely to report uncompensated care as bad debt rather than charity care. By contrast, non-profit hospitals might be more inclined to define these costs as charity care. Over time, these motivations can change. For instance, a non-profit hospital may become concerned about an impression that they are not aggressive enough in tracking down non-payments. Given this unclear distinction, we consider solely the sum of bad debt and charity care, total uncompensated care costs.[12]

A second concern with the uncompensated care data is that hospitals report this outcome as charges rather than costs. A well-known problem in the study of hospital finance is the growing spread between the list price that hospitals charge for a service and the actual payments these facilities receive from private payers. As a result, charge-based measures of uncompensated care provide an inaccurate description of actual costs. Given that the contractual adjustments for the various private payers are generally unavailable to researchers, we use a cost-to-charge ratio to approximate the actual costs of providing services. Our primary uncompensated care specifications are at the state-year level and we therefore adjust the reported uncompensated care charges in the AHA data using an annual cost-to-charge ratio.[13]

A final concern with the AHA data is that it focuses on dollars, not visits. For that reason, we also digitized data from the Joint Annual Reports (JAR) for health care facilities in Tennessee. These data are collected by the Tennessee Department of Health from licensed health facilities in Tennessee. While many of the data in these reports are duplicative of the data in the AHA survey, the JAR data also include outcomes such as the number of admissions or visits by payer type. Of particular importance to this project, from 2000 through 2006, the JAR data include the number of charity care admissions and outpatient visits by the pa-

[11] Importantly, our definition of uncompensated care does not include any portion of hospital costs that exceed reimbursements from government programs such as Medicare and Medicaid.
[12] Given these concerns, our data-use agreement with the AHA only allows us to study total uncompensated care in those data.
[13] Specifically, we calculate an annual cost-to-charge ratio as the average of each hospital's cost-to-charge ratio that year. The individual cost-to-charge ratios consist of total expenses divided by the sum of gross patient revenue and other operating revenue. Appendix Table A2 explores alternative cost-to-charge ratios: state-by-year average cost-to-charge ratios and hospital-by-year cost-to-charge ratios. The results are qualitatively similar regardless of which cost-to-charge ratio we use.

tients' county of residence rather than simply the address of the provider. Given that our data on the regional impact of the TennCare disenrollment is available at the county of residence, this allows for a more precise matching of the treatment and outcome variables. While the JAR data are not available outside of Tennessee, we can exploit regional, within-Tennessee variation in exposure to the TennCare disenrollment, and use these data to supplement our primary state-level panel analysis.

In order to identify spillovers of uncompensated care across hospitals, we require systematic data on hospital closures. We obtained such data for 1987–2000 from reports generated by the Office of the Inspector General (OIG) at the Department of Health and Human Services. The OIG data were originally compiled by the Center for Medicare and Medicaid Services and various state agencies and associations (OIG, 2000). We merge the OIG records to the AHA hospital data and consider a hospital closed when it is both listed as a closure in the OIG data and no longer appears in the AHA hospital data. In total we identify 745 closures from 1987–2000.[14]

Finally, for the state-panel analysis below, we use the March Supplement to the Current Population Survey (CPS). The CPS is an annual survey of employment, income, and health insurance outcomes. The March CPS asks about insurance coverage in the previous year and we use these data to determine the share of the population in a state that lacks insurance each year.

4. The Local Demand For Uncompensated Care

This paper's first goal is to study the demand for uncompensated care. In particular, we study how changes in the uninsured population affect hospital uncompensated care. Section 4.A. examines the relationship between the share of a local market that is insured and the amount of uncompensated care provided by its hospitals. The section focuses on state-by-year variation in the size of the uninsured population. Section 4.B. complements those results with a case study, the 2005 Missouri Medicaid disenrollment. Section 4.C. focuses on a second case study, the 2005 Tennessee Medicaid disenrollment, which affected non-traditional Medicaid

[14] An alternative way to identify hospital closures would be to identify hospitals that simply cease to exist in the AHA data. However, hospitals that merge but maintain separate physical locations are often combined into one entry in the AHA data. Since we cannot separate mergers from closures, this strategy would inaccurately classify facilities as closed when they remain open.

beneficiaries. Section 4.D. presents calibration exercises that compare the estimates from Section 4.A to estimates based on these two case studies.

4.A. Health Insurance Penetration and Uncompensated Care

A likely contributing factor to the provision of uncompensated care is the portion of the local population that lacks health insurance. After all, if individuals are insured, then they need little uncompensated care.[15] To explore this relationship, Figure 2 presents variation in the share uninsured versus total uncompensated care costs per capita. Panel A suggests a strong cross-state relationship between these two variables, while Panel B shows a similar relationship using changes within states over time. To further explore this relationship and quantify its magnitude, we estimate the cross-sectional relationship between state-level data on the share insured and uncompensated care costs using OLS regressions. Table 1 presents these estimates for 1990, 1995, and 2000. In all years there is a positive, statistically significant relationship between the share of the population without insurance and the amount of uncompensated care provided by hospitals. For example, in 1995, a ten-percentage-point change in the share uninsured was associated with a $55 increase in uncompensated care costs per capita. This is true for hospitals with and without an ED.

Of course, these cross-sectional relationships may simply reflect longstanding differences across states and over time. For that reason, we estimate the following panel regression:

$$y_{st} = \alpha_s + \delta_t + \beta \cdot PercentInsured_{st} + X_{st}\Gamma + \varepsilon_{st}. \quad (1)$$

Here, α_s are state fixed effects, δ_t are year fixed effects, X_{st} is a vector of controls added to some specifications, and ε_{st} is an idiosyncratic error term that allows for arbitrary correlation between observations in the same state. The coefficient of interest, β, represents the change in uncompensated care costs based on the percentage of the population covered by health insurance and is identified off of changes within states over time. This coefficient can also be interpreted as the change in uncompensated care for each newly uninsured person. That is, when per-capita uncompensated care is the outcome of interest, the state population is in the denominator in both the outcome and the independent variable of interest. Thus, [beta] represents both

[15] The insured may also consume uncompensated care if they do not pay their cost-sharing expenses. This has become more of a problem in recent years. For example, in 2006, only 3 percent of workers with employer-provided insurance had deductibles greater than $2,000 and only 10 percent had deductibles greater than $1,000. By 2012, these numbers grew to 14 and 34 percent respectively (Rae, Panchal, and Claxton, 2012).

the effect of a change in a percentage-point increase in the uninsured share, and as the effect of one additional uninsured state resident.

Column (1), Panel A of Table 2 presents estimates of this regression for the full sample of hospitals in the AHA. This estimate is remarkably similar to the cross-sectional estimates in Table 1. Panel B presents estimates with a full set of region-by-year fixed effects. The inclusion of these additional controls has little effect on the precision or magnitude of the estimates. Appendix Table TK shows that the results are also robust to state-specific linear time trends and additional state-level time-varying controls for local economic conditions and demographics.

As discussed above, it is impossible to identify a precise date after which EMTALA was binding. That said, EMTALA should have strengthened the relationship between share uninsured and uncompensated care for hospitals with an emergency department (ED). Table 1 suggests a cross-sectional relationship between share uninsured and uncompensated care for hospitals with and without an ED. However, this could just represent time-invariant factors across states. Columns (2) and (3) of Table 2 present panel estimates based on whether a hospital currently operates an ED. In contrast to the cross-sectional results, these estimates demonstrate that the increase in uncompensated care following an increase in share uninsured is entirely driven by hospitals with an ED. Facilities without an ED exhibit a small and statistically insignificant increase in uncompensated care when the share insured decreases.

The next six columns of Table 2 present estimates based on the ownership status of the firm. Columns (4) through (6) present estimates for non-profit hospitals. For these hospitals, each newly uninsured person is associated with an average increase of $320 in uncompensated care costs. However, this effect is driven entirely by non-profit hospitals that have an ED. The estimate for hospitals of this type without an ED is small in magnitude and statistically indistinguishable from zero.[16]

[16] This pattern suggests that the ED is a primary channel through which hospitals receive uninsured, non-paying patients. To further investigate that pattern, we identified hospitals in the AHA data that closed their ED but otherwise remained open. Figure 14 presents the average uncompensated care costs four years before and after the closure of the emergency department. The figure suggests that closing ED's decreases hospitals' uncompensated care costs by approximately 50 percent, or roughly $800,000 per year. Appendix Table A.TK presents estimates of a differences-in-differences regression that compares the uncompensated care costs in hospitals that close an ED to those that continue to have an ED. The table suggests that the closure of an ED leads to a decrease of $1.2 million in uncompensated care, a 40-percent reduction.

By contrast, the estimates in columns (7) through (9) show no detectable relationship between insurance coverage and uncompensated care for for-profit hospitals. Economists have long asked whether non-profit hospitals act differently than their for-profit counterparts or if they are instead "for-profits in disguise" (Weisbrod, 1988). These estimates can be interpreted as evidence for the former hypothesis: after an increase in the uninsured population, non-profit hospitals seem to provide more uncompensated care than for-profit hospitals.

This does not necessarily suggest that for-profit hospitals deny services to the uninsured. Other authors have shown that for-profit hospitals may simply choose to locate in different areas or provide a set of services that are less amenable to the provision of uncompensated care. For example, Norton and Staiger (1994) find that non-profit and for-profit hospitals located in the same area serve a similar number of uninsured patients, but for-profit hospitals choose to locate in areas with fewer uninsured people. That being said, these estimates document an important difference between the two types of hospitals.

Finally, it is important to note that the lack of a relationship between the share uninsured and uncompensated care for for-profit hospitals is not driven by the lack of an ED. Even for-profit hospitals operating an ED do not see an increase in uncompensated care as the local uninsured population grows. In our results below, we return to the question of how ownership status affects the provision of uncompensated care.

Columns (10) through (12) present estimates for public hospitals. The estimated relationship for these hospitals is large but imprecise. The size of the coefficient should be expected; government hospitals are seen as the primary providers of uncompensated care. The lack of precision likely results from the relatively small number of public hospital in the United States (GAO, 2005).

One concern with these results is the source of variation in share uninsured.[17] That variation is a combination of local economic factors and policy decisions regarding the generosity of public insurance. Of course, there are a variety of economic factors that could impact both the percent of a state with insurance and the provision of uncompensated care. Appendix Table A.TK presents estimates of equation (1) including a number of controls for local economic conditions, such as the unemployment rate and average income.

[17] A related concern is that these results may suffer not from omitted-variables bias but rather from reverse causality. The availability of uncompensated care may itself *cause* some people to choose to be uninsured (Rask and Rask, 2000; Herring, 2005; Lo Sasso and Meyer, 2006). We cannot entirely rule out either omitted-variables bias or reverse causality. Our approach instead is to examine two case studies, in Missouri and Tennessee, in which omitted-variables bias and reverse causality are unlikely.

Even after including a rich set of controls, there is still a large and statistically significant relationship between the share uninsured and the amount of uncompensated care provided in a state.[18] These results are also robust to accounting for changes in the share insured that come solely from changes in the size of the Medicaid population in a state.

The main panel-data estimates above suggest that a 10-percent increase in the percentage of the population with insurance results in a $54 increase in uncompensated care costs per capita. We can compare the magnitude of this estimate to estimates in related studies. Finkelstein et al. (2012) find that those who received new insurance as a result of the Oregon Health Insurance Experiment had an increase in hospital charges of approximately $1,000 and a decrease in medical collections of $390. Assuming that only bad-debt charges are sent to collection agencies, and applying Oregon's 2009 cost-to-charge ratio using our AHA data, we estimate that each newly insured person reduced the uncompensated care in Oregon hospitals by approximately $500. This suggests that a 10-percentage-point increase in the share of the Oregon population with health insurance results in a $50 reduction in uncompensated care costs per capita, which is very similar to our estimated change of $54 from the state-level panel estimates above.

This calculation highlights an under-appreciated aspect of public health insurance. Health insurance not only provides financial protection to the insured consumer, but it also provides financial protection to private firms in the health sector.

Although the state-panel estimates are robust to various control variables, we cannot rule out potential bias from unobserved, confounding trends. For example, a recession could decrease the share insured in a state and also decrease the ability of previously uninsured individuals to pay for their hospitalization.

To address this concern, we next focus on large, sudden increases in the uninsured population. Borh increases arose from large-scale public health insurance disenrollments in Missouri and Tennessee. These are the two largest disenrollments during the sample period covered by our data. Overall, the results from these two case studies, below, lead to similar conclusions as the state-level panel regressions above.

[18] In addition, one may be concerned that these results are driven by changes in the cost-to-charge ratio. For example, hospitals may increase their charges to serve as a higher starting point for negotiations with insurers. Appendix Table ATK presents estimates from equation (1) with each hospital's cost-to-charge ratio as the dependent variable. We find no statistically significant relationship between the percent insured and this ratio, suggesting that our results are not driven by hospitals manipulating their charges.

4.B. THE MISSOURI MEDICAID DISENROLLMENT

Following the 2001 recession, Missouri faced many years of revenue shortfalls. From 2001 through 2005, state revenues declined by 0.6 percent each year (Blouin et al., 2005). This resulted in budget cuts of over $2 billion over that time period, with nearly half of those reductions coming from social services, health, and mental-health services. Chief among these cuts was a sharp reduction in the generosity of the state's Medicaid program in 2005. In 2004, Missouri Medicaid provided insurance for over 900,000 low-income state residents. As a result of the 2005 policy changes, approximately 150,000 residents lost access to Medicaid and SCHIP (Zuckerman, Miller, and Pape, 2009).[19]

The reduction in generosity came primarily from five policy changes. First, a reduction in the income limits for parents from 75 percent of the federal poverty line (FPL) to the income limits for the Temporary Assistance for Needy Families limits of approximately 17 to 22 percent of FPL. Second, the state increased premiums for children in families earning more than 150 percent of FPL (premiums were previously required for those earning more than 225 percent of FPL). Third, the state made families ineligible for SCHIP if they earned more than 150 percent of FPL and had access to employer provided insurance costing less than $335 per month. Fourth, the state eliminated the Medicaid Assistance for Workers with Disabilities (MAWD) program, which allowed disabled workers earning less than 250 percent of FPL to buy into the state Medicaid program. Finally, fifth, the state created an annual reinvestigation program to ensure eligibility (Zuckerman, Miller, and Pape, 2009).

The severity of the cuts in Missouri means that those who lost coverage were similar to the traditional beneficiaries of public health insurance gaining and losing insurance in our panel-data estimates above. For example, approximately half of those losing insurance were low-income parents with incomes between 17 and 75 percent of the FPL (Ku and Solomon, 2005). As a result, the magnitude of the effect of the Missouri disenrollment serves as an appropriate benchmark for our panel-data estimates.

[19] The effect of the Missouri disenrollment exhibited little regional variation. Examining county-level Medicaid enrollment data, the county-level Medicaid caseload reduction ranged from 0.3 to 4.8 percentage of the population. The median reduction was approximately 2 percentage points and the interquartile range was 1.55 percent to 2.46 percent. As a result, in our empirical analysis, below, we are only able to compare changes in uncompensated care in Missouri to those in similar states. We cannot exploit within-Missouri variation in the effect of the disenrollment.

The reductions in the generosity of Missouri's Medicaid program provide a sudden shock to the state's uninsured population that should be unrelated to previous trends or other contemporaneous events in these markets. We begin by examining the uncompensated care costs in Missouri compared to the trend in neighboring states. Figure 3 depicts the uncompensated care costs in Missouri and all other TK Midwestern states over the same time period. Following the disenrollment, there was a sudden increase in aggregate uncompensated care for Missouri's hospitals as compared to those in the comparison states. Importantly, prior to the disenrollment, the costs for hospitals in Missouri and its neighboring states followed roughly similar trends.

To identify the magnitude of the increase in uncompensated care, we turn to a regression analysis composed of state-by-year difference-in-difference regressions:

$$y_{st} = \alpha_s + \delta_t + \beta \cdot I\{s = Missouri\} \cdot I\{t \geq 2006\} + \varepsilon_{st} \quad (2)$$

The variable y_{st} represents an outcome for state s and year t, such as the uncompensated care costs for the state's hospitals. The model includes state fixed effects (α_s), year fixed effects (δ_t), and an error term (ε_{st}).

The key coefficient of interest is β, the difference-in-difference estimate of the effect of the change in Medicaid. This coefficient is identified by comparing outcomes in Missouri after the policy changes to outcomes in neighboring states before the disenrollment and to the comparison states. The key identifying assumption is that outcomes in Missouri would not have evolved differently relative to other neighboring states in the absence of the disenrollment. The similar pre-trends in Figure 3 provide supporting evidence for this identifying assumption.

In addition, Panel A of Table 3 presents a set of summary statistics from 2004 for Missouri and the other Midwestern states. Both Missouri and Tennessee provided about $151 million in uncompensated care in 2004, which was more than their comparison states. The final two rows detail the distribution of hospitals by tax status and shows that Missouri had a larger share of for-profit hospitals than its neighboring states..

Table XX presents the estimates of equation (3) and shows an approximately 13-percent increase in uncompensated care costs for hospitals in Missouri compared to hospitals in surrounding states. This suggests an approximately $61 million increase in uncompensated care costs as a result of the disenrollment.[20] Similar to the state-panel results detailed above, this increase is driven almost entirely by non-profit hospitals. Pri-

[20] Missouri hospitals provided $471 million in uncompensated care.

vate, non-profit hospitals experience an increase of approximately 14 percent while government hospitals see an increase of 50 percent.

4.C. THE TENNCARE DISENROLLMENT

The Tennessee disenrollment was more complicated than the Missouri disenrollment, because it involved the termination of a large Medicaid expansion program targeting a population not traditionally eligible for public health insurance. Specifically, the Tennessee expansion program targeted "uninsured" and "uninsurable" individuals regardless of income. As a result of the lack of an income requirement, the expansion enrollees had higher incomes than traditional Medicaid enrollees. In 1995, over 40 percent had incomes above 100 percent of the federal poverty line. In addition, relative to traditional TennCare enrollees, they were more likely to be white, between the ages of 21 and 64, and to not have children at home.

The expansion program made TennCare more expensive than anticipated, and, by 2001, the system faced a budget shortfall of over $300 million (Chang and Steinberg, 2009). As a result, beginning in late July of 2005, Tennessee disenrolled individuals over the age of 19 in the expansion program.[21] As a result of the disenrollment, approximately 4 percent of the non-elderly adult population of Tennessee lost public insurance coverage and TennCare enrollment remained depressed for many years.[22] Many disenrollees were able to secure private coverage, but Garthwaite, Gross, and Notowidigdo (2014) find that approximately 70,000 remained without insurance for many years after August 2005. For these individuals, the loss of insurance may have led them to consume uncompensated care. It is that possibility that we test for here.

Despite the size of the TennCare disenrollment, it remains a relatively understudied phenomenon. Several studies examined shift in the payer mix following the disenrollment (Emerson et al, 2012, Hearven et al. 2011, Garthwaite, Gross and Notowidigdo, 2014). With respect to uncompensated care, Farrar et al. (2007) conduct focus groups and examine health care utilization for a sample of providers before and after the

[21] Tennessee also cut certain services for the remaining enrollees. Perhaps the most significant reduction in benefits for those retaining coverage affected prescription drug coverage. In 2004, drugs accounted for 33 percent of overall TennCare spending. Effective August 1, 2005, TennCare beneficiaries retaining coverage were limited to 5 prescription drug refills per month of which no more than 2 could be brand name medications (Blue Cross Blue Shield, 2005). From 2005 to 2006, total TennCare spending fell by approximately $1.7 billion, with nearly $1.23 billion of this reduction coming from reduced pharmacy payments. After the reform, prescription drugs accounted for only 21 percent of overall TennCare expenditures (TennCare, 2005).
[22] For more institutional details on the TennCare disenrollment, see Garthwaite, Gross, and Notowidigdo (2014).

TennCare cuts. One respondent reported: "[i]t's not that we're seeing more people, I believe it's the same people who used to be insured and now are not."

Figure 4 presents uncompensated care costs for hospitals in Tennessee and for those in other Southern states. Following the disenrollment, uncompensated care costs suddenly increased in Tennessee. Similar to Missouri, prior to the disenrollment the costs for each set of state were similarly trending. Panel B of Table 3 presents sample statistics for Tennessee and all other southern states. The first row presents the percentage uninsured in each group prior to the reform. Unsurprisingly, a much larger share of the Tennessee population was covered by public health insurance than in other southern states. This is likely a result of the generosity of the TennCare expansion. The next row presents the amount of uncompensated provided by hospitals in each state.

Table 5 presents difference-in-differences estimates with the total amount of uncompensated care costs in each state as the outcome of interest. The first column presents estimates for all hospitals. It suggests that, following the TennCare disenrollment, Tennessee hospitals provided approximately 20 percent more uncompensated care than similar hospitals in other Southern states. This amounts to an approximately $133 million increase in uncompensated.[23] Columns (2) to (4) of Table 4 present the estimated impacts on uncompensated care for private hospitals. The first of these columns presents estimates for all private hospitals and the next two columns split the private-hospital sample by their tax status. Column (5) presents estimates for public hospitals.

The largest proportional increase in uncompensated care occurred at government-owned hospitals, but private, non-profit hospitals account for roughly 60 percent of the total increase in uncompensated care. The effect for for-profit hospitals in column (4) is statistically insignificant. That lack of precision should be unsurprising given the absence of an effect of share uninsured on for-profit hospitals in the panel-data estimates above. It should also be noted that the sudden timing of the disenrollment, may have made it difficult for for-profit hospitals to entirely avoid the increase in uncompensated care.[24] While the estimates for for-

[23] In 2004, Tennessee hospitals provided approximately $670 million in uncompensated care.
[24] However, for-profit hospitals could still offer a set of services that are less likely to attract uncompensated care (e.g. obstetrics or trauma centers).

profit hospitals are not statistically different from the estimates for non-profit hospitals, they suggest that there may be true economic differences in the behavior of hospitals based on their ownership status.

The cross-state evidence of an increase in uncompensated care in both Tennessee and Missouri suggests a causal relationship between the size of the uninsured population and hospital uncompensated care. A remaining concern is that another, contemporaneous event within each state is driving the estimates. For this reason, we next exploit the substantial, within-state variation in exposure to the TennCare disenrollment to estimate the effect of the disenrollment on uncompensated care.[25]

While the disenrollment was enacted simultaneously across Tennessee, the number of citizens who lost coverage varied a great deal across the state. We obtained county-level enrollment data from the Bureau of TennCare annual reports for 2004 and 2005.[26] The percentage of a county's population losing health insurance in the year after the disenrollment ranges from a low of 0.8 to a high of 9.1. The median county experienced a drop in enrollment of 3.3 percentage points, and the interquartile range was 2.7 to 5.0 percentage points. We aggregate these disenrollment data into the 14 health-department regions in the state identified by the Tennessee Department of Health. We construct regression models which interact the region-specific change in share of population enrolled in TennCare with an indicator variable for the years following the disenrollment. Specifically, we estimate the following regression:

$$y_{rt} = \lambda_r + \delta_t + \beta(\Delta TennCare_{r,2004-2005}) \cdot I\{t \geq 2006\} + \varepsilon_{st} \qquad (3)$$

where y_{rt} is the outcome of interest for region *r* and year *t*. This model includes region fixed effects (λ) and year fixed effects (δ). The key coefficient of interest is β, which estimates the effect of the TennCare disenrollment by exploiting differences across regions in the magnitude of decline in TennCare enrollments from December 31, 2004 to December 31, 2005 ($\Delta TennCare_{r,2004\text{-}2005}$), when the vast majority of the TennCare disenrollment occurred. The key identifying assumption is that the uncompensated care in these hospital regions would have evolved similarly in the absence of the disenrollment. While we cannot test this assumption directly, we show below that trends in uncompensated care in these regions were not evolving differently in

[25] The lack of regional variation in exposure to the Missouri Medicaid disenrollment makes this type of analysis infeasible for that state.

[26] These are the earliest available annual reports for TennCare. While quarterly reports for earlier years exist, those documents do not contain enrollment by county and eligibility category. Our attempts to receive earlier enrollment data from TennCare administrators were unsuccessful.

the years before the disenrollment in a way that was correlated with our measure of exposure to the disenrollment. Note that we can also scale the estimates of equation (3) by the state-wide change in TennCare enrollments, which produces a scaled estimate comparable in magnitude to the difference-in-difference estimates of equation (2).

We begin by comparing changes in unadjusted sample means across health department regions. Figure 8 depicts the relationship between $\Delta TennCare_{r,2004\text{-}2005}$ and the change in total uncompensated care from 2004 and 2005 to 2006 and 2007. We observe a strong negative relationship: regions with larger decreases in TennCare enrollments experienced larger increases in uncompensated care costs. Figure 9 presents a simple falsification test: it depicts the relationship between the same changes in TennCare enrollments in 2005 and differences in uncompensated care before and after 2002 rather than 2005. Importantly, the negative relationship that we observe in Figure 9 is not present in Figure 8.

We next quantify the magnitude of the changes in uncompensated care costs with a within-Tennessee regression analysis. Panel A of Table 5 reports results from estimating equation (2) with the total amount of uncompensated care in each Tennessee health department region as the outcome of interest. The first column demonstrates that hospital regions with a larger decrease in TennCare enrollment experienced a statistically significant increase in uncompensated care costs. The scaled estimate in column (1) suggests an approximately 18-percent increase in uncompensated costs, which is very similar to the state-by-year difference-in-difference estimate of 21 percent in Table 6. Columns (2) presents the estimates for all private hospitals, it shows a statistically significant increase in uncompensated care (p = 0.045). The scaled estimate of a 19-percent increase in these costs is again very similar to the corresponding estimate of 20 percent in Panel A of Table X.[30]

A remaining concern with these within-state estimates involves pre-existing time trends specific to each region. We address this concern in two ways. First, Panel B of Table 5 presents estimates of equation (3) af-

[30] The relatively small sample of counties makes it difficult to precisely estimate the effects for private hospitals by tax status. Appendix Table A.TK presents these imprecise estimates. The estimated impact for non-profit, private hospitals is in the hypothesized direction and the scaled estimate is similar in magnitude to the difference-in-differences coefficient in Table 4. However, this coefficient is not statistically significant at conventional levels. The estimate for for-profit hospitals in column (4) is very imprecise and of the unexpected sign. Combined with the insignificant estimate for both the across-state TennCare regressions and our state-panel results this estimate provides further evidence of a limited effect of changes in public health insurance on the uncompensated care costs of for-profit hospitals.

ter the inclusion of region-specific linear time trends. These results are similar to the main estimates in Panel A. Similarly, Panel C of Table 5 presents a simple placebo exercise designed to demonstrate that pre-existing time trends in uncompensated care do not account for the results above. We estimate equation (3) for a different sample of years, 1997 through 2004, and estimate the coefficient on an interaction between the (future) 2004–2005 change in TennCare enrollment with an indicator for the years after 2001. The panel, reassuringly, presents no evidence of a statistically or economically significant relationship.

Our preferred within-state analysis exploits variation across Tennessee health department regions. We prefer this level of aggregation because it provides a large number of geographic areas ($N = 14$). At the same time, health department regions are large enough to allow for a relatively accurate estimate of the change in TennCare eligibility in the area as well as minimize the possibility of spillovers across areas, both of which would attenuate the results. In order to demonstrate that our results are not sensitive to the specific choice of geography, Appendix Figures A4, A5, and A8 as well as Appendix Table A2 consider a number of alternate geographies. These include the 8 hospital referral regions (HRRs) and 81 hospital service areas (HSAs) in Tennessee, as well as the 9 Economic Development Districts established by the Tennessee Development District Act of 1965. The estimated impacts at the development district and the HRR level are similar in magnitude to the main estimates in Table 5, although the within-state estimates using HRRs are not precisely estimated ($p = 0.327$).

The estimated impact for the 81 HSAs is statistically significant at conventional levels but the magnitude is roughly half of the preferred estimates which use the larger health department regions in Table 5. This likely arises from a greater degree of measurement error; as discussed in more details below, HSAs are much smaller than the other areas. In addition, dividing Tennessee into HSAs may allow more spillovers in uncompensated care across smaller HSAs as compared to the other three geographic categories. Such spillovers indicate that the incidence of the TennCare disenrollment likely extends beyond the hospitals directly affected by the disenrollment and represents an important area of future work.

A remaining concern with the results above is that the simple accounting definition of uncompensated care may provide an incomplete picture of the actual amount of care provided without payment. For that reason, we next explore the effect of the disenrollment on tangible medical services such as inpatient admis-

sions and outpatient visits which we obtain for Tennessee hospitals from the JAR dataset. Figures 7(a) through 7(d) plot the change in inpatient admissions and outpatient visits, in Tennessee hospitals by insurance status. Figure 7(a) presents this variable for patients insured by TennCare. Prior to 2005, there is a smooth upward trend. However, after 2005 there is a decline in the number of these hospital encounters. A fair question is whether this demonstrates that medical care was foregone or simply a shift in the expected source of payment. Figure 7(b) focuses on hospital encounters for self-pay patients. Following the disenrollments there was an increase in the number of these encounters for individuals without insurance. However, this increase was smaller than the decline in TennCare visits.

Given that Garthwaite, Gross, and Notowidigdo (2014) estimate large amounts of crowdout following the disenrollment, we should also expect that some of the difference between Figures 7(a) and 7(b) stems from an increase in utilization by privately insured patients. Figure 7(c) provides some suggestive evidence that this may have occurred. Following the disenrollment there appears to have been a slight increase in the number of hospital encounters for privately insured patients.[31] Finally, Figure 7(d) shows the total number of hospital encounters in Tennessee over time. Prior to 2005, these visits are trending upwards. However, after the disenrollment there was a break from this trend and the number of visits remained level for the next two years. This suggests that the disenrollment reduced the use of hospital services while increasing the share of visits by uninsured patients. This is confirmed by Figure 6, which shows the percent of hospital encounters that are self-pay each year. Prior to 2005, this share averaged approximately 6 percent. However, in the year after the disenrollment this share suddenly jumped to between 8 and 9 percent.

We next examine JAR data on the number of charity care visits by each patient's county of residence.[32] Because this variable is based on the patient's county of residence and not the hospital's location, we are able to use county-level data rather than health department regions. Unfortunately, these data only exist until 2006, only one full year after the disenrollment. We group counties into quartiles based on the absolute size of the disenrollment and show the number of charity-care visits from top-quartile and bottom-quartile coun-

[31] Appendix Figure A.TK decomposes the change in hospital encounters by insured patients based on whether they are inpatient admissions or outpatient visits. The slight overall increase is a combination of a large relative change in inpatient admissions and a small increase in outpatient visits. This pattern may result from the differential cost sharing for ED visits between Medicaid and most private insurance plans.

[32] The JAR data do not contain other types of visits by county of residence, such as self-pay visits, or total visits.

ties. Figure 5 presents that comparison. The figure demonstrates an increase in the number of charity-care visits for counties that suffered the largest absolute decline in TennCare enrollment. Similarly, we could examine the number of self-pay admissions by the Hospital Region. Appendix Figure A9 shows that regions which were more affected by the disenrollment had larger increases in the number of self-pay admissions compared to those that which were less affected.

Finally, we examine the use of ED services following the disenrollment. A common rationale for public health insurance expansions is a reduction in the use of the ED as a source of primary care. It is often assumed that expanding insurance will decrease inappropriate use of the ED.[33] However, recent evidence suggests that the causal effect of health insurance on ED visits is positive (Taubman at al., 2014; Anderson et al., 2012). If this were the case in our setting, then we would expect that the disenrollment would decrease the aggregate use of ED services in Tennessee. Appendix Figure A7 presents the number of ED visits by year in Tennessee. Prior to the disenrollment, the number of visits is smoothly increasing. However, beginning in 2005 there is a break from this trend and the number of visits remains roughly level in the subsequent years. This decline provides suggestive evidence that insurance coverage increases rather than decrease the use of the ED.

4.D. The Magnitude of the Public Health Insurance-Uncompensated Care Cost Gradient

The results above consist of three tests of the relationship between the uninsured and uncompensated care: a cross-state analysis, the Missouri case study, and the Tennessee case study. All three sets of estimates suggest a statistically significant relationship. We next compare the magnitudes of the panel-data and across-state estimates by predicting the expected decline in uncompensated care costs as a result of the ACA. We begin with Missouri, whose disenrollment was most similar to the changes in the share publicly insured from 1984–2011. Previous estimates suggest that 150,000 state residents lost access to public health insurance coverage as a result of the Missouri disenrollment (Zuckerman, Miller, and Pape, 2009). However, it is unclear how many of these residents secured private coverage. We therefore bound our estimates of the effect

[33] For example, President Obama said "I think that it's very important that we provide coverage for all people because if everybody's got coverage, then they're not going to the emergency room for treatment" (Tavernise, 2014). Similar comments have been made by Secretary of Health and Human Services Kathleen Sebelius and Michigan Governor Rick Snyder (Kliff, 2014).

on uncompensated care by considering two cases: we assume that 50 percent of the disenrollees secured private coverage and that 0 percent secured private coverage. Prior to the disenrollment, hospitals in Missouri provided $471 million in uncompensated care. Therefore, the 17-percent reduction in Table 6 amounts to a decline of approximately $80 million. With no crowdout, this would amount to a $533 increase per uninsured individual. A 50-percent crowdout rate would lead to $1,066 per uninsured individual. The ACA is expected to provide health insurance to 25 million previously uninsured individuals, which means that our Missouri estimates would suggest a decrease in uncompensated care of approximately $13–$26 billion. Given the fairly low income of the disenrollees in Missouri, one might expect less crowdout, and therefore estimates in the lower end of this range may be preferable.

The panel-data estimates suggest that each newly uninsured person raises average costs by $540. This suggests that newly insuring 25 million people would result in approximately $13.5 billion in reduced uncompensated care costs. This is within the range of estimates from Missouri. We find the similarity in these estimates reassuring.

While the ACA provides insurance to approximately half of the uninsured, our estimates suggests it will only decrease uncompensated care costs by approximately one third. This suggests that the marginal publicly insured person leads to fewer uncompensated costs than the average uninsured person.

Further evidence of this can be seen from our estimates from Tennessee, which affected a population that might be more similar to a portion of the currently uninsured. Our Tennessee estimates suggest an increase in uncompensated care of approximately $1,441 per uninsured individual. Using this estimate, we would predict that approximately $36 billion in uncompensated care costs would disappear under the ACA. However, many of the disenrollees originally gained TennCare coverage because they had been denied coverage in the private market. The disenrollees thus had higher Medicaid expenditures than traditional Medicaid enrollees. As a result, the marginal uninsured person in Tennessee likely generates more uncompensated care costs than the average pre-ACA uninsured individual.

These estimates suggest that the expected change in uncompensated care from the ACA will be determined by the relative health of the uninsured gaining coverage compared to those that will remain uninsured. Shartzer, Long, and Zuckerman (2014) find that approximately 18 percent of the newly insured in 2014 re-

ported being in fair or poor health. If we assume that these individuals will have a change in uncompensated care costs similar to the TennCare disenrollees and the other newly insured will be more similar to the Missouri and panel-data estimates, then we predict the ACA will decrease uncompensated care costs by approximately $19 billion, or 41 percent of the pre-ACA level.[34]

5. The Local Supply of Uncompensated Care

The estimates above suggest that the demand for uncompensated care, which is a function of the size of the uninsured population, affects hospital uncompensated care costs. Hospitals in a local market appear to serve as the "residual payer" for medical services following changes in the generosity of social health insurance. In this way, private hospitals provide an additional form of social insurance in that they are health insurers of last resort.

If the uninsured require a certain amount of medical care regardless of their ability to pay, and hospitals in a market serve as insurers of last resort, then the amount of uncompensated care hospitals provide should also be a function of the supply of medical services by other providers in their local market. We examine this hypothesis next. To do so, we estimate the spillovers of both uncompensated and compensated care across hospitals following the closure of one local hospital. If the provision of uncompensated care occurs because the uninsured demand a minimum and unavoidable quantity of medical services for which they cannot pay, then closing competing facilities should not reduce the total provision of uncompensated care in a geographic area. Instead, each remaining hospital should see its uncompensated care costs increase, as the uncompensated care costs are reallocated from the closing facility to the hospitals that remain open. However, if hospitals are providing care solely at their discretion or if the very existence of a facility induces care that otherwise would not be demanded, then a hospital closure ought to reduce the total amount of uncompensated care in a local market.

[34] It should also be noted that approximately 20 percent of the remaining uninsured population will be eligible for Medicaid but will choose not to enroll. These individuals should actually be thought of as insured for the purposes of considering hospital uncompensated care costs. If we count these people as insured, the ACA will provide new health insurance to 6 million individuals and will reduced uncompensated care by an additional $4.7 billion.

Section 5.A. examines the change in the distribution and level of uncompensated care costs provided in a local market after a hospital's closure. Section 5.B. estimates the pattern of revenue spillovers following a closure and calculates the net effect of these closures on hospitals finances, since a hospital closure may affect revenue, as well.

5.A. Uncompensated Care Spillovers from Hospital Closures

To examine the spillovers of uncompensated care across hospitals we use a combination of the OIG and AHA data to identify 745 hospital closures from 1986–2000. We examine the amount of uncompensated care provided by hospitals that remain open after a nearby hospital closes. We begin our analysis at the county level. Using the OIG closure data, we identify a sample of 102 counties that suffered a single hospital closure in this time period.[35] In this sample, the mean closing hospital accounted for approximately 35 percent of the county's uncompensated care costs in the year prior to its closure. We estimated the following event-study specification:

$$y_{ct} = \lambda_c + \delta_t + \sum_{i=-2}^{5} \beta_i \bullet I\{i \text{ Years Since Closure}\}_{ct} + \varepsilon_{ct} \qquad (3)$$

Here λ_c are a set of county fixed effects, δ_t are year fixed effects, and ε is an error term that allows for arbitrary correlation between observations from the same county. The coefficients of interest, β_i, estimate the change in uncompensated care costs in the county for the 3 years before and the 5 years after closure with the year of the closure servings as the omitted category.

As outcomes, we focus on the number of hospitals in the county, the logarithm of uncompensated care costs for hospitals that do not close, and the logarithm of total uncompensated care costs in the county. Figure 10 presents these estimates. As would be expected, the number of hospitals is relatively stable in the years prior to the closure and then drops by one in the year following the closure.[36] Figure 11(b) suggests

[35] We additionally restrict our attention to closures in which the hospital that closed represented between 10 and 90 percent of the uncompensated care costs in that county in the year prior to its closure.

[36] Given that we select a sample of geographic areas that have exactly one closure from our closure data, we would expect that this coefficient would be a precisely estimated one. However, this is not the case. Examining our data we are able to rule out that this is driven by a large number of closures not included in the OIG data. Therefore, the difference from a coefficient of one is the result of other hospitals opening in the local area in the time period around a closure. The coefficients less than one would indi-

that the amount of uncompensated care provided by hospitals that do not close is stable prior to the closure and then increases by approximately 20 percent following the closure. The dashed horizontal line show that the closing facility accounted for approximately 20–30 percent of uncompensated care costs in the county prior to it closing. The figure suggests that all of the costs previously born by the closing hospital are not transferred to the remaining hospitals. Therefore, it should not be surprising that in Figure 11(C) the overall amount of uncompensated care provided in hospitals in the county fall by 30 percent following the closure. This demonstrates that either the closure of a hospital decreases the amount of uncompensated care consumed by the uninsured, or uninsured patients travel outside of the original county of treatment to receive these services following a closure.

In order to distinguish between these two possibilities, we next consider other definitions of the local market. Two traditional market definitions in the literature are the hospital service area (HSA) and the hospital referral region (HRR). These areas provide measures of local health care markets and are defined by the utilization of care for Medicare patients. HSAs are groups of zip codes in which more Medicare patients receive hospital care in the local hospital than in any single HSA (Wennberg et al., 1996). Therefore, HSAs are a fairly localized hospital market definition. By contrast, HRRs represent a collection of HSAs whose residents were referred for cardiovascular and neurosurgery treatments. This is a far larger market definition. In total, we have TK HSAs and TK HRRs in our data.

But these traditional definitions of hospital markets may not be appropriate in our setting. HSAs likely suffer from the same problem as counties, in that after a facility closes, many uninsured patients leave the HSA to receive medical care. We would then erroneously conclude a reduction in the total amount of uncompensated care following a hospital closure. On the other hand, HRRs are quite large. Therefore, the closure of a hospital may have little detectable effect on the provision of services in an area that large. In addition, both HSAs and HRRs are based on the flow of Medicare patients. Uninsured patients may seek care based on factors different from Medicare patients.

Appendix Figure A11 presents estimates of equation (3) based on HSAs. The estimates for the HSA samples largely mirror those from the county-based analysis: a sudden increase in uncompensated care costs

cate that the area has slightly fewer than average openings while those greater than one suggest that new hospitals on average slightly offset the effect of the closure.

for the remaining hospitals, but an overall decrease in the amount of medical care provided without compensation. For the estimates using HRR as the unit of analysis, we are able to clearly identify the closure of a hospital based on the number of hospitals in the area. However, we cannot identify meaningful changes in the uncompensated care costs of remaining hospitals or in the amount of uncompensated care provided in the area. This is likely the result of the size of HRRs. For example, the average hospital closing accounted for only six percent of the uncompensated care costs in the year prior to its closure, making this geographic aggregation underpowered to detect meaningful spillovers.

Therefore, we next consider the spillover of uncompensated care across hospitals located within the same commuting zone. Often used in the local labor markets literature, commuting zones are mutually exclusive sets of counties that have strong commuting ties between each other and weak ties to other areas (Autor, Dorn, Hansen, 2013; Tolbert and Sizer, 1996). These areas have the advantage of being larger than an HSA or county but smaller than an HRR. In addition, given that they are based on daily traffic patterns rather than the medical-care decisions of elderly insured patients, they may better capture the catchment area for uncompensated care.

In our data, we identify 38 commuting zones that had a single hospital closure from 1984–1999. The mean hospital closure accounted for approximately 28 percent of the uncompensated care provided in the commuting zone in the year prior to the closure. Figure 12(a) displays the event-study estimates for the log of uncompensated care costs at hospitals in the commuting zone that did not close. These coefficients show little change in uncompensated care costs prior to the closure and then a large and immediate increase that accounts for the vast majority of uncompensated care costs from the closing hospital. Therefore, it should not be surprising that in Figure 12(b), there is at most a slightly decline in the overall amount of uncompensated care provided in the commuting zone.

5.B. Revenue Spillovers from Hospital Closures

In addition to the spillover of uncompensated care, one would also expect a spillover of profits from insured patients. This positive spillover is the more-traditional outcome considered in other sectors. Figure 13(a) describes the change in revenue for hospitals that remain open in a county experiencing a closure from 1984–1999. Following the closure, these hospitals experience an approximately 10 percent increase in reve-

nue. This increase represents only a fraction of the revenue earned by the hospital that closed. This can be seen in Figure 13(b) which shows a sharp reduction in the consumption of medical services (as measured by revenue) in the county following a closure. This reduction is likely at least partly the result of insured patients seeking medical care at facilities located outside of their original treatment county.

Guided by our uncompensated care spillover estimates, we next consider revenue spillovers within a commuting zone.[37] The average hospital that closes accounted for 20–30 percent of the revenue in its commuting zone. Figure 13(c) shows an approximately 11 percent increase in revenue for the hospitals in the community zone that remained open following a closure. Figure 13(d) suggests that the total revenue for hospitals in the commuting zone decreased by approximately 12 percent. This suggests that even in this relatively large geography, there is a reduction in the consumption medical services as a result of the closure. While it could be that these insured patients are leaving the commuting zone to receive medical care after a closure, we note two facts. First, commuting zones are far larger than counties, suggesting that the average insured patient would travel a long distance for care if they left the region. Second, when considering uncompensated care costs, we did not find a similar aggregate reduction in the consumption of these services within a community zone following a closure.

A reduction in the consumption of insured medical services following a closure would be consistent with a model where at least some of the medical services provided by a hospital are marginal. Closing patients' preferred provider increases the cost of receiving these services and as a result these marginal services are no longer purchased. By contrast, we see no reduction in uncompensated care. This suggests that uncompensated services are non-discretionary.

Hospitals often object to and even actively lobby against the closure of competing hospitals. We believe that such a phenomenon is unusual. In most industries, the closure of a competitor is welcome news. We use a simple back-of-the-envelope calculation to evaluate whether these objections are warranted. Consider that hospitals in the average commuting zone suffering a closure had revenues of $212.6 million. Therefore, the closure of a hospital increases revenue at the hospitals that did not close by approximately $23 million. Given the average profit margin for all hospitals from 2000 to 2010 was approximately 5 percent (AHA, 2013), the

[37] Appendix Figure TK provides estimates for revenue spillovers with an HSA. Similar to the uncompensated care results, a large fraction of revenue from hospitals within an HSA either disappears or is moved outside of the HSA.

total profit from this revenue increase was roughly $1.2 million. Along with these profits comes the hospital's share of uncompensated care costs previously borne by the closed hospital. The average commuting zone affected by a closure had uncompensated care costs of approximately $12 million. Given an increase in these costs among remaining hospitals of approximately 20 percent, there was an increase of roughly $2.4 million in uncompensated care costs resulting from a closure. These estimates suggest that the closure of a hospital results in a net loss for remaining hospitals of approximately $1.2 million.[38] This implies that hospital profits decrease by approximately 11 percent following a nearby closure.[39]

This loss results from hospitals serving as insurers of last resort. Due to this role, the amount of uncompensated care demanded in a local medical market amounts to a fixed cost that must be paid by all providers. After a hospital closes, the remaining facilities must bear an increased share of these costs. This problem is exacerbated by the fact that, while the total amount of uncompensated care does not decrease following a closure, a non-trivial portion of the revenue from insured patients either is not earned by any hospital or accrues to providers outside of the commuting zone.

6. CONCLUSION

A combination of factors uniquely force hospitals to provide health care regardless of the patient's ability to pay. As a result, American hospitals serve as insurers of last resort, providing an informal form of social insurance that partially fills gaps in the existing system. When public policy does not provide insurance to a population, local hospitals instead provide medical services without compensation. The results above also demonstrate that this informal insurance creates a market-level fixed cost that is borne by all hospitals in the local market. When one hospital closes, the uncompensated care costs spill over onto neighboring hospitals.

This market-level cost distinguishes hospitals from firms in many other sectors. In most product markets, the closure of a competitor benefits incumbent firms, by providing them with increased market power

[38] This calculation does not account for future profits that might occur from providers having more market power in future years.
[39] With a profit margin of 5 percent and average annual revenues of $212.6 million, hospitals earn approximately $11 million in annual profits.

and additional customers.[40] In the case of hospitals, however, the pattern is more complex. For hospitals, a closure means fewer firms to cover the fixed cost of treating the uninsured. This appears to decrease the average profits of the remaining firms.

Indeed, hospital administrators and board members to whom we have spoken have indicated that their hospitals often oppose the closure of a nearby hospital with high uncompensated care costs. Our results suggest that it may be profit-maximizing for hospitals to support some policies that benefit their competitors, something that is not true for other industries.

Our estimates can inform policymakers about the likely consequences of the ACA for hospitals. That area is of substantial policy interest due to the recent decision, by some states, not to expand Medicaid eligibility. As of October 2014, 23 states have chosen not to implement the ACA's Medicaid expansion, even though the federal government will fund 90 percent of the cost through 2020. As a result, approximately 4.8 million individuals in these non-expanding states will not receive coverage under the ACA (Kaiser, 2014). The state portion of the cost of covering these individuals as of 2022 is estimated to be $6.5 billion.[41] Our estimates suggest that the uninsured population will generate approximately $6.3 billion in uncompensated care costs that year. That number only includes uncompensated care costs at hospitals, not uncompensated care at other health-care providers.[42] These potential additional costs were summarized by Governor Bill Haslam of Tennessee, who said the following regarding his uncertainty about the ACA Medicaid expansion:

> We have to remember what the state went through seven years ago when it made the difficult decision to cut a lot of people from the TennCare rolls. We have to be very deliberate about making a decision to add that many and more back to the rolls, but I also understand that the decision isn't just as easy as standing here today and saying, 'We're not going to expand Medicaid.' There are hospitals across this state, many of them in rural communities, that are going to struggle if not close under the health care law without expansion, and that's not something to take lightly (Haslam, 2013).

Hsia, Kellerman, and Shen (2011) found that from 1990 to 2009, approximately 30 percent of the nation's EDs closed, primarily due to hospital closures. ED closures were more likely to occur in low-income

[40] A rare exception may be markets in which the closure of a rival hurts an incumbent when it weakens the economies of agglomeration (Benmelech et al., 2014).
[41] States are responsible for their full portion of the expansion costs after 2022.
[42] It is not clear how much uncompensated care physicians provide. Gruber and Rodriguez (2007) study payments made to private physicians' offices and find that uncompensated costs are either negative or very small. Private physicians, according to their results, charge the uninsured patients *more* for care on average than insured patients. It should be noted that, even considering a more standard definition based on adjusted charges, these authors find that physicians provide approximately half the uncompensated care, as a fraction of revenue, than hospitals.

areas and at hospitals with low profit margins. Our results indicate that an ED attracts a large amount of uncompensated care to a hospital, with sharp increases in uncompensated care when nearby hospitals close. Our results therefore demonstrate why these areas may have seen so many ED closures. In this sense, policy decisions that leave a large number of individuals uninsured – such as choosing to not expand Medicaid or leaving undocumented immigrants ineligible for public health insurance coverage – may impose costs beyond those who remain uninsured. Future work should investigate the extent to which the combination of factors that make hospitals insurers of last resort also contributes to ongoing challenges in maintaining access to emergency medical treatment in areas with low rates of health insurance.

Lastly, our paper expands upon research that estimates the beneficiaries of social health insurance programs. This literature has primarily focused on the effect of these programs on access to health care or on the financial well-being and health of the newly insured (Cutler and Gruber, 1996; Finkelstein et al., 2014). We broaden this focus to include the effect of public health insurance on the financial health of providers themselves. Specifically, we note that health insurance, particularly social health insurance, provides important financial protection for private firms. This financial protection is particularly true for hospitals located in areas with large low-income populations.

This also relates to the political economy of the Medicaid program. It is often argued that means-tested programs are not politically viable in the United States, that "a program for the poor is a poor program." Indeed, traditional cash welfare did not survive the 1990s and the generosity of other safety-net programs such as food stamps has recently been pared back (Shear, 2014). But Medicaid has never disappeared from a state and – absent a few isolated disenrollments – the program has only grown in size over time.[43] Our paper suggests one explanation for this. A unique aspect of Medicaid is that it directly benefits not only the citizens it covers but also the hospitals they visit. Given that hospitals are an important political force at all levels of government, the factors requiring hospitals to provide uncompensated care may thus have unintentionally assured Medicaid's long-term political stability. This can also be seen in the revealed preferences of hospitals in recent year. For example, as part of the state of Tennessee's recent ACA Medicaid expansion, hospitals in

[43] In 1987 approximately 8 percent of the population (20 million individuals) was covered by Medicaid. By 1997, this increased to roughly 11 percent (29 million individuals). By 2012 this had increased to over 16 percent (51 million individuals). In contrast, from 1990-2008 the number of cash-welfare beneficiaries fell from approximately 4 million to 2 million (HHS, 2004).

that state jointly agreed to finance any expenses above the estimated cost of the program (Goodnough, 2014).

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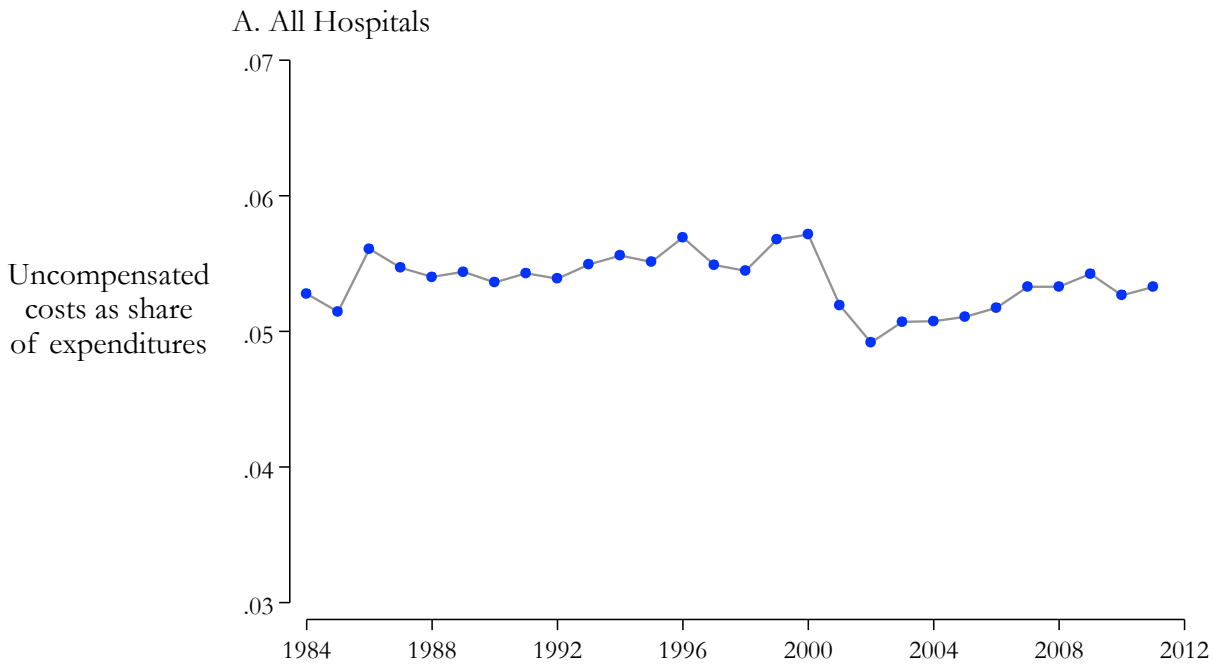
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Figure 1. Uncompensated Care Cost Shares, 1984–2011



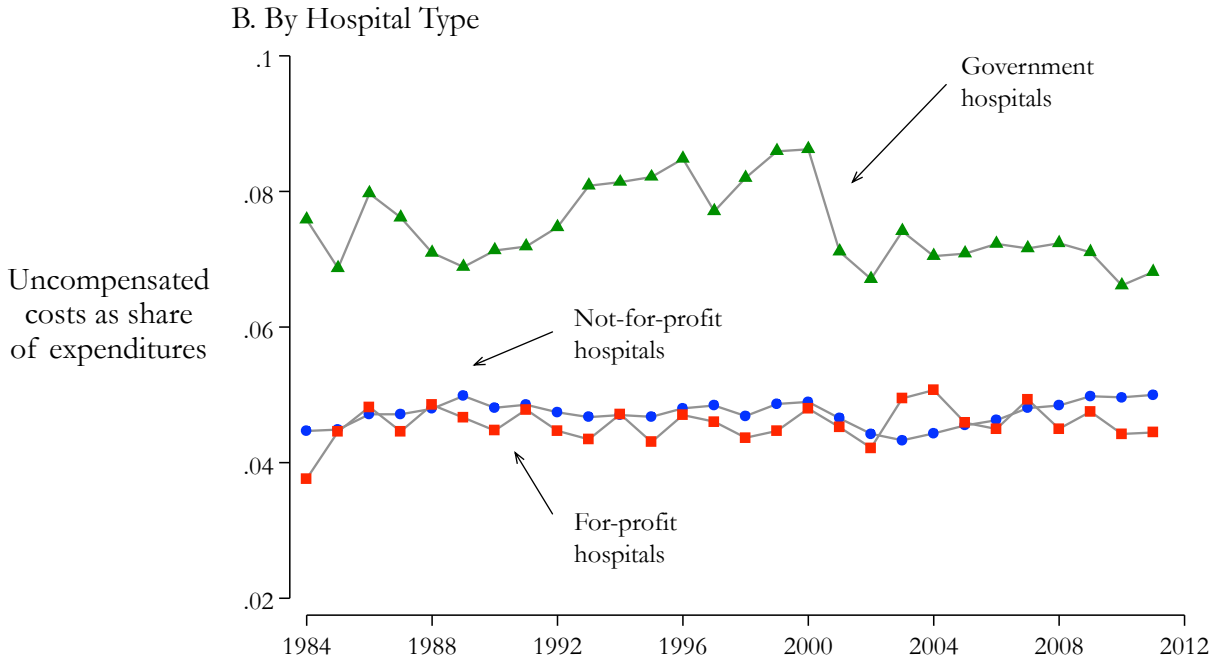
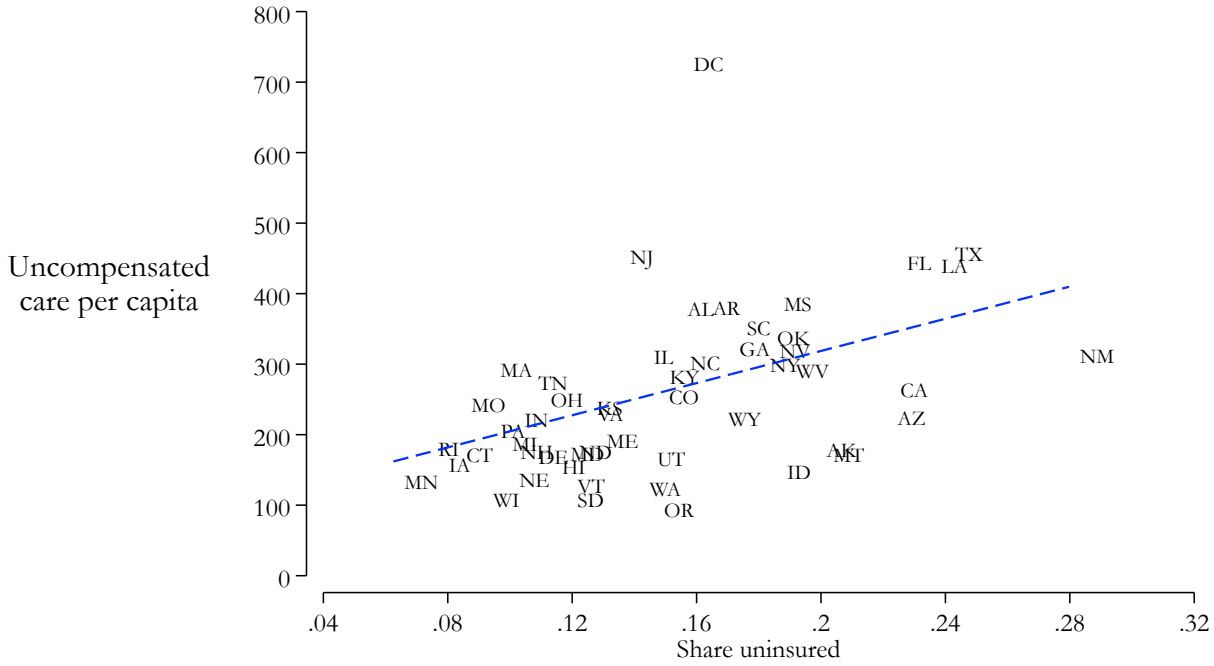


Figure 2. Share Uninsured and Uncompensated Care Costs

A. 2000 Cross Section



B. 2000–2005 Changes

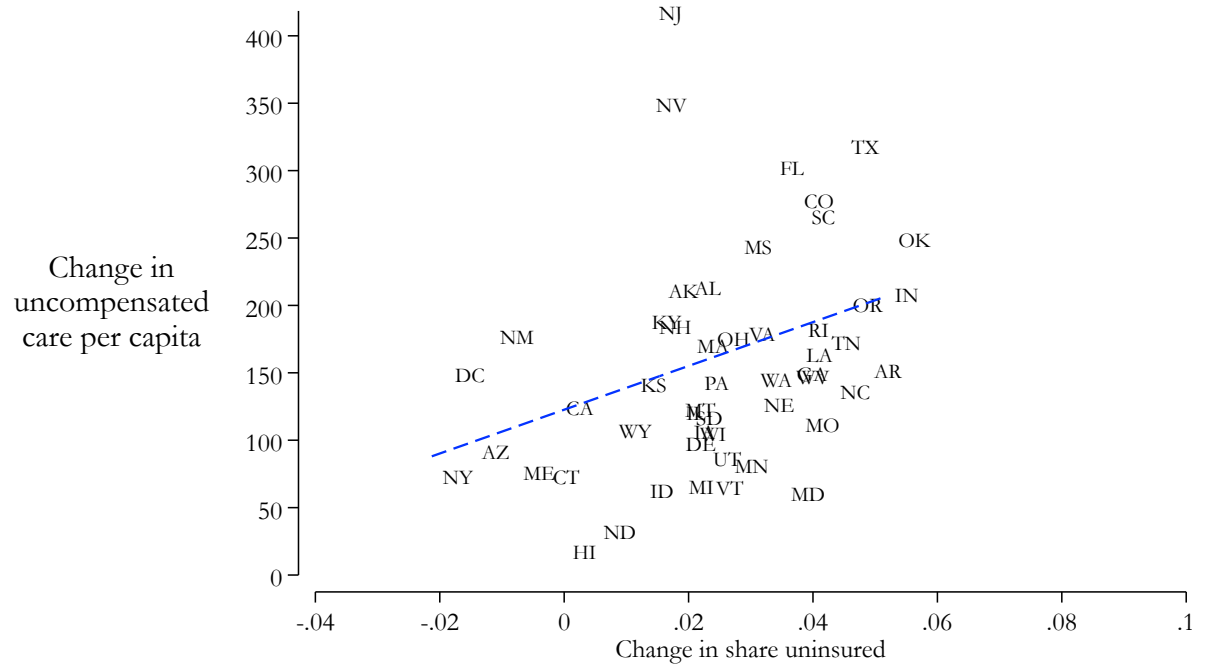
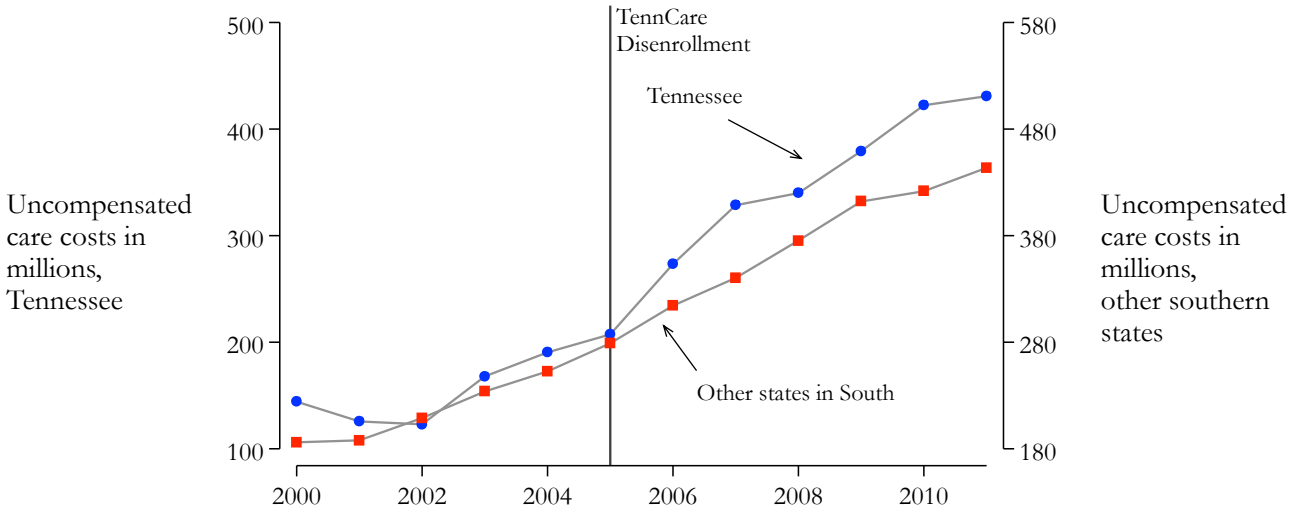
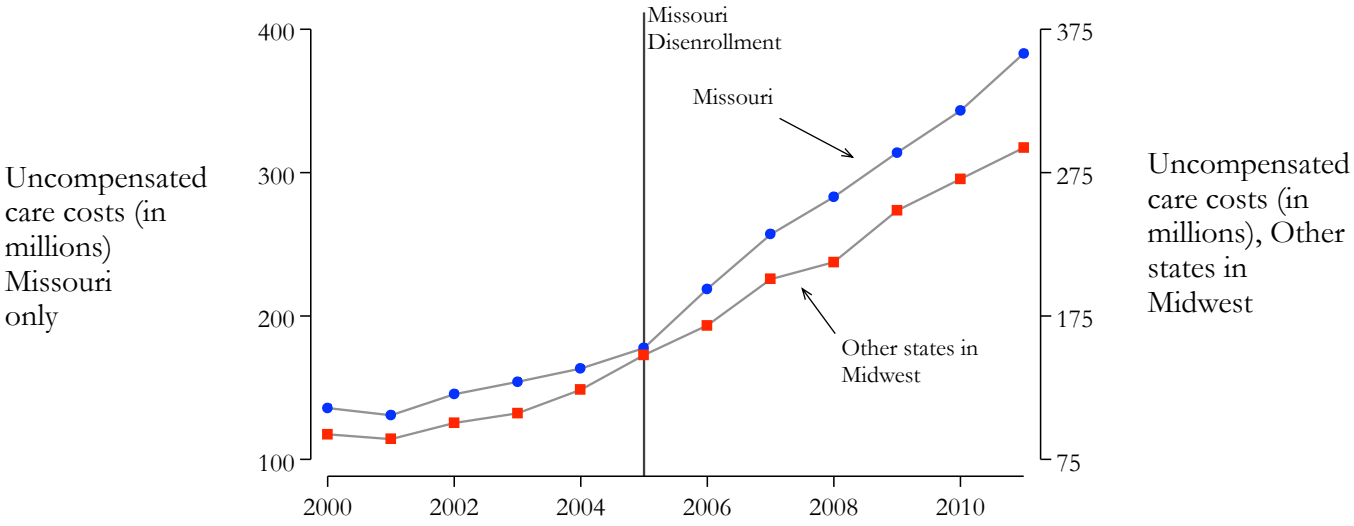


Figure 3. Uncompensated Care Costs in Tennessee



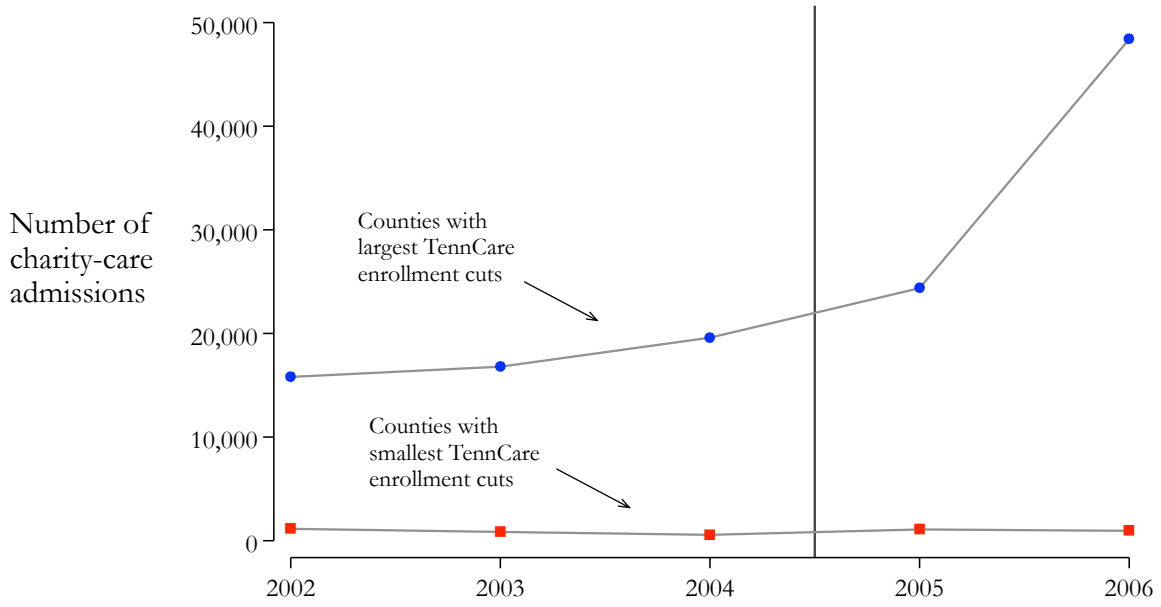
Note: This figure presents total uncompensated care costs in Tennesse versus other Southern states, as reported in the AHA survey. See text for details.

Figure 4. Total Uncompensated Care Costs in Missouri



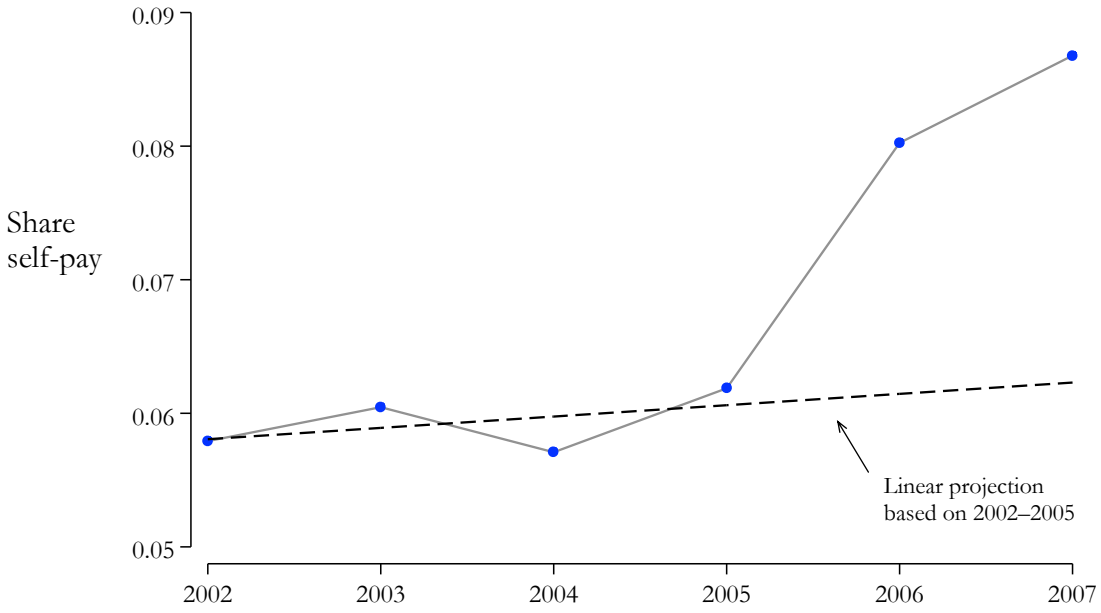
Note: This figure presents total uncompensated care costs in Missouri versus other midwestern states, as reported in the AHA survey. See text for details.

Figure 5. Charity-Care Visits by Patients' County of Residence



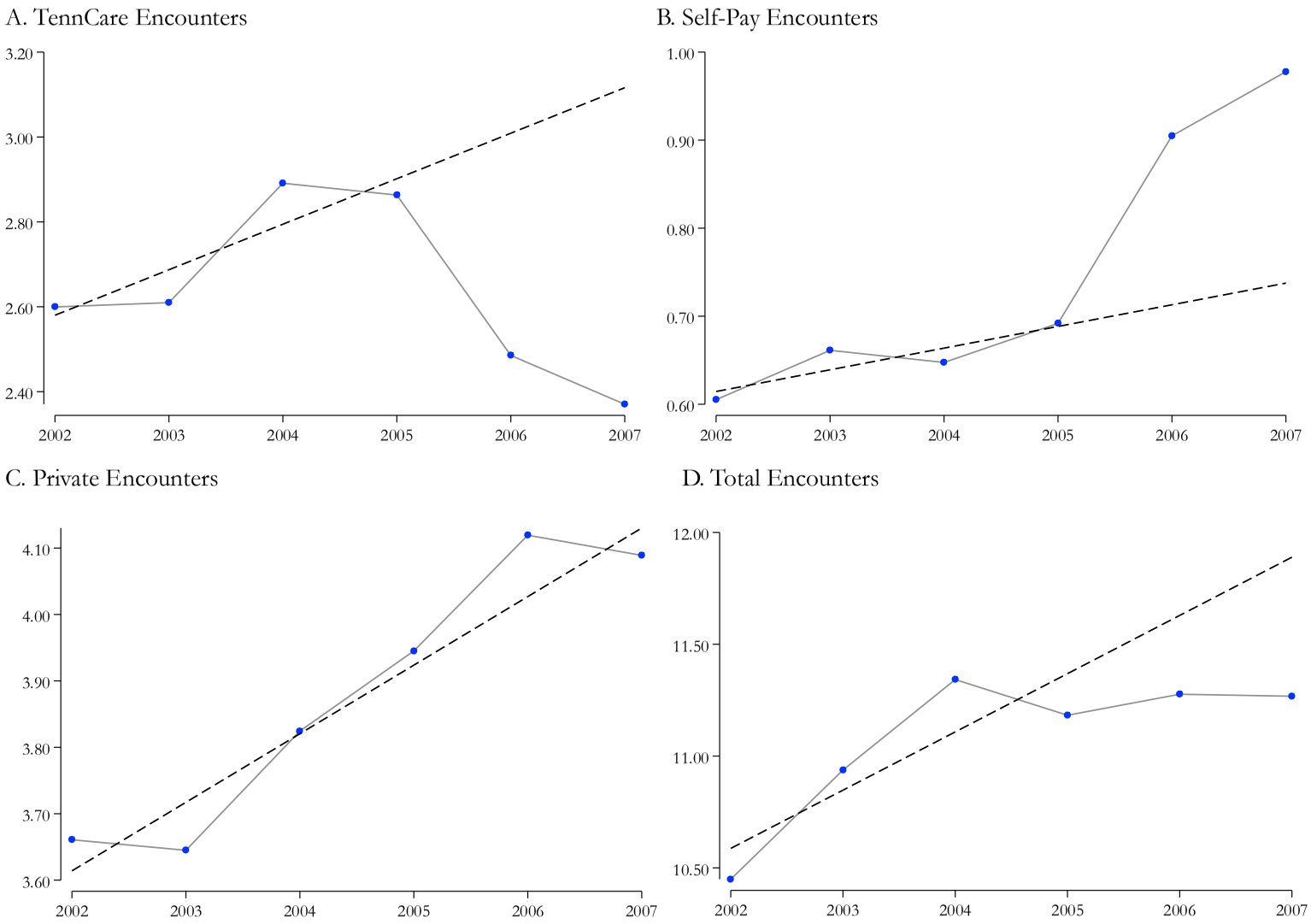
Note: This figure presents the number of charity-care admissions for patients from two groups of counties, as recorded in the JAR data. We rank the patients' counties by the absolute size of the decrease in TennCare enrollments between 2004 and 2005. This figure compares the top 15 counties to the bottom 15 counties.

Figure 6. Share of Tennessee Hospital Encounters that are Self-Pay, JAR Data



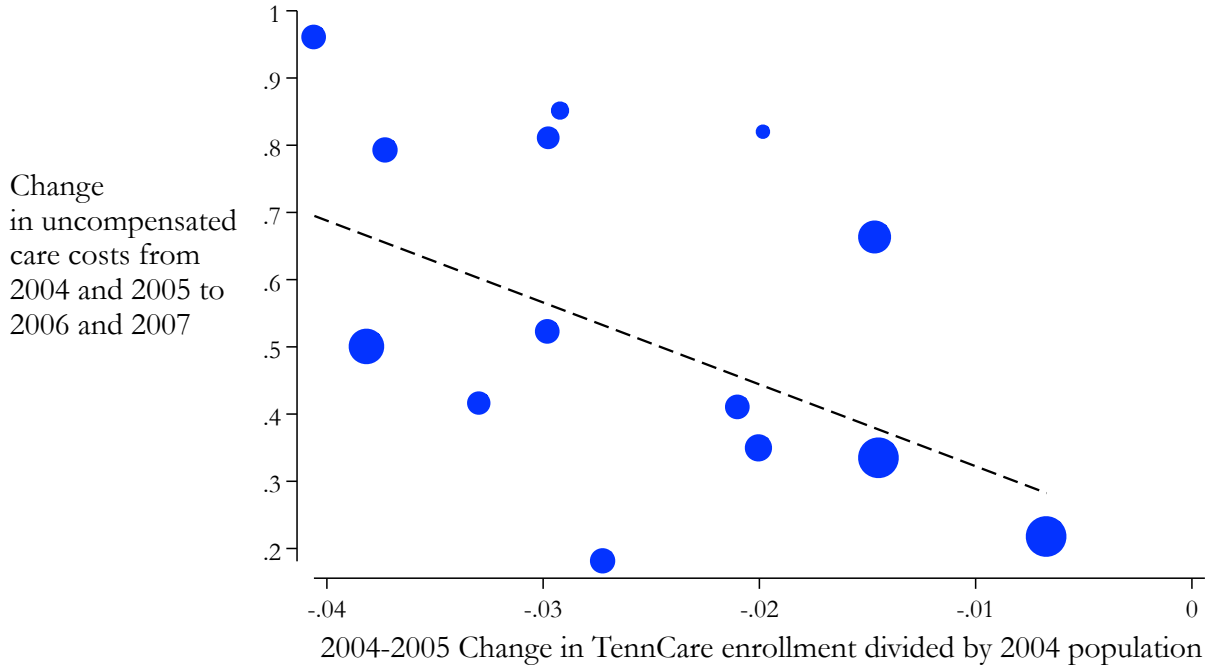
Note: This figure presents the share of hospital encounters (inpatient, ED, and outpatient visits) that are self-pay in Tennessee, as recorded in the JAR data. The dashed line plots a linear projection based solely on years 2002 through 2005. The linear projection predicts a share self-pay of 0.061 in 2006 and 0.062 in 2007; actual shares for 2006 and 2007 were 0.080 and 0.087, respectively.

Figure 7. Hospital Encounters in Tennessee, JAR Data



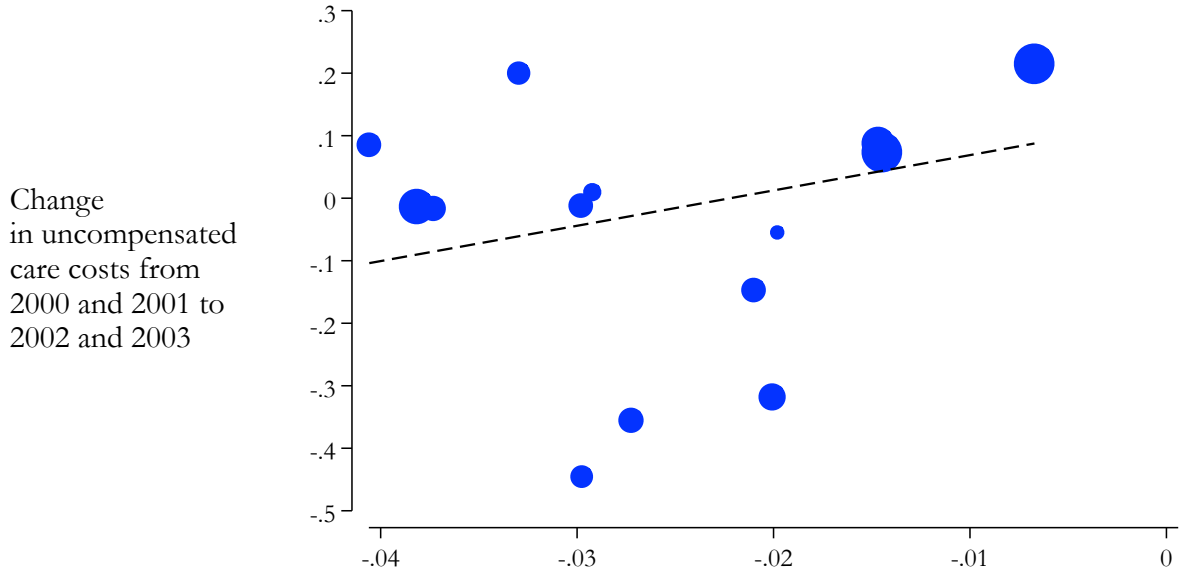
Note: This figure presents the number of hospital encounters (ED visits, outpatient visits, and inpatient visits) at hospitals in Tennessee, as recorded in the JAR data. The figures plot encounters in millions. In each panel, the dashed line plots predicted encounters based solely on 2002 through 2005.

Figure 8. Changes in Uncompensated Care Costs within Tennessee, Before and After TennCare Disenrollment



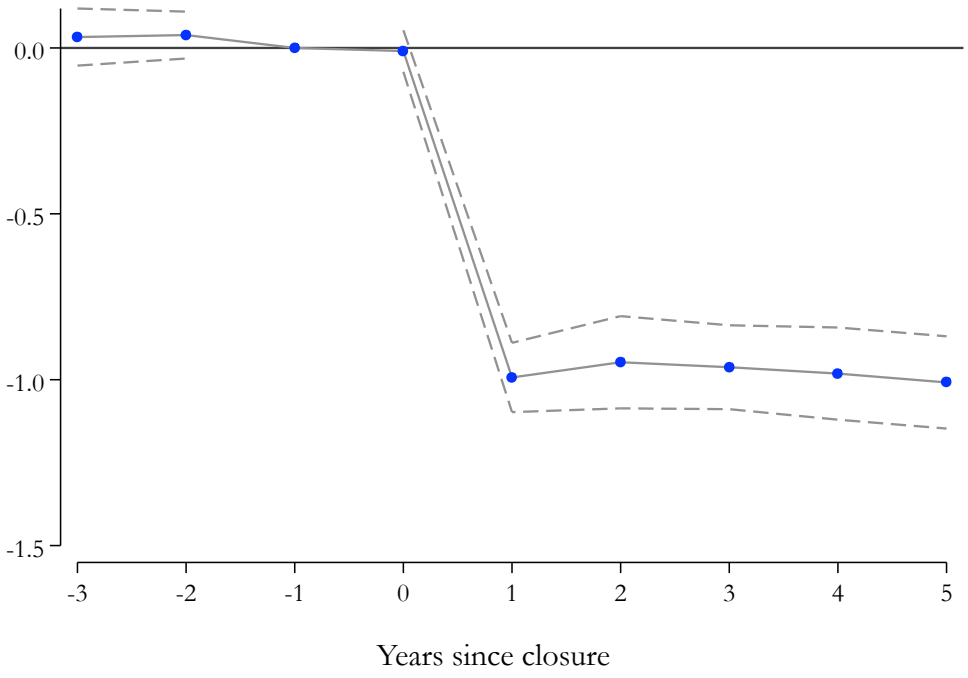
Note: This figure presents uncompensated care costs for the 14 health department regions in Tennessee, as recorded in the AHA survey. See text for details.

Figure 9. Changes in Uncompensated Care Costs within Tennessee, Before and After 2002



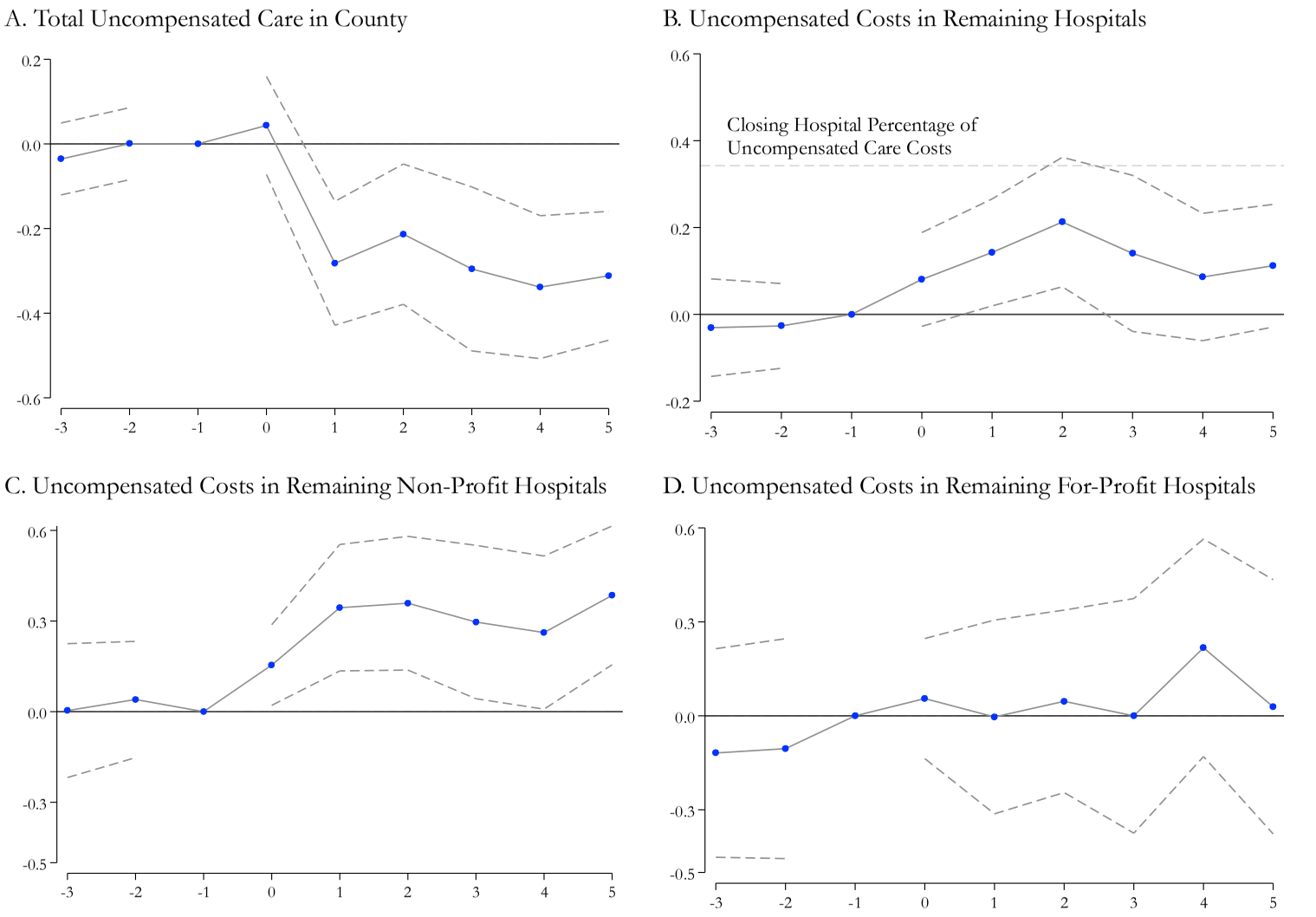
Note: This figure presents uncompensated care costs for the 14 health department regions in Tennessee, as recorded in the AHA survey. See text for details.

Figure 10. Change in Number of Hospitals in County After A Hospital Closure



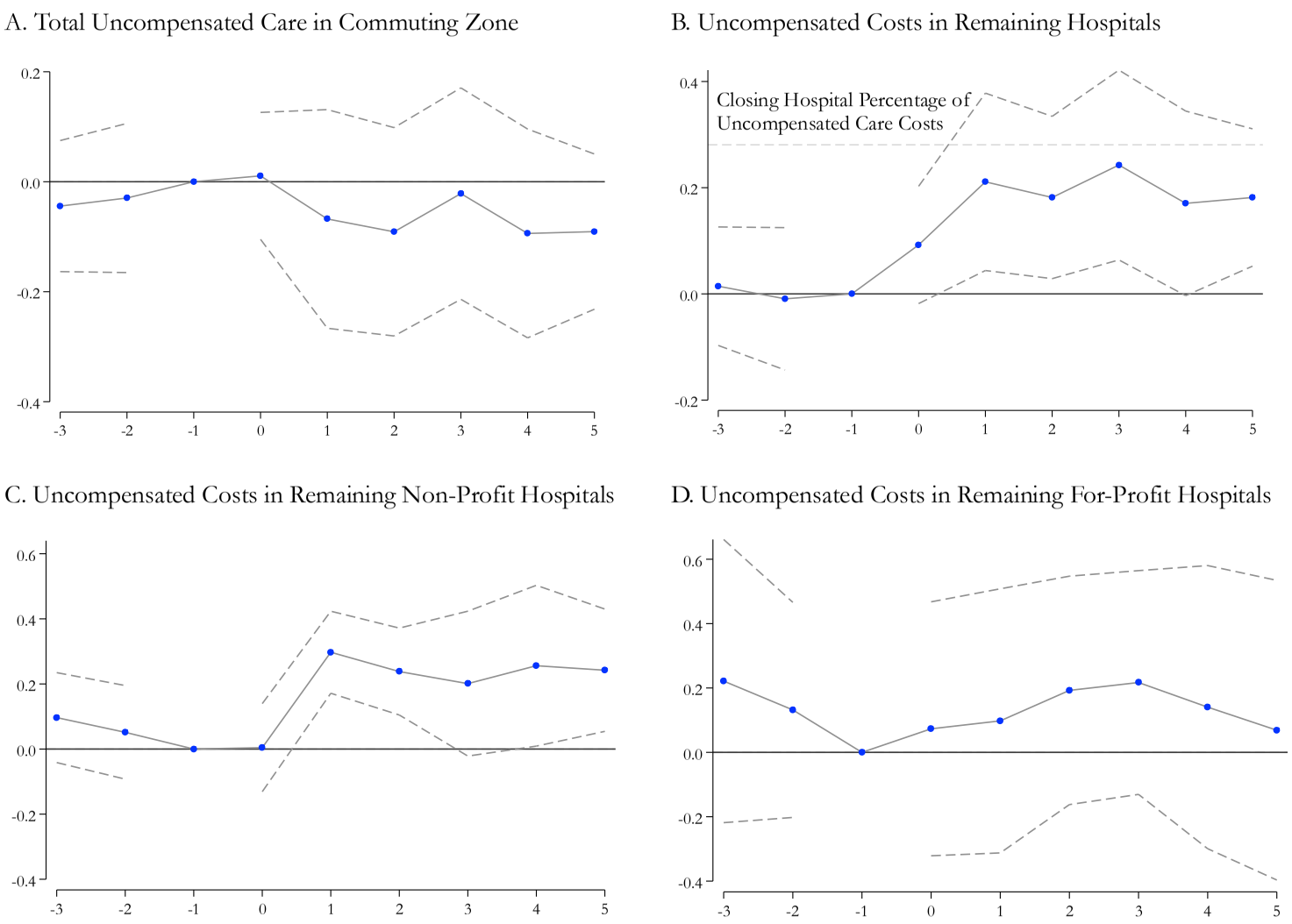
Note: This figure plots point estimates from a regression of number of hospitals in each county on a series of exhaustive indicator variables for the years since the closure of a large hospital. The year before the closure is the omitted category. The data consist of GAO records of hospital closures combined with the AHA survey. See text for details. The dashed lines connect 95-percent confidence intervals.

Figure 11. Change in Uncompensated Care in a County After a Hospital Closure



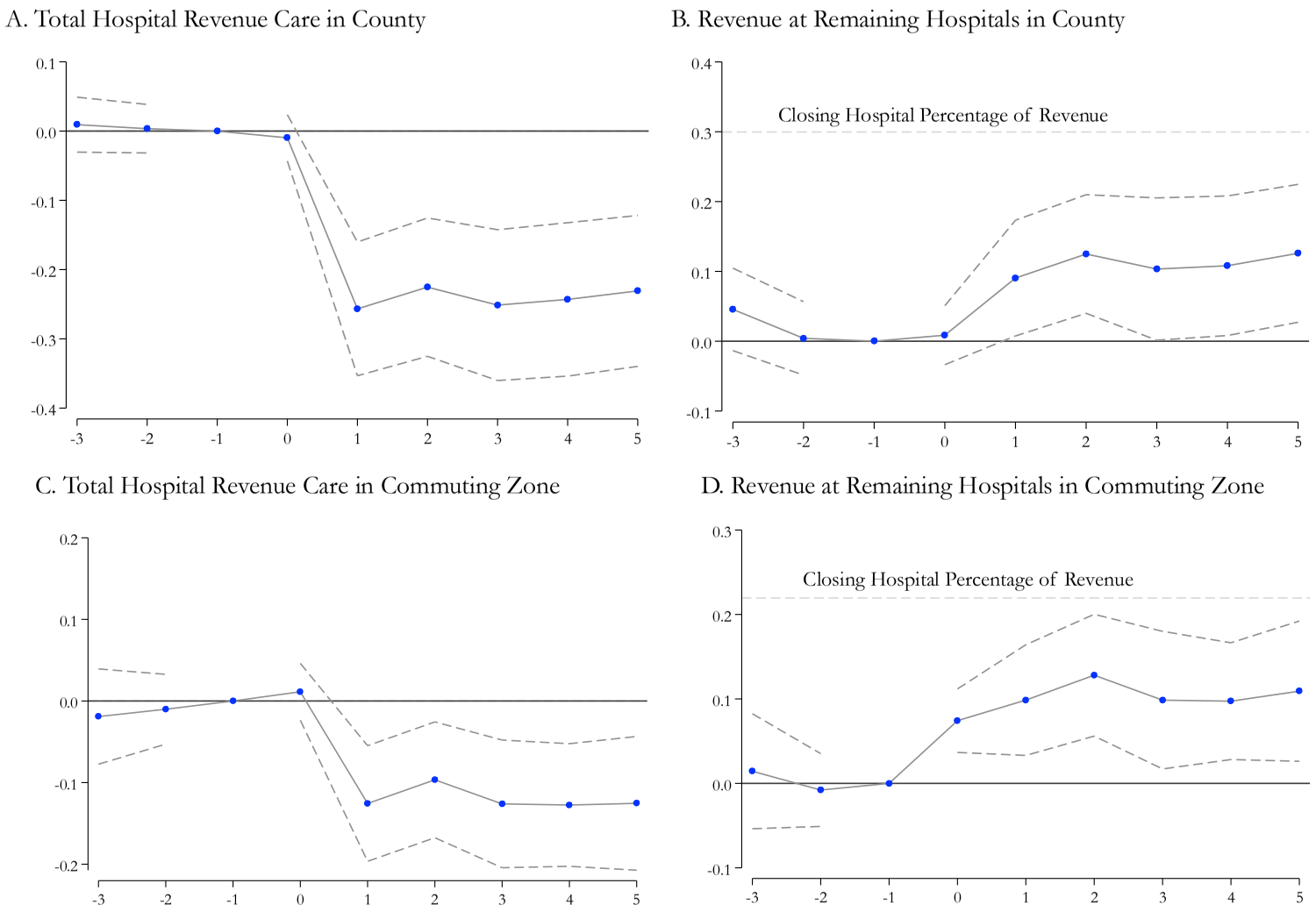
Note: This figure plots point estimates from a regression of number of hospitals in each county on a series of exhaustive indicator variables for the years since the closure of a large hospital. The year before the closure is the omitted category. The data consist of GAO records of hospital closures combined with the AHA survey. See text for details. The dashed lines connect 95-percent confidence intervals.

Figure 12. Change in Uncompensated Care in a Commuting Zone After a Hospital Closure



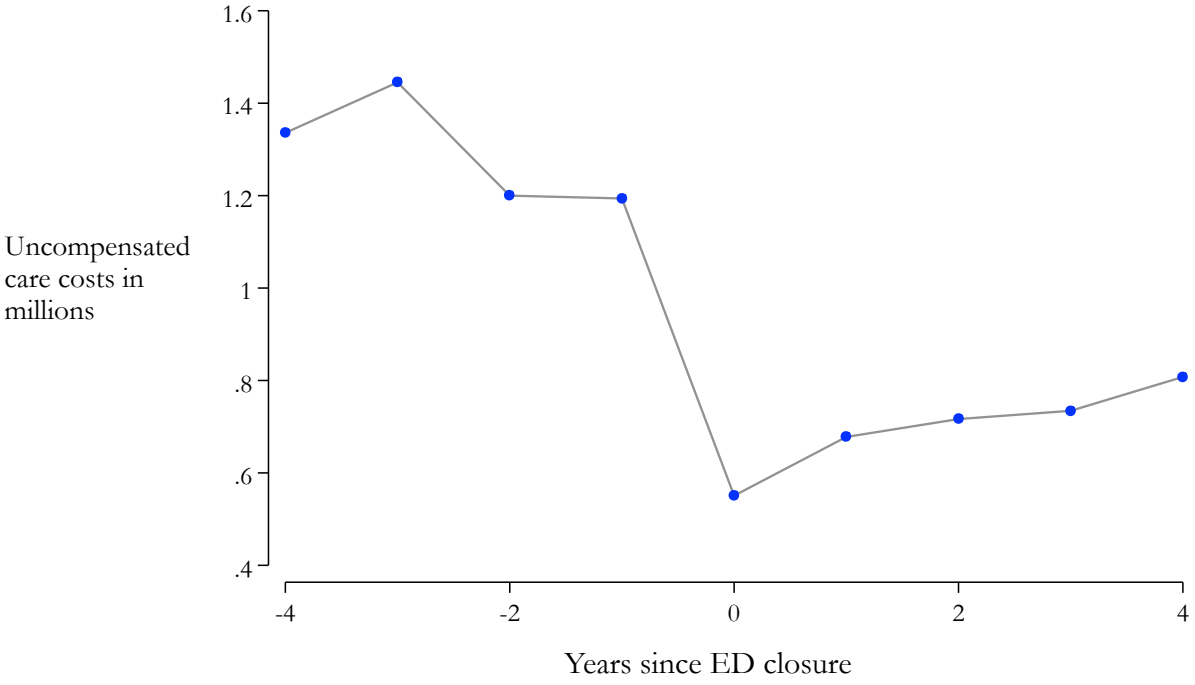
Note: This figure plots point estimates from a regression of hospital uncompensated care in each commuting zone on a series of exhaustive indicator variables for the years since the closure of a large hospital. The year before the closure is the omitted category. The data consist of GAO records of hospital closures combined with the AHA survey. See text for details. The dashed lines connect 95-percent confidence intervals.

Figure 13. Change in Hospital Revenue in County After a Hospital Closure



Note: This figure plots point estimates from a regression of hospital revenue in each county (A and B) or each Commuting Zone (C and D) on a series of exhaustive indicator variables for the years since the closure of a large hospital. The year before the closure is the omitted category. The data consist of GAO records of hospital closures combined with the AHA survey. See text for details. The dashed lines connect 95-percent confidence intervals.

Figure 14. Uncompensated Care Costs in a Hospital Before and After ED Closure



Note: This figure presents a re-centered time series with average uncompensated care costs in the years before and after a hospital closes its ED.

Table 1. Health Insurance and Hospital Uncompensated Care Costs
Dependent Variable: Total State-Level Hospital Uncompensated Care Costs Per Capita

	(1)	(2)	(3)
	1990 cross-section	1995 cross-section	2000 cross-section
		A. All Hospitals	
Share of Population Insured	-$456.05	-$555.13	-$558.83
	(107.28)	(224.50)	(154.99)
	[0.000]	[0.016]	[0.001]
R^2	0.27	0.11	0.21
		B. Hospitals with an ER	
Share of Population Insured	-$439.99	-$411.54	-$511.78
	(102.21)	(215.53)	(151.63)
	[0.000]	[0.022]	[0.001]
R^2	0.27	0.10	0.19
		C. Hospitals without an ER	
Share of Population Insured	-$14.61	-$41.96	-$47.06
	(9.86)	(13.06)	(19.06)
	[0.145]	[0.002]	[0.017]
R^2	0.04	0.18	0.11
N	51	51	51

Notes: The sample consists of all states and years shown. Robust standard errors in parentheses; associated p-values in brackets.

Table 2. Health Insurance and Hospital Uncompensated Care Costs
Dependent Variable: Total State-Level Hospital Uncompensated Care Costs Per Capita

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All Hospitals			Not-for-Profit Hospitals			For-Profit Hospitals			Public Hospitals		
	All	with an ER	No ER	All	with an ER	No ER	All	with an ER	No ER	All	with an ER	No ER
						A. State Fixed Effects and Year Fixed Effects						
Share of Population Insured	- 584.00	- 551.00	- 33.00	- 320.00	- 329.00	9.52	36.42	53.00	4.24	- 234.00	- 85.90	- 153.00
	(174.00)	(158.00)	(27.36)	(71.01)	(73.49)	(12.88)	(64.78)	(64.24)	(4.67)	(173.00)	(80.74)	(145.00)
	[0.00]	[0.00]	[0.23]	[0.00]	[0.00]	[0.46]	[0.58]	[0.41]	[0.37]	[0.18]	[0.29]	[0.30]
R^2	0.889	0.897	0.255	0.882	0.878	0.585	0.695	0.690	0.361	0.671	0.751	0.257
						B. State Fixed Effects, Year Fixed Effects, and Region-by-Year Fixed Effects						
Share of Population Insured	- 608.00	- 577.00	- 31.20	- 390.00	- 402.00	15.94	65.63	72.33	3.92	- 239.00	- 67.40	- 205.00
	(189.00)	(178.00)	(21.28)	(90.19)	(92.74)	(18.49)	(66.70)	(62.48)	(5.57)	(211.00)	(95.66)	(184.00)
	[0.00]	[0.00]	[0.15]	[0.00]	[0.00]	[0.39]	[0.33]	[0.25]	[0.48]	[0.26]	[0.48]	[0.27]
R^2	0.906	0.914	0.323	0.904	0.900	0.651	0.806	0.807	0.471	0.731	0.806	0.394
N	1,224	1,224	1,200	1,224	1,224	1,060	1,161	1,050	1,075	1,111	1,074	703

Notes: The standard errors in parentheses are robust to auto-corrleation between observations from the same state; associated p-values in brackets. Year and state fixed effects not shown.

Table 3. Sample Statistics

	Tennessee	Rest of South	Missouri	Rest of Midwest
Uncompensated care per year (in millions of dollars)	809.39	1048.90	621.21	540.27
Hospitals open each year	150.64	144.69	150.55	137.98
Share of hospitals not-for-profit	0.44	0.43	0.46	0.64
Share of hospitals for-profit	0.34	0.28	0.19	0.08

Notes: The sample consists of AHA data from 2000 through 2010.

Table 4. The Effect of TennCare Disenrollment on Uncompensated Costs
Dependent Variable: The logarithm of uncompensated costs in each state and year

	(1)	(2)	(3)	(4)	(5)
Hospitals	All	Private	Private, Not-for-Profit	Private, For-Profit	Public
Tennessee × Post 2005	0.198	0.183	0.177	0.150	0.368
	(0.026)	(0.035)	(0.043)	(0.092)	(0.108)
	[0.000]	[0.000]	[0.001]	[0.123]	[0.004]
Avg. uncompensated costs in millions in Tennessee, 2000–2005	549.40	456.54	359.63	96.91	92.86
R^2	0.996	0.995	0.993	0.991	0.988
N	136	136	136	136	124

Note: The sample consists of state-by-year total uncompensated care for states in the south. State and year fixed effects and state-specific linear time trends not shown. The standard errors in parentheses are robust to autocorellation between observations from the same state; associated p-values in brackets. We restrict the sample to southern states from 2000 through 2007.

Table 5. The Effect of TennCare Disenrollment on Uncompensated Costs
Dependent Variable: The logarithm of uncompensated costs in each region and year

	(1)	(2)	(3)
Hospitals	All	Private	Public
	A. Within-Tennesse Estimates		
2004–2005 disenrollment in region / 2004 population × Post 2005	- 6.713	- 6.787	- 17.300
	(2.270)	(3.063)	(10.131)
	[0.011]	[0.045]	[0.123]
Estimates scaled by statewide disenrollees per capita (compare to Table 4)	0.175	0.177	0.450
R^2	0.979	0.981	0.900
	B. Within-Tennesse Estimates with Linear Trends		
2004–2005 de-enrollment in region / 2004 population × Post 2005	- 10.400	- 9.528	- 12.400
	(4.954)	(6.200)	(12.527)
	[0.056]	[0.148]	[0.348]
Estimates scaled by statewide disenrollees per capita (compare to Panel A)	0.271	0.248	0.323
R^2	0.984	0.986	0.925
	C. Placebo Estimates Within-Tennesse (1997–2004)		
2004–2005 disenrollment in region / 2004 population × Post 2001	1.103	0.442	- 2.401
	(4.816)	(6.100)	(8.409)
	[0.822]	[0.943]	[0.782]
Estimates scaled by statewide disenrollees per capita (compare to Table 4)	-0.029	-0.012	0.063
R^2	0.965	0.970	0.890
N	112	112	80

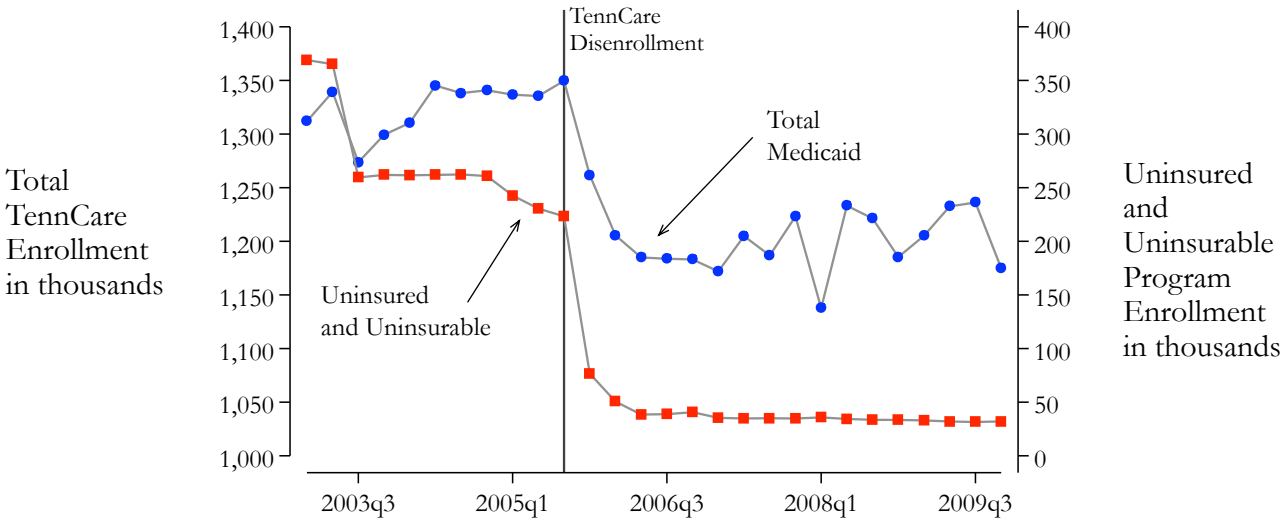
Note: The sample consists of Tennessee-hospital-region-by-year total uncompensated care. In Panel A and C region and year fixed effects not show. In Panel B region-specific linear trends are not shown. The standard errors in parantheses are robust to autocorellation between observations from the same region; associated p-values in brackets. In Panels A and B we restrict the sample to Tennessee hospital regions from 2000 through 2007. In Panel C, we restrict the sample to Tennesse hospital regions from 1997 through 2004, stopping before the Tennesse reform. All regressions are weighted by the region's population.

Table 6. The Effect of Missouri Disenrollment on Uncompensated Costs
Dependent Variable: The logarithm of uncompensated costs in each state and year

	(1)	(2)	(3)	(4)	(5)
Hospitals	All	Private	Private, Not-for-Profit	Private, For-Profit	Public
Missouri × Post 2005	0.131	0.059	0.139	- 0.696	0.403
	(0.032)	(0.047)	(0.041)	(0.355)	(0.092)
	[0.002]	[0.231]	[0.006]	[0.076]	[0.001]
Avg. uncompensated costs in millions in Missouri, 2000–2005	471	396	335	60.6	75.3
R^2	0.997	0.996	0.997	0.914	0.995
N	96	96	96	88	89

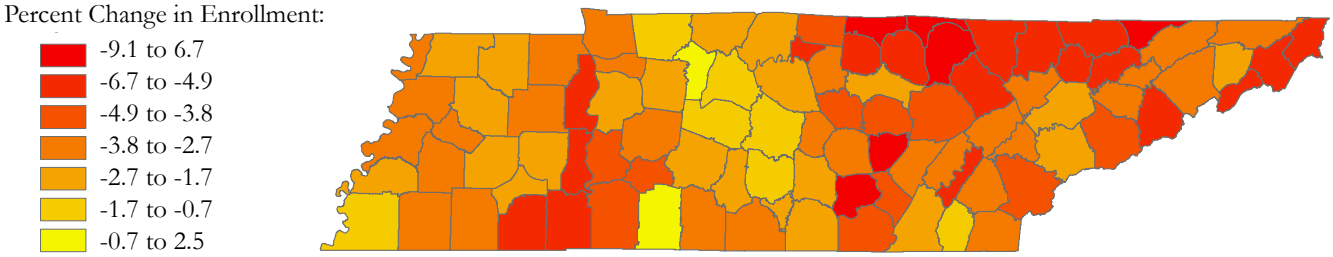
Note: The sample consists of state-by-year total uncompensated care for states in the midwest State and year fixed effects and state-specific linear time trends not shown. In Panel B, state-specific linear trends are also not shown. The standard errors in parantheses are robust to autocorellation between observations from the same state; associated p-values in brackets. We restrict the sample to southern states from 2000 through 2007.

Appendix Figure A1. Quarterly Medicaid Enrollment in Tennessee



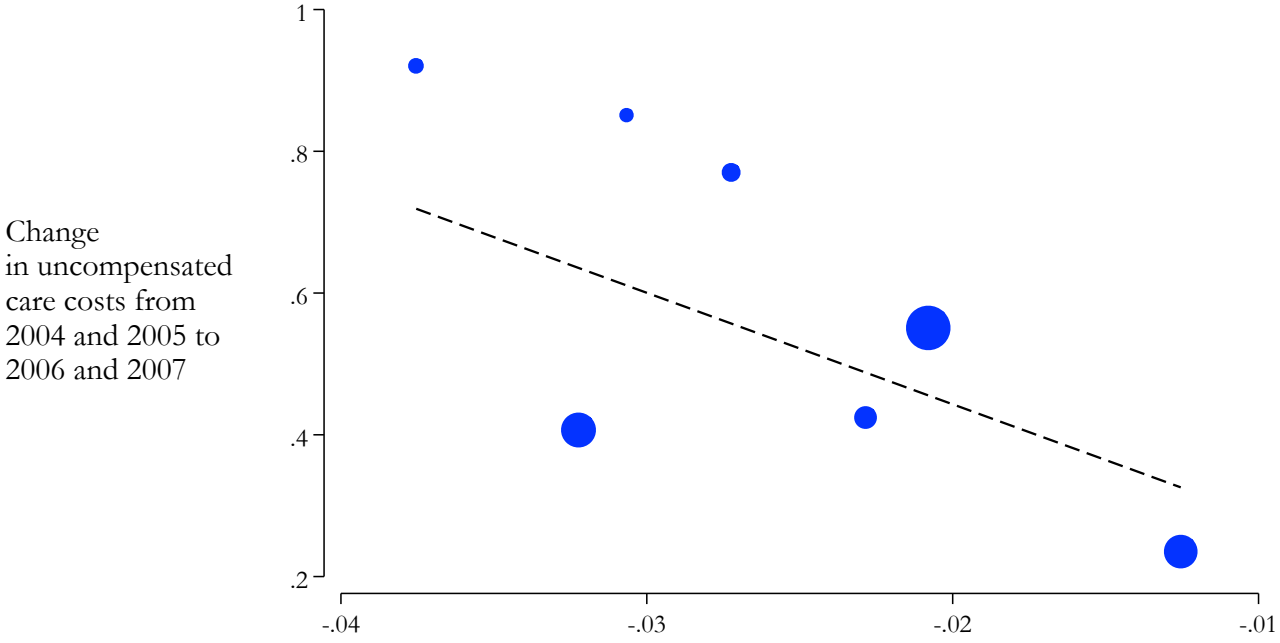
Note: This figure presents enrollment numbers reported in TennCare quarterly reports. Tennessee disenrolled most of those in the Uninsured and Uninsurable program in the last quarter of 2005.

Appendix Figure A2. Changes in TennCare Enrollment by Tennessee Counties



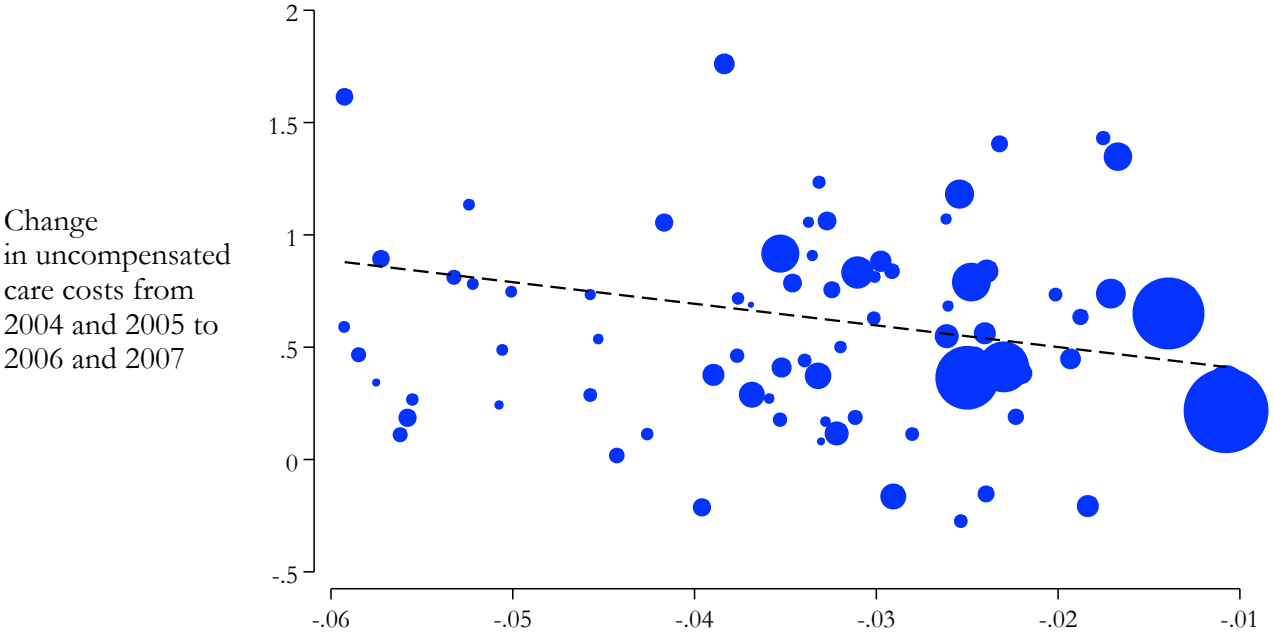
Note: This map indicates changes in Medicaid enrollment for each county in Tennessee as reported in the 2004–2005 and 2005–2006 annual reports for TennCare.

Appendix Figure A3. Changes in Uncompensated Care Costs within Tennessee, Before and After TennCare Disenrollment, By Hospital Referral Region



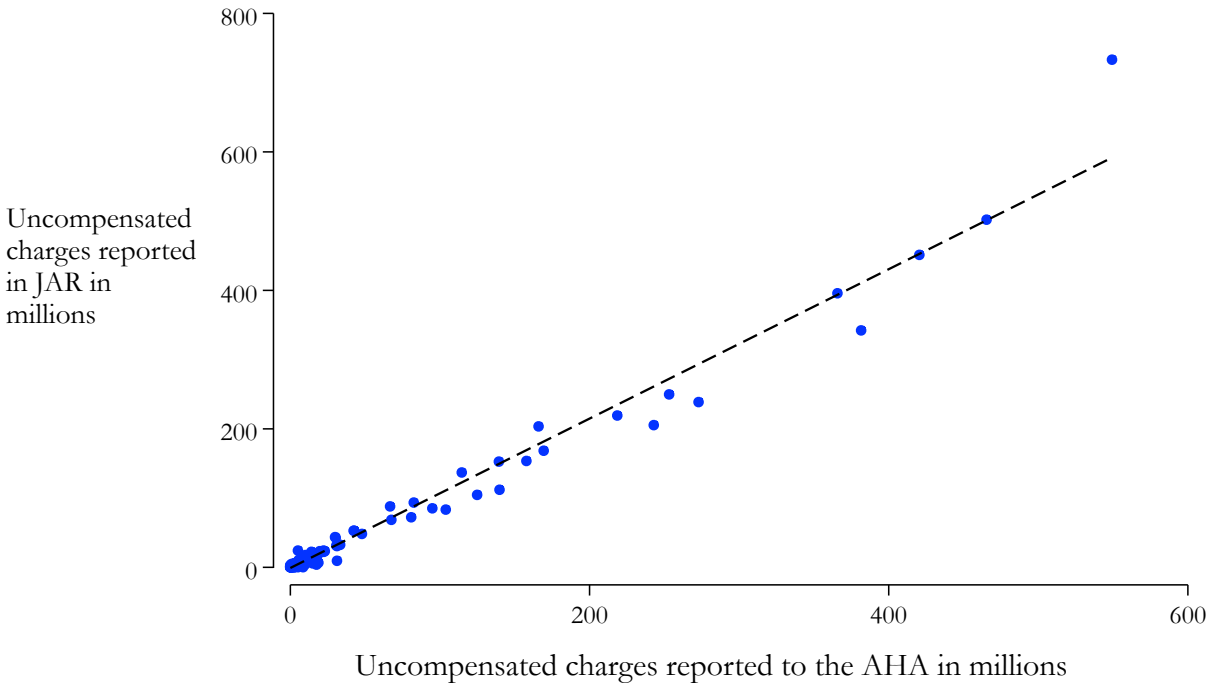
Note: The scale of each marker indicates the population of each HRR. We drop one HRR from the figure to improve visibility, but it is included in the regression line and in the associated appendix table.

Appendix Figure A4. Changes in Uncompensated Care Costs within Tennessee, Before and After TennCare Disenrollment, By Health Service Area



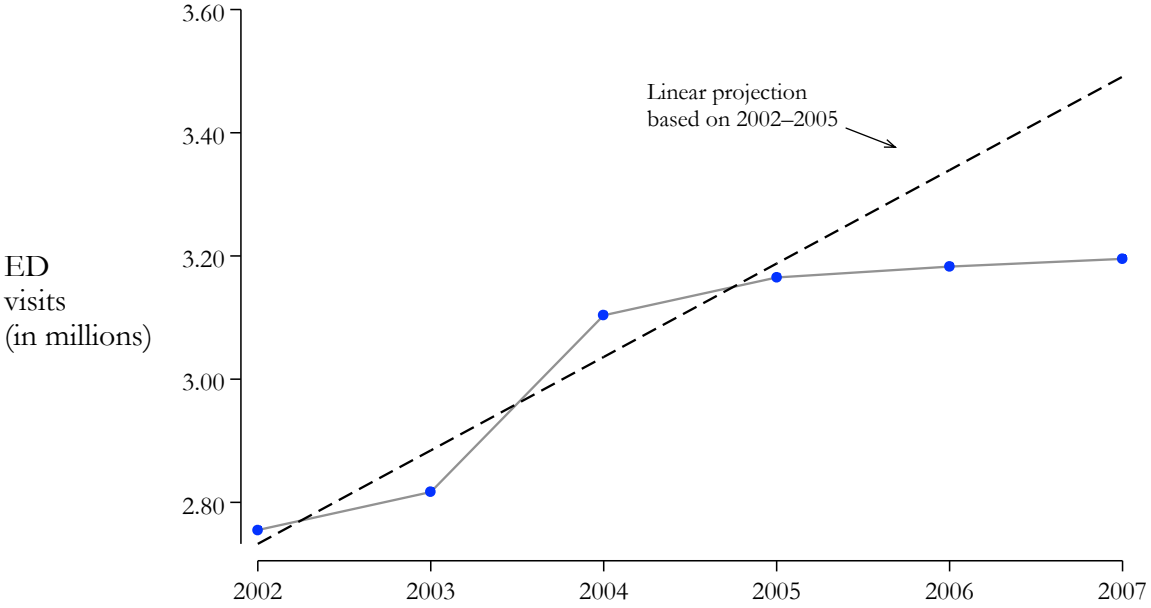
Note: The scale of each marker indicates the population of each HSA. We drop three HSAs from the figure to improve visibility, but they are included in the regression line and in the associated appendix table.

Appendix Figure A5. Comparison of JAR and AHA Uncompensated Care Numbers



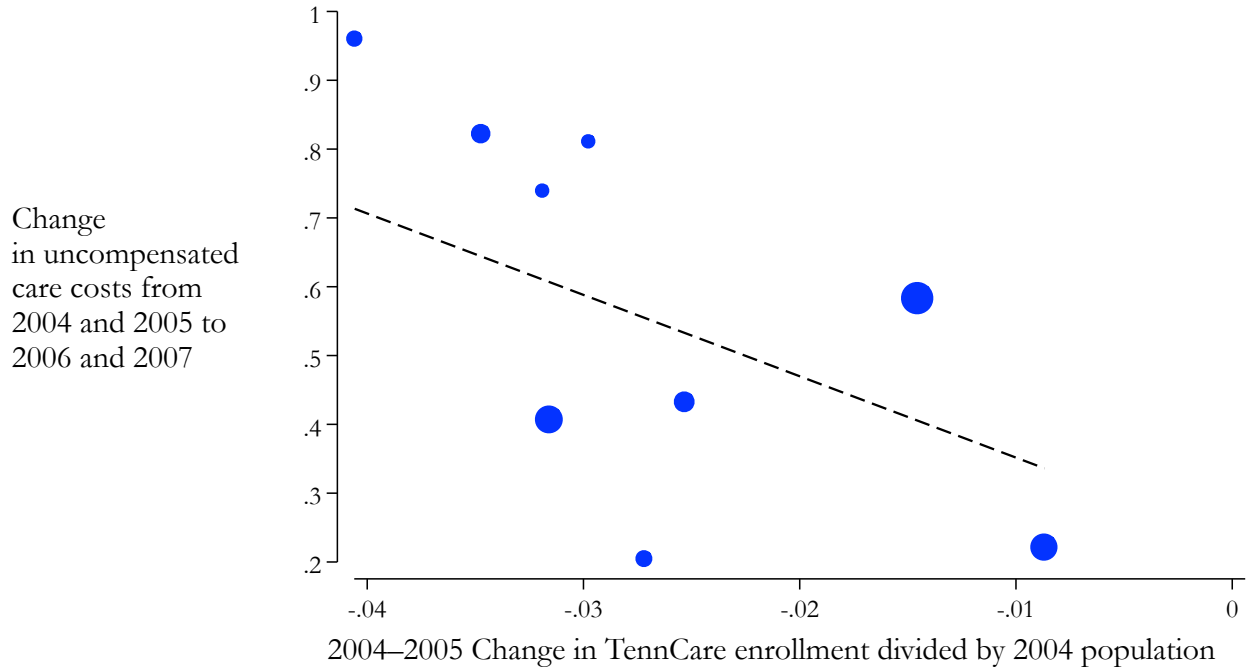
Note: The data for this figure come from both the AHA survey and the JAR data. See text for details.

Appendix Figure A6. Tennessee ED Visits, JAR Data



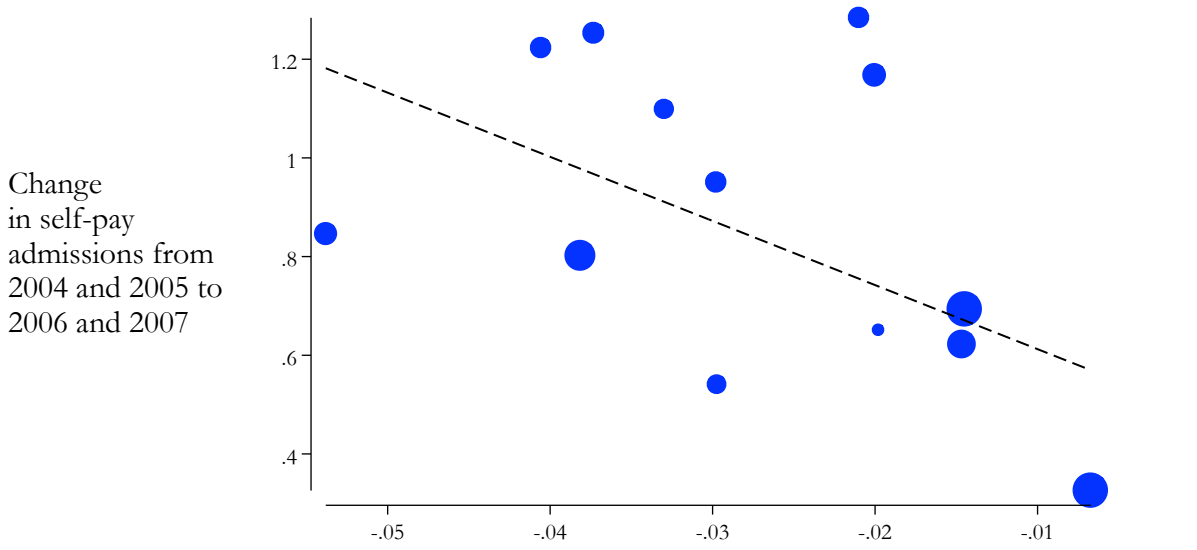
Note: This figure presents the share of ED visits in Tennessee, as recorded in the JAR data. The dashed line plots a linear projection based solely on years 2002 through 2005.

Appendix Figure A7. Changes in Uncompensated Care Costs within Tennessee, Before and After TennCare Disenrollment, By Development District



Note: The scale of each marker indicates the population of each development district.

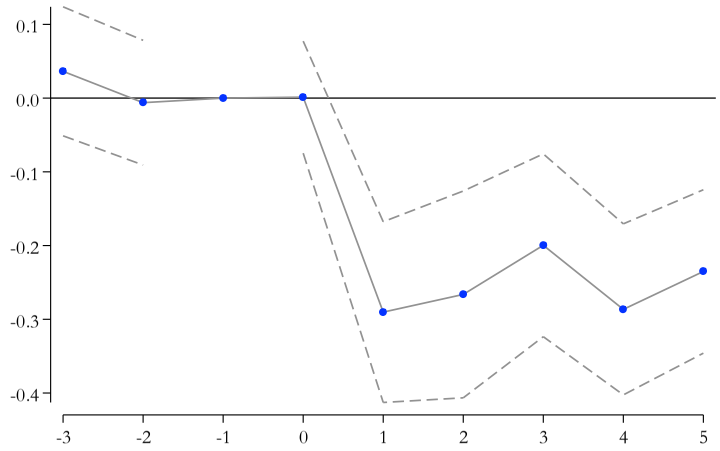
Appendix Figure A8. Self-Pay Admissions Before and After the Disenrollment



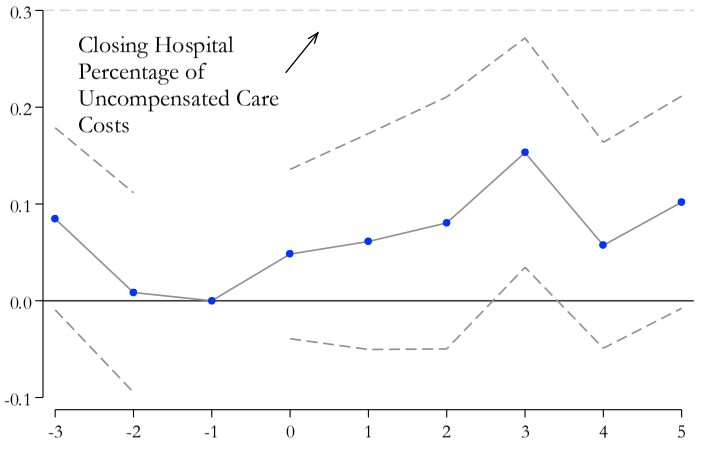
Note: This figure presents the percent change in self-pay admissions for the 14 health department regions in Tennessee, as recorded in the JAR data. We exclude the Sullivan region from this figure. The scale of each marker indicates the population of each development district. See text for details.

Appendix Figure A9. Change in Uncompensated Care in an HSA After A Hospital Closure

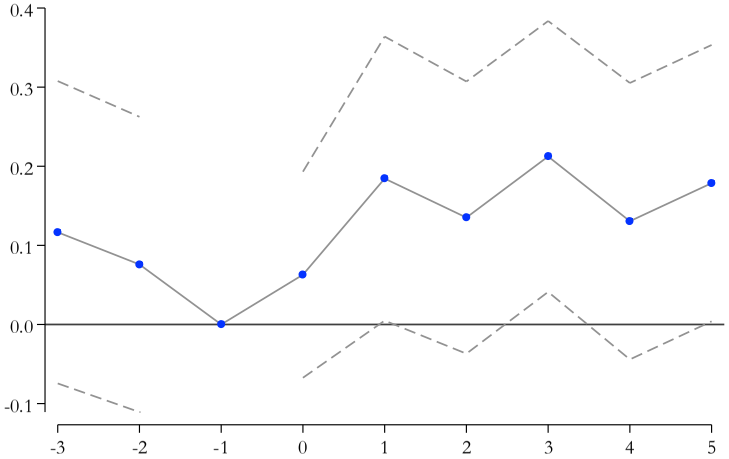
A. Total Uncompensated Care in HSA



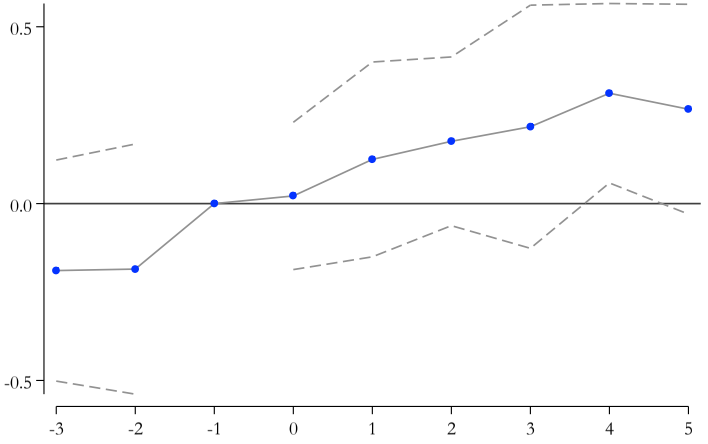
B. Uncompensated Costs in Remaining Hospitals



C. Uncompensated Costs in Remaining Non-Profit Hospitals



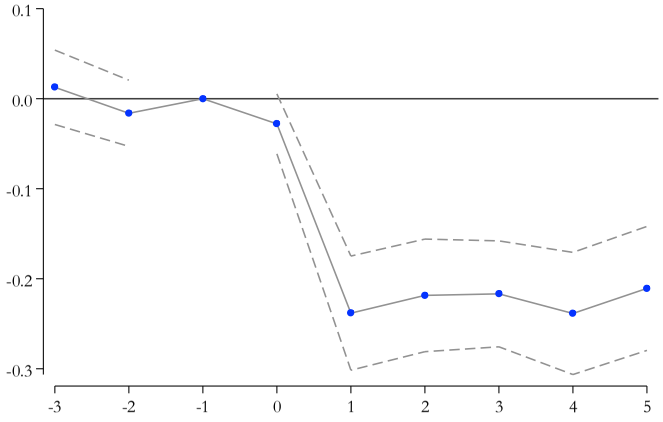
D. Uncompensated Costs in Remaining For-Profit Hospitals



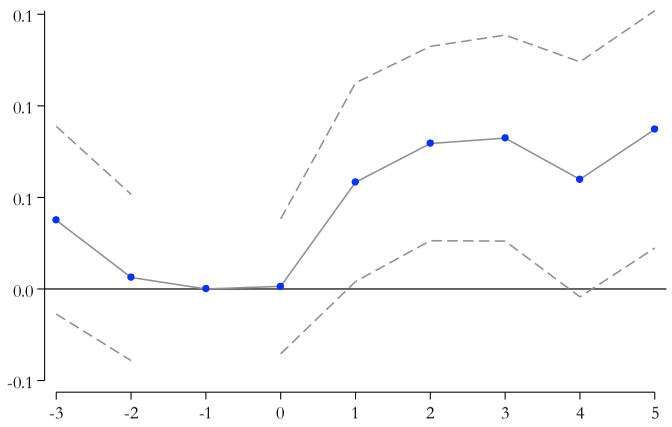
Note: This figure plots point estimates from a regression of hospital uncompensated care in each HSA on a series of exhaustive indicator variables for the years since the closure of a large hospital. The year before the closure is the omitted category. The data consist of GAO records of hospital closures combined with the AHA survey. See text for details. The dashed lines connect 95-percent confidence intervals.

Appendix Figure A10. Change in Hospital Revenue in an HSA After A Hospital Closure

A. Total Hospital Revenue Care in HSA



B. Revenue at Remaining Hospitals



Note: This figure plots point estimates from a regression of hospital revenue in each HSA on a series of exhaustive indicator variables for the years since the closure of a large hospital. The year before the closure is the omitted category. The data consist of GAO records of hospital closures combined with the AHA survey. See text for details. The dashed lines connect 95-percent confidence intervals.

Appendix Table A1. Health Insurance and Hospital Uncompensated Care Costs
Dependent Variable: Total State-Level Hospital Uncompensated Care Costs Per Capita

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	All Hospitals			Not-for-Profit Hospitals			For-Profit Hospitals			Public Hospitals		
	All	with an ER	No ER	All	with an ER	No ER	All	with an ER	No ER	All	with an ER	No ER
						A. Charges						
Share of Population Insured	- 1020.00	- 992.00	- 27.20	- 669.00	- 678.00	7.90	84.02	123.00	12.14	- 322.00	- 141.00	- 150.00
	(284.00)	(278.00)	(28.17)	(132.00)	(135.00)	(15.34)	(140.00)	(142.00)	(12.14)	(241.00)	(144.00)	(145.00)
	[0.00]	[0.00]	[0.34]	[0.00]	[0.00]	[0.61]	[0.55]	[0.39]	[0.32]	[0.19]	[0.33]	[0.31]
R^2	0.888	0.889	0.296	0.886	0.883	0.576	0.684	0.684	0.272	0.718	0.756	0.257
						B. Charges times hospital-year mean cost-to-charge ratio						
Share of Population Insured	- 410.00	- 379.00	- 31.70	- 238.00	- 247.00	9.36	37.25	47.06	0.40	- 162.00	- 21.70	- 143.00
	(199.00)	(177.00)	(25.59)	(74.45)	(81.82)	(12.17)	(38.12)	(37.69)	(2.45)	(152.00)	(52.41)	(137.00)
	[0.04]	[0.04]	[0.22]	[0.00]	[0.00]	[0.45]	[0.33]	[0.22]	[0.87]	[0.29]	[0.68]	[0.30]
R^2	0.860	0.875	0.254	0.885	0.878	0.574	0.726	0.700	0.473	0.671	0.780	0.261
						C. Charges times state-year mean cost-to-charge ratio						
Share of Population Insured	- 486.00	- 463.00	- 22.60	- 357.00	- 355.00	- 2.74	71.63	87.07	8.31	- 152.00	- 39.30	- 95.70
	(207.00)	(188.00)	(24.13)	(121.00)	(122.00)	(3.94)	(63.49)	(64.92)	(6.82)	(126.00)	(47.05)	(91.89)
	[0.02]	[0.02]	[0.35]	[0.00]	[0.01]	[0.49]	[0.26]	[0.19]	[0.23]	[0.23]	[0.41]	[0.30]
R^2	0.875	0.880	0.262	0.870	0.865	0.564	0.686	0.678	0.223	0.724	0.798	0.260
N	1,224	1,224	1,200	1,224	1,224	1,060	1,161	1,050	1,075	1,111	1,074	703

Notes: The standard errors in parentheses are robust to auto-corrleation between observations from the same state; associated p-values in brackets. Year and state fixed effects not shown.

Appendix Table A2. The Effect of TennCare Disenrollment on Uncompensated Costs For Different Types of Within-Tennessee Regions

Dependent Variable: The logarithm of uncompensated costs in each region and year

	(1)	(2)	(3)	(4)
Type of Region	14 Health Department Regions	9 Tennessee Development Districts	8 Hospital Referral Region	82 Hospital Service Areas
2004-2005 disenrollment in region / 2004 population × Post 2005	- 7.172	- 9.002	- 9.350	- 4.604
	(3.124)	(4.201)	(6.028)	(2.335)
	[0.039]	[0.065]	[0.165]	[0.052]
Estimates scaled by statewide de-enrollment per capita (compare to state-year results)	0.185	0.233	0.242	0.119
R^2	0.971	0.975	0.983	0.986
N	112	72	64	641

Note: The sample consists of region-by-year total uncompensated care. The standard errors in paranthesis are robust to autocorellation between observations from the same region; associated p-values in brackets. We restrict the sample to 2000 through 2007. The regression presented in column 3 is weighted by each HSA's population, because there exists substantial variation in HSA population.

Appendix Table A3. The Effect of the TennCare Disenrollment on Charity Care, JAR Data

	(1)	(2)
Dependent Variable:	Charity-Care Admissions	Charity-Care Days
Number of county residents losing TennCare Coverage × 2006	- 0.803 (0.392) [0.043]	- 1.814 (0.863) [0.038]
R^2	0.829	0.785

N = 465. The sample consists of county-year observations for 2002 through 2006. The standard errors in parentheses are robust to autocorellation between observations from the same county; associated p-values in brackets. The outcome is based on patients' county of residence.