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How do nonprofits respond to negative wealth shocks? The impact of the 2008 stock market collapse on hospitals

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The theory of cost shifting posits that nonprofit firms "share the pain" of negative financial shocks with their stakeholders, for example, by raising prices. We examine how nonprofit hospitals responded to the sharp reductions in their assets caused by the 2008 stock market collapse. The average hospital did not raise prices, but hospitals with substantial market power did cost shift in this way. We find no evidence that hospitals reduced treatment costs. Hospitals eliminated but left unchanged their offerings of profitable services. Taken together, our results provide mixed evidence on whether nonprofits behave differently from for-profits.

1. Introduction

■ There is growing interest in the behavior of nonprofit firms in the United States that reflects the increasing prevalence of this organizational form. From 1985 to 2004, nonprofit organizations saw an inflation-adjusted increase in assets and annual revenue of 222% and 171% percent respectively (IRS, 2008), and by 2010, nonprofits accounted for approximately 5.5% of US Gross Domestic Product (GDP) (Roeger, Blackwood, and Pettijohn, 2012). This growing source of economic activity is exempt from all taxes. In 2009, just the state and local property tax component of these exemptions was estimated to be worth between \$17 and \$32 billion (Sherlock and Gravelle, 2009). To place this in context, the tax breaks represent 4% to 8% of overall property tax receipts for these governments (Kenyon and Langley, 2011).

In exchange for these valuable tax benefits, nonprofits are expected to behave differently than profit-maximizing organizations. For example, universities are expected to subsidize research and

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hospitals are expected to provide "community benefits" such as uncompensated care. However, despite the growing economic importance of this sector and the corresponding costs of the tax benefits to the government, prior research has failed to convincingly demonstrate consistent, meaningful differences between nonprofit and for-profit behavior.[1]

As federal and state budgets grow tighter, it is important to understand whether nonprofits are merely "for-profits in disguise," that is, firms that are simply receiving inframarginal transfers from tax payers. We examine this question by estimating the reaction of nonprofit firms to large financial shocks. Firms of all types often experience negative lump-sum financial shocks. For example, a firm may lose a lawsuit, experience an accident, or see its investment portfolio decline in value. Economists usually presume that a profit-maximizing firm has previously fully exploited all opportunities to reduce costs or raise revenues, so absent a fundamental rethinking of the firm's strategy, it would have to absorb the loss.[2] However, theory and evidence suggest that nonprofits should respond differently (Dranove, 1988; Brown et al., 2014). In particular, a nonprofit that was previously sacrificing some profits in order to provide other benefits to the community should mitigate the effects of a negative financial shock by "sharing the pain" with its stakeholders. This could involve raising prices, reducing quality, or some other action that decreases the size of the profit-sacrificing community benefits previously offered by the firm. When accomplished using price changes, such "sharing of the pain" is traditionally described as cost shifting and should not be observed in profit-maximizing firms.

Existing research has focused on price-based cost shifting as the only mechanism for "sharing of the pain" and therefore may miss other important aspects of nonprofit behavior. In addition, most previous work has not focused on whether firms may differ in the amount of rents available for redistribution, which may cause them to respond to shocks using different mechanisms. In this article, we examine a range of potential channels for cost shifting in the hospital sector and note that if a hospital cost shifts *in some manner*, we can distinguish true nonprofits from for-profits in disguise. We also examine heterogeneity across hospitals in their reaction to a financial shock based on measures of market power, which should be positively correlated with differences in the rents that are available for redistribution.

The distinctive behavior of nonprofit organizations can have important policy implications, as illustrated by the recent debate about the Affordable Care Act (ACA). The ACA extends health insurance to millions of previously uninsured Americans, and it is expected that hospitals will realize a substantial positive shock from the reduction in uncompensated care (Garthwaite, Gross, and Notowidigdo, 2015). Many analysts and policy makers believe that, in a sort of "reverse cost shift," nonprofit hospitals will reduce their prices for privately insured patients, thereby benefitting taxpayers who have subsidized the expansion of insurance coverage under the ACA. President Barack Obama offered this argument in defense of the ACA, as did the United States Supreme Court when it upheld its constitutionality. In the majority opinion, Justice John Roberts offered what is, essentially, a cost-shifting argument, stating that hospitals recoup the losses from uncompensated care by, "pass(ing) on the cost to insurers through higher rates, and insurers, in turn, pass on the cost to policy holders in the form of higher premiums." It follows that if hospitals pare their losses from uncompensated care, they will reduce their rates, and that insurers will pass on the savings to policy holders. Though this argument rests on nonprofit cost shifting, as we discuss below, there is at best mixed evidence to support it in the existing literature.

In this article, we examine the performance of nonprofit firms by exploiting the 2008 stock market collapse (henceforth, we will refer to this as the "2008 collapse" or, when unambiguous, the "collapse") as an exogenous negative financial shock to nonprofit hospitals—the largest single class of nonprofit organizations. We first document that the 2008 collapse caused an economically

[1] Weisbrod (1988) summarizes the mixed evidence on nonprofit behavior.

[2] If firms funded investments through internal capital markets (Stein, 1997); the negative shock could curtail investments. Borenstein and Farrell (2000) posit that profitable firms may suffer from "X-inefficiency" and will attempt to remove slack if profits fall.

meaningful decline in hospital assets.[3] We also show that there was great variation in the asset declines that was unrelated to local economic factors, and not driven by a change in the real estate holdings of the hospital. Thus, the shock that we study is unlikely to be correlated with changing local demand conditions for medical services and serves as an exogenous event that we can use to assess how nonprofits respond to financial shocks.

At a broad level, we document that the assets of the average hospital remain lower for several years, suggesting they cannot recoup losses from financial shocks as easily as the theory of cost shifting would suggest. We then examine the specific channels through which hospitals may have been able to recover some of their losses. Given that assets remain depressed for several years, it should not be surprising that we find that the average nonprofit hospital suffering a large financial loss did not raise prices, cut operating costs, or decrease their offering of charity care. We find price changes for only a small subset of nonprofit hospitals with arguably the greatest market power and rents available for redistribution.[4] We do find that the average nonprofit decreased its offerings of relatively unprofitable services, some of which may provide substantial community benefits. Overall, our results suggest that the average nonprofit adjusts its provision of service-related community benefits but does not otherwise behave differently than for-profits, particularly with respect to pricing. However, hospitals with more market power, and presumably more rents to redistribute, adjust prices without changing service offerings.

The next section provides a theoretical framework for understanding how nonprofits may respond to financial shocks. Section 3 describes our data. Section 4 shows the effect of the 2008 stock market collapse on hospital finances while Section 5 shows the effect of the collapse on hospital behavior. Section 6 concludes the paper.

2. Differences in how firms respond to financial shocks

■ Healthcare providers make up the largest category of nonprofit organizations. In 2010, nearly 40% of all nonprofit revenue was earned by hospitals and nonhospital primary care facilities (Blackwood, Roeger, and Pettijohn, 2012). As a result, economists attempting to understand the objective functions of nonprofits firms have often concentrated their research on hospitals and have advanced several conceptually distinct theories of their behavior (Cutler, 2012). Weisbrod (1988) posits that some nonprofits are actually “for-profits in disguise,” behaving in all ways like for-profits but benefitting from preferential tax treatment. Pauly and Redisch (1973) observe that physicians have *de facto* control of hospital production and hypothesize that the hospital is therefore a “physicians’ cooperative,” managed to maximize physician profits.

A number of economists offer positive theories of nonprofits. Weisbrod (1988) argues that nonprofits represent an alternative to government subsidies and government provision of public goods. Thus, nonprofits might provide subsidized services to low-income individuals and offer unprofitable services that are deemed to be socially valuable. Importantly, under this theory, we would expect that the response of hospitals to a financial shock would not involve changes in prices. Arrow (1963) suggests that nonprofit hospitals are an institutional response to consumer uncertainty about quality. Hansmann (1980) elaborates on this idea by pointing out that nonprofit hospitals are barred from compensating managers on the basis of financial returns. This limits managerial incentives to shirk on hard-to-measure aspects of quality. Patients are presumably aware of this and favor nonprofits, allowing these firms to outcompete for-profit rivals. A few studies document differences on hard-to-measure dimensions of quality. For example, Svarstad and Bond (1984) find that nonprofit nursing homes use fewer sedatives than for-profit facilities,

[3] Throughout this article, we use “assets” to describe the net assets of a hospital. This includes financial assets (including endowment), physical assets (i.e., property, plant, equipment), and debts. We confirm that the financial shock that we study is driven by changes to a hospital’s financial assets.

[4] Market power may not directly translate into profits, as these nonprofits may dissipate their rents on other utility-enhancing activities.

and Weisbrod (1994) shows that church-owned nonprofit nursing homes have a greater percentage of registered nurses on their staff.

Examining the dynamics of hospital behavior, Newhouse (1970) supposes that nonprofits maximize a convex combination of quality and quantity subject to a zero-profit constraint. Dranove (1988) builds on this idea to examine pricing responses by hospitals to lump-sum profit shocks. He models an objective function that includes profits and the utility of privately insured patients and shows that nonprofits would respond to lump-sum profit shocks by adjusting prices up and down so as to "share the pain" of negative shocks and "share the gain" of positive shocks. Hospitals that adjust prices to privately insured patients in response to financial shocks are said to engage in "dynamic" cost shifting (Morrisey, 1994).

In Dranove's original model, nonprofits are restricted to responding along a single dimension, price. However, this restriction is not necessary from a theoretical perspective and may unnecessarily limit the focus of empiricists seeking to detect differences between nonprofits and for-profits. For example, Newhouse's (1970) model suggests that hospitals might reduce the quality of care even if they do not change prices. Alternatively, we might expect nonprofits to eliminate unprofitable service lines or decrease the number of customers they serve at deeply discounted rates, unlike for-profits, which would not be expected to offer such responses to lump-sum shocks. Indeed, Chang and Jacobson (2011) find that following a financial shock created by mandatory earthquake retrofitting in California nonprofit hospitals increased their provision of relatively profitable services.

Although the size and importance of the hospital market within the nonprofit sector has led to a focus on these firms, the expansion of this cost shifting model to allow nonprofits to adjust to financial shocks along a variety of dimensions is not specific to hospitals. A wide range of nonprofit organizations suffered financial losses in 2008, and the responses by these organizations illustrate the multitude of ways that nonprofits "shared the pain." For example, several art museums, including the Art Institute of Chicago, the Brooklyn Art Museum, and the Philadelphia Art Museum, engaged in dynamic cost shifting by substantially raising admission fees (Kaufman, 2009). Art museums also cut staff and cancelled costly exhibitions (Henning, 2013). Many universities also suffered large endowment losses. Harvard University, which suffered a 22% endowment decline over a four-month period, immediately instituted a hiring freeze and slowed construction projects (Marks and Wu, 2008). Other universities postponed construction, curtailed landscaping, and cut back on air conditioning (Hand, 2008). In a more systematic analysis, Brown et al. (2014) found that an endowment shock equal to 10% of a university's budget led to an approximately 3% reduction in the number of tenure-track faculty during the year of the shock, followed by an approximately 6% decline in the following year. There were also meaningful declines in support employees. There is no evidence that affected universities cost shifted using prices (i.e., imposed unusually large tuition increases).

In this article, we examine whether nonprofit hospitals adjust to lump-sum financial shocks across a similarly wide variety of dimensions, as has been discussed in these other sectors. Our most salient prediction is that nonprofits that are actually behaving differently than profit-maximizing firms should react to profit shocks by adjusting along one or more of the dimensions that we consider. This prediction stems from the fact that for the postshock adjustment to be optimal, the firm must not have been previously maximizing profits along that dimension. For example, a hospital that responds to a negative lump-sum financial shock by raising the prices charged to privately insured patients must not have been previously setting the profit-maximizing price. Therefore, if we identify such adjustments, we consider this evidence that nonprofit hospitals were not simply acting like "for-profits in disguise."

Although there is abundant anecdotal evidence from other nonprofit sectors to support the "share the gain/share the pain" model, empirical evidence of hospital cost shifting through any mechanism is quite sparse. Dranove uses his original theory to motivate an estimate of the magnitude of cost shifting by Illinois hospitals in the wake of a sharp reduction in state Medicaid payments, which he treats as a lump-sum negative shock. His point estimate suggests that cost shifting allowed hospitals to make up about half of their lost revenue. Subsequent studies find at best mixed evidence of cost shifting, and in his review of this literature, Frakt (2011) concludes: "... as a whole, the evidence does not support the notion that cost shifting is both large and pervasive. Instead, it reveals that cost shifting can occur but may not always do so."

Despite the mixed empirical evidence, many in the policy community are convinced that hospitals cost shift. As a result, this phenomenon has been used as the basis of supporting or opposing a wide variety of economically meaningful policies. In 1982, the Hospital Association of America described cost shifting as a "hidden tax" paid by insured patients whenever state governments cut Medicaid payments (Health Insurance Association of America, 1982). Hadley and Feder (1985) view cost shifting as a survival response by hospitals trying to offset Medicaid cutbacks. Concerns about cost shifting have motivated important government policies. Dranove and Cone (1986) argue private insurers agreed to participate in all-payer state rate setting plans rather than suffer from cost shifting that might result from Medicaid cutbacks. In 1992, the Medicare Prospective Payment Assessment Commission played down the impact of cutbacks in Medicare payments by noting that hospitals could recoup their losses by cost shifting (ProPAC, 1992). Finally, as discussed above, the cost shifting argument served a prominent role in the debate about portions of the ACA.

□ **Heterogeneity in the responses of nonprofit firms.** Although we take evidence of postfinancial shock adjustments by nonprofit hospitals as evidence that they have a different objective function from their for-profit counterparts, we also note that the converse is not always true. If we cannot identify meaningful adjustments along the wide variety of dimensions we consider, this does not serve as conclusive evidence the average nonprofit hospital must be a "for-profit in disguise." That is to say, even a nonprofit hospital with an objective function that truly differs from its for-profit counterpart might not respond for a number of reasons. First, they could be adjusting along a dimension that we are not able to observe or measure in our data. Relatedly, a dynamically optimizing nonprofit might extract profits just like a for-profit in most states of the world but do so with every intention of redistributing those profits should some great social need arise. Finally, if a nonprofit hospital had exhausted all opportunities for providing community benefit, its provision of community benefit might be unresponsive to marginal changes in profits. Beyond these simple points, the lack of a response may simply reflect the fact that in a perfectly competitive market for-profit and nonprofit hospitals cannot behave differently because all firms earn zero profits. There are reasons, however, to believe that nonprofit hospitals should be earning positive profits.[5]

In addition, we note that there could be heterogeneity among nonprofit hospitals on which dimension they select to respond to a financial shock. Although it may seem intuitive that hospitals would adjust across all dimensions at their disposal, there is nothing about the "share the gain/share the pain" model that suggests hospitals should symmetrically respond. This lack of a response along some dimension may simply reflect that the nonprofits we are examining are not, on the margin, redistributing rents on that dimension before the shock. This could be relevant for any of the dimensions that we consider and could lead to heterogeneous responses across firms, depending upon the magnitude of their rents before the financial shock. For example, a social welfare-maximizing hospital with sufficient rents may, prior to the shock, have been providing the social welfare-maximizing level of quality, charity care, and service offerings. That is to say, even though this hospital has remaining rents sufficient to supply more of a particular service that doesn't maximize profits, it believes that doing so would not maximize social welfare.[6] If

[5] There are at least two reasons why nonprofit hospitals should earn positive economic profits. First, in many models of oligopolistic competition with high fixed costs, the average firm earns positive economic profits. Second, nonprofit hospitals are exempt from a number of taxes that are paid by their for-profit competitors.

[6] For example, an overly generous charity care policy might dissuade relatively high-income individuals from purchasing insurance (Coate, 1995). As a case in point, because the passage of the ACA improved insurance access, many nonprofit hospitals have reexamined their charity care policies (Goodnough and Pear, 2014).

this were the case, this hospital may choose to return the remaining rents to society in the form of lower prices. It is quite conceivable that these hospitals would subsequently find that, following a shock, social welfare is maximized by retaining their current service offerings and raising prices on the privately insured.

In contrast, a hospital with fewer rents may find that they lack sufficient funds to reach the social welfare-maximizing level of unprofitable service offerings or charity care and thus don't return any of their rents to privately insured patients through lower prices. Following a shock, such a hospital should respond by adjusting along nonprice dimensions. We will examine this potential heterogeneity empirically by examining the response of hospitals separately based on measures of market power, with the assumption that hospitals with greater market power would have more rents to redistribute to society, and therefore may respond to a financial shock along different dimensions.

We conclude this discussion by noting that there are additional possible conditions under which a nonprofit hospital may be behaving differently from its for-profit counterpart, but we do not observe a response to a lump-sum financial shock. This is an important limitation in our ability to test conclusively for whether hospital ownership type affects hospital behavior. However, we note that this limitation does not relate to the *source* of the financial shock in our setting. The spirit of the Dranove (1988) cost-shifting model would predict that nonprofits would not respond differently to a lump-sum financial shock that comes from the financial market versus one from the ACA coverage expansion. That being said, we admit that more nuanced theories might generate different price responses to specific kinds of shocks.[7] For example, hospitals may view financial shocks from government reimbursement cutbacks as a kind of "focal point" in a dynamic pricing game. Suppose that no hospital in a competitive market would raise prices unilaterally, but also that every hospital believes that its rivals will raise prices in response to government cutbacks. In this case, dynamic cost shifting becomes a self-fulfilling prophecy. We would note that the primary cost shifting argument supporting the ACA is not tied to a government reimbursement change, however, but is instead tied to a potential reduction in uncompensated care. Although this is more similar to a lump-sum financial shock such as the endowment shock that we consider, we cannot rule out some other nuanced theory that would generate a pricing response for uncompensated care.

3. Data

■ We draw our data from a variety of sources, including Medicare Cost Reports, Centers for Medicare and Medicaid Services (CMS) impact files, the American Hospital Association Annual Survey, and some additional sources. We compute our main predictors and dependent variables at the hospital/year level. We supplement these data with a variety of market-level controls. Hospital financial data notoriously have outliers, so we censor all time-varying variables. Specifically, no residuals from regressions with facility and year fixed effects are outside of the 5th and 95th percentiles of residuals. We restrict our regression analyses to the years 2003–2011, so as to begin after the smaller recession of the early 2000s.

□ **Measuring changes to hospital assets.** Our main independent variable, *FinShock*, is constructed from Medicare Cost Reports and describes the change in the hospitals' assets as a result of the 2008 stock market crash. We construct this variable for each system c, treating each nonsystem hospital as its own system. To maintain a consistent definition of system membership across our analysis, we use system definitions from the 2007 American Hospital Association (AHA) for all years. When computing *FinShock*, we exclude changes resulting from operating income or losses, which effectively restricts attention to changes in the value of investments. Thus, *FinShock*,

[7] For example, in a recent article, Clemens and Gottleib (2013) present a model of physicians operating under capacity constraints, where these physicians respond to Medicare price increases by *raising* prices, a phenomenon they describe as "cost-following."

represents a true lump-sum, exogenous, shock.[8] We scale *FinShock* to hospital size, based on the system's operating costs. We do this because a large hospital suffering an investment loss would likely not react similarly to a small hospital suffering the same absolute loss. More detail on this measure is contained in Appendix 2.

For system hospitals, some assets may be held by a parent organization and would be unobserved to us. Therefore, we present system results separately.[9] As we discuss further below, the data on systems yield similar conclusions to the nonsystem hospitals but are less precisely measured and attenuated. This is consistent with classical measurement error in our construction of the system asset losses.

In some analyses below, we examine the ability of a hospital system to withstand profit shocks using their assets. Specifically, we measure the number of years a hospital system could cover its operating costs solely off of its net assets: $Reserves_{ct} = \frac{net\ assets_{ct}}{operating\ costs_{ct}}$. Hospital system operating costs are very high relative to net assets; even the wealthiest hospital systems could cover only one or two years of operating costs with their net assets alone.

We perform these calculations (and all future analyses) for only nonprofit hospitals. It might seem that for-profit hospitals present a natural placebo test for our analysis. We do not perform such a test because *reserves* and *FinShock* do not naturally translate to a for-profit setting. Moreover, the sample of for-profits is much smaller and heavily tilted toward large chains, for which we have difficulty measuring wealth shocks even for nonprofits. Data issues aside, we are unaware of any theoretical reason why for-profits would adjust prices or quality in response to a lump-sum profit shock.

□ **Dependent variables.** As discussed in the previous section, the burden of a negative profit shock may be expressed in a number of ways. Throughout our analysis, we consider the following outcomes:

□ **Prices.** We construct our measure of hospital prices, *Price*, from Medicare Cost Reports. *Price* is revenue per non-Medicare discharge and is identical to a measure constructed by Dafny (2009), except that Dafny's measure is case-mix adjusted, whereas we include case mix as an independent regressor. One shortcoming of *Price* is that it is an average over different types of patients, including Medicaid, privately insured patients, and uninsured patients. Thus, changes in *Price* may confound changes in private prices with changes in Medicaid prices or the numbers of uninsured. That being said, Garmon (2015) finds that *Price* is highly correlated with actual, negotiated private prices.

Still, at a minimum, our use of *Price* introduces noise into our dependent variable and reduces the precision of our estimates. It may also introduce bias if changes in Medicaid reimbursements or the uninsured are correlated with *FinShock*. We took several steps to deal with this potential bias. First, although several states attempted to cut Medicaid prices around the time of the 2008 collapse, successful injunctions filed by hospitals prevented most of these cuts from taking effect. Nonetheless, hospitals may have cost shifted in anticipation of eventual cuts. Therefore, we obtained data from the Kaiser Family Foundation on whether states announced changes in their Medicaid hospital prices in 2008–2011. Our results remain similar when we reestimate our price analysis, excluding the states that announced cuts in any of those years. For some states, Kaiser reports the magnitudes of the announced decreases. We confirmed that our results were further robust to adding back the states for which we could calculate Medicaid price changes using Kaiser's data to directly control for the Medicaid price changes. Third, we restricted our

[8] Alternatively, one might compute the change in "nonoperating revenue," which consists largely of transfers from the endowment. Such transfers are based on artificial accounting definitions, rather than underlying economic differences. For example, hospitals may transfer money out of the endowment but realize revenues in excess of costs.

[9] We exclude two systems from our analysis: Advocate Healthcare (because of data errors) and Kaiser Permanente (because the cost-shifting predictions do not cleanly translate to a vertically integrated insurer).

analysis to hospitals with below-average Medicaid market shares in 2007. If our results were confounded by the inclusion of Medicaid pricing, the results for these low-Medicaid hospitals would be different than those for all hospitals. In fact, the results are nearly identical. Finally, we construct an alternative measure of prices, *Price2*. *Price2* results from an analysis that decomposes annual changes in *Price* into a hospital-specific and a statewide component. The latter captures the change in Medicaid reimbursements; the former is *Price2*. Appendix 1 describes this construction in more detail. Our results using *Price2* are similar, albeit less precise, to those using *Price* and are presented in Appendix 5, Table 10.

□ **Costs per discharge.** Hospitals suffering a financial setback may reduce the quality of care they provide to patients. There are many ways to measure quality and most are problematic for our purposes, either because they are not systematically available or because they are measured with substantial noise. As suggested by Dranove and White (1998), we assume that the level of services provided to patients, as measured by the cost of care per discharge, is a proxy for quality. We obtain *Cost per Discharge* from the Medicare Cost Reports.[10] *Cost per Discharge* is an "all-in" cost that includes amortized fixed costs.[11]

□ **Uncompensated care.** Available data sets lack clean or well-populated measures of charity care or bad debt at the hospital level.[12] This is a likely reason why relatively few previous studies examine the hospital-level provision of uncompensated care. However, there are many states that in recent years have required hospitals to report their levels of uncompensated care, and a number of these states have made these data publicly available to researchers. We gathered hospital-level data on uncompensated care for 15 states from 2003–2011.[13] Our sample contains approximately 48% of the hospitals in our Medicare Cost Reports data. The average of *FinShock* for this selected sample of hospitals is statistically and economically indistinguishable from that in the full sample. These data contain information on the amount of bad debt and charity care provided by a hospital in the previous year. As the definition of "bad debt" and "charity care" can vary across institutions and over time, we consider the composite category of uncompensated care services. *UCC2GPR* is the ratio of gross uncompensated care charges to gross patient charges.

□ **Unprofitable services.** We also examine whether the stock market losses affect the offering of relatively unprofitable services. Nonprofit hospitals may chose profit-maximizing price and quality levels for private patients and use the profits to fund other activities, such as unprofitable services that provide a community benefit. This analysis is guided by Horwitz (2005), which examines the provision of relatively profitable and unprofitable services based on tax status of the hospital. Horwitz (2005) finds that for-profit hospitals are more likely to offer profitable services and less likely to offer unprofitable services than nonprofit hospitals.

We examine the three unprofitable services for which Horwitz (2005) found the strongest relationship between ownership status and the probability of the service being offered: trauma care, emergency psychiatric care, and drug and alcohol treatment. We also consider changes in service offerings for three more profitable services: adult cardiac surgery, extracorporeal shock

[10] Revenue numbers are reported separately for inpatient and outpatient by revenue center. Costs are not. Therefore, for estimating inpatient costs, we assume that inpatient costs for each cost center are: costs*(inpatient revenues)/(inpatient revenues + outpatient revenues) and then sum over cost centers.

[11] Because many hospital costs are fixed, this may be a low-powered test. As an alternative, Appendix 5 presents analyses using the variable *Salaries per Discharge*, which equal the total labor costs per discharge for a hospital. The results are very similar.

[12] Medicare Cost Reports provide a measure of uncompensated care. However, prior to 2011, these data were unreliable. Appendix 3 provides a more detailed discussion of these data and a comparison to our preferred sample from individual state reports.

[13] All states have data from 2003–2011 except for Maine, which only had data available from 2004–2011.

wave lithotripter, and adult interventional cardiac catheterization.[14] Each of these is a binary variable, taking a value of one if a hospital offers the service and zero if it does not. In our main analysis, we use as our dependent variable the share of the three profitable services, and the share of the three unprofitable services that these hospitals provide. Appendix 4 provides details on the analysis when we separately examine each of the services.

□ **Control variables.** Many of our specifications include an array of commonly used control variables that could plausibly impact hospital revenues and pricing decisions, including a measure of local labor market costs computed by Medicare; a measure of the average severity, or the "case-mix index," of Medicare patients treated at the hospital (*CMI*); the percent of discharges from deliveries; lagged county unemployment; and the ratio of medical residents to hospital beds.

□ **Sampling restrictions.** Because we draw on a variety of data sets, each with some incomplete data, and because we make some sample restrictions, sample sizes differ from regression to regression. Appendix 5, Table 1, illustrates the effects of our sampling restrictions in our *Price* regressions. Our sample consists of private, nonprofit, acute care hospitals for which we could obtain all relevant variables for all of our data sets. CMS does not report *CMI* for critical access hospitals (CAHs), so they are excluded. It is important to note that our sample is likely weighted toward those hospitals which are most likely to cost shift. For-profit hospitals should exploit their market power at all times, and government hospitals and CAHs are unlikely to have any market power. Therefore, finding no evidence of price changes in this sample makes it highly unlikely that cost shifting is a broad phenomenon in the modern healthcare market.

The final six rows of Appendix 5, Table 1, list the number of hospitals in our sample based on their system affiliation.

□ **Sources of heterogeneity in response.** Recall that hospitals with different levels of rents prior to a financial shock may have redistributed those rents through different channels and therefore may have heterogeneous responses to financial shocks. Although there is no comprehensive measure of which hospitals have more rents to redistribute, we are able to identify hospitals that are likely to have the most market power, which should result in greater available rents.

As there is no obvious method of measuring the relative market power of hospitals in a nationwide sample, we pursue two *ad hoc* approaches. First, we ask whether a hospital was either nationally ranked in the *US News and World Report* annual hospital rankings or whether the hospital serves as the main teaching affiliate of a medical school (hereafter, referred to as US News/AAMC hospitals). Highly ranked hospitals may add a great deal of value to insurers' networks, giving them substantially more pricing power than the average hospital.

Second, we developed a broader measure of market power derived from a national survey of consumer perceptions of hospital quality. These data, the Market Insights survey by the National Research Corporation (National Research), are an annual survey of approximately 270,000 respondents in 250 geographic markets. All respondents are over the age of 18 and the sample is weighted according to age, population density, income, race, presence of children in the home, and marital status. National Research asks consumers about the characteristics of hospitals in their area, and we treat the hospitals that respondents identify as having the "Best Overall Quality" as their preferred facility.

This survey question focuses on overall quality and does not necessarily identify hospitals that have market power when negotiating with insurers. To address this, we follow Capps, Dranove, and Satterthwaite (2003) and compute a measure of negotiating leverage that they call "willingness to pay" (WTP). Specifically, for each three-digit zip code, z, and hospital system, c, let N_{zc} be the

[14] Prior to 2004, the AHA asks whether hospitals provided "open-heart surgery" rather than adult cardiac surgery and a "cardiac catheterization lab" rather than "adult interventional cardiac catheterization." Therefore, these variables may slightly differ from the ones used by Horwitz (2005). For consistency, we begin the service offering analysis in 2004.

number of patients in z choosing c, and N_z be the total number of patients in zip code z. Then, the share, of patients in z choosing c is $S_{zc} = \frac{N_{zc}}{N_z}$ and $\text{WTP}_c = -\sum_z N_z ln[1-S_{zc}]$. This measure of hospital market power can be derived from a logit-demand system.[15] We group hospitals by terciles of this measure of consumer preferences, and call the upper third "High WTP Hospitals."[16] Because system size is highly correlated with WTP and is correlated with measurement error in our key independent variable, when categorizing systems by WTP, we do so separately by system size.

The main analysis presents only a subset of the possible permutations of dependent variables, potential sources of heterogeneity in response, and regression specifications. Many of the remaining permutations are presented in Appendix 4 or Appendix 5. Appendix 5, Table 8, and Appendix 5, Table 9, also illustrate that our main findings are robust to adding a large number of additional control variables.

4. The 2008 stock market collapse and hospital assets

■ The 2008 collapse provides an opportunity to study the effects of an exogenous financial shock. Nonprofit hospitals in our sample held \$244 billion in assets in 2007, with an average of \$123 million per facility, and a substantial fraction relied on income from their investments to help defray operating costs. For example, from 2003–2006, hospitals had an average profit margin of 2.8% of operating costs. Investment income added profits of another 1.7% of operating costs. Many hospitals experienced economically meaningful financial shocks as a result of the 2008 collapse. Such shocks are apparent in hospital investment returns. Figure 1a illustrates the percentage return on investments for hospitals based on their system affiliation alongside the returns on the overall S&P 500. We present all results in this section for nonsystem hospitals, those in systems with fewer than seven facilities, and those in large systems.

On average, hospitals experienced small negative returns during the stock market collapse of the early 2000s and then a far larger decline during the 2008 collapse.[17] Hospital investments appear to be relatively diversified with respect to stock market risk, as evidenced by the larger movements in the S&P 500. These average losses mask a large amount of heterogeneity in investment performance across hospitals. For example, the 75th percentile nonsystem hospital in 2008 experienced a slight investment gain of 0.5% whereas the 25th percentile hospital experienced an investment loss of 7.9%. At the extreme, the 5th percentile nonsystem hospital saw a 2008 investment loss of 21%. For comparison, in 2006, the 5th percentile nonsystem hospital lost only 7.4% and the 75th percentile gained 4.5%. This substantial heterogeneity should not be surprising. Hospitals with little exposure to stock market risk should suffer small losses even during a downturn, whereas those with larger exposures should see greater variation in their year-to-year performance.

Figures 1(b)–1(d) show net assets, operating costs, and *reserves* (the ratio of net assets to operating costs) for a balanced panel of hospitals for the period 1998–2011 by hospital system status. Across all hospital types, there is a small decline in net assets associated with the stock market decline of the early 2000s, and a much larger decline in 2008. Because operating costs climb steadily, *reserves* fall slightly in the early 2000s and then experience a larger decline in 2008. This drop is greatest for nonsystem hospitals, which experienced an 11-percentage point decline in *reserves* compared to a 9.7-percentage point decline for small system hospitals, and a 9.3-percentage point decline for large system hospitals.

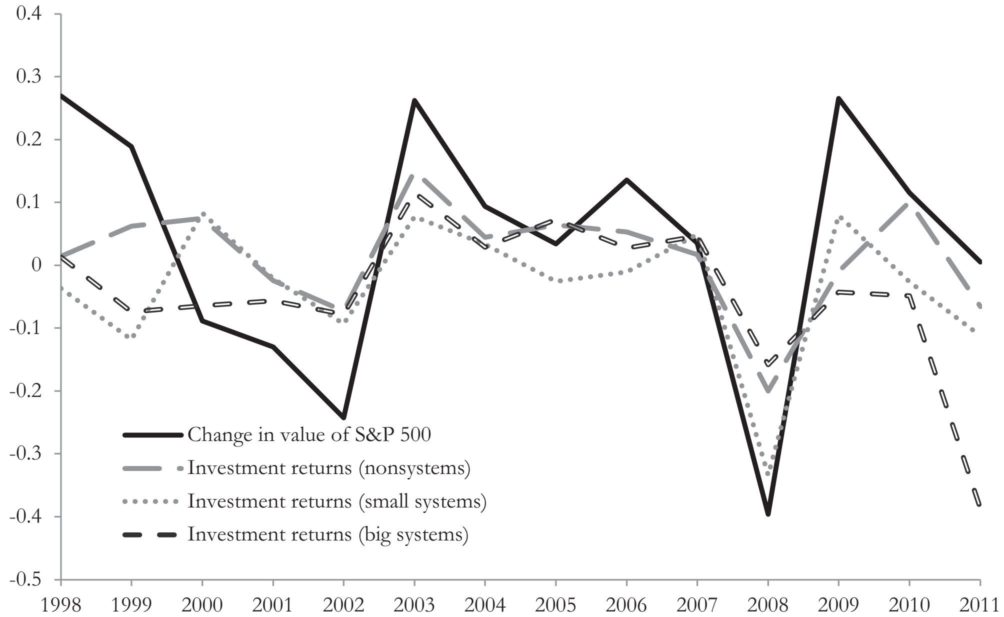
[15] We match the National Research and Cost Report data sets on facility name, hospital zip code, and patient zip code. We include all National Research facilities in the WTP calculations, placing facilities into systems based on the AHA data where possible.

[16] We restrict the WTP analysis to the 88% of hospitals in our final sample matching to the National Research data.

[17] We do not exploit variation in investment income in years other than 2008 for three reasons. First, such analysis would require assumptions on lag structures and expectations. Second, it is harder to rule out endogeneity. Conveniently, there is also less variation in investment performance.

FIGURE 1a

INVESTMENT RETURNS OF HOSPITALS COMPARED TO THE S&P 500, 1998–2011



Notes: S&P 500 value is measured as of year-end. Hospital investment returns are measured as realized and unrealized investment returns divided by total investment assets as of prior year. Hospital investment returns are weighted by prior year-end investments, so give the average return on a dollar. Hospital investment returns are censored at the 1st and 99th percentile by year.

We measure the impact of the 2008 collapse on hospital finances with the variable $FinShock_i$, which is the change in the assets resulting from the stock market crash of system c, of which hospital, i is a member in 2008 (for system-level analysis, we subscript *FinShock* with a c). To illustrate the impact of the 2008 collapse on hospital *reserves* over time, we estimate the following system level-equation on hospital data from the years 1998–2011:

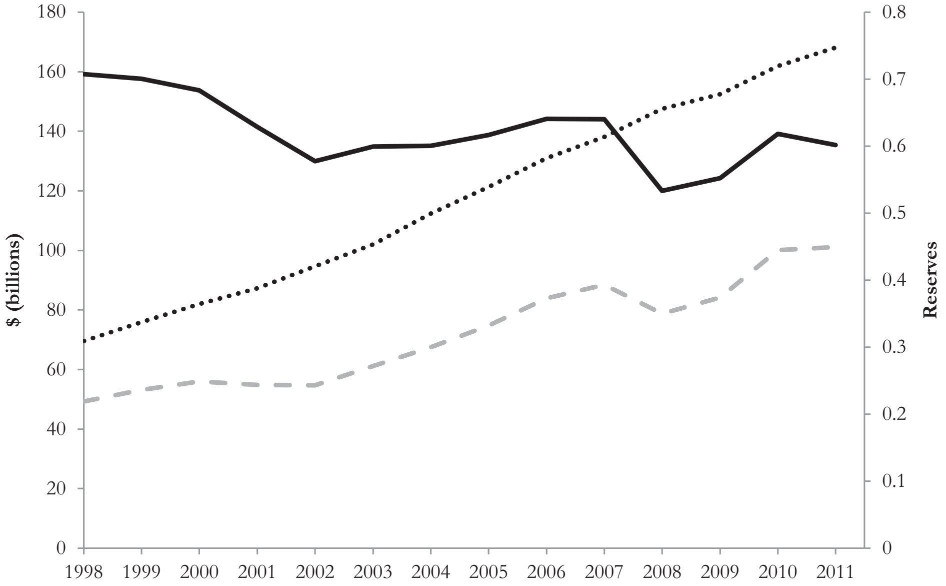
$$reserves_{ct} = \alpha_c + \alpha_t + \beta_t(FinShock_c), \tag{1}$$

where α_c is a hospital system fixed effect, α_t at is a year fixed effect, and β_t represents a series of coefficients for each year from 1999 to 2011, with 1998 serving as the omitted year. The regression is weighted by operating costs. Figure 2a plots the estimated β_t coefficients and confidence intervals for each year for nonsystem hospitals. Note that the coefficient is positive and statistically significant in 2008 and 2009, as well as in 2001 and 2002. The latter likely reflects correlated investment strategies, that is, hospitals pursuing investment strategies subject to stock market risk in 2008 were likely pursuing similar strategies in 2001. We will discuss this correlation in more detail during the analysis of hospital pricing behavior. As would be expected if our measure of losses was capturing the impact of the 2008 collapse on hospital finances, β_{2008}-β_{2007} is approximately equal to 1. A generally similar pattern is seen in Figure 2b for hospitals that are in systems with fewer than seven facilities. The pattern in Figure 2c for hospitals that are in systems with seven or more facilities is less clean—there are large movements in β_t coefficients prior to 2008. Furthermore, the effect of the 2008 collapse dissipates more for this sample. The sharp movements for large systems are consistent with parent companies holding assets and bringing them on and off the books of hospitals in a manner that is not observable in our data.

The estimates depicted in Figures 2(a)–2(d) are especially noteworthy, because they presage our results about the effectiveness of cost shifting for the average hospital. If hospitals were unable

FIGURE 1b

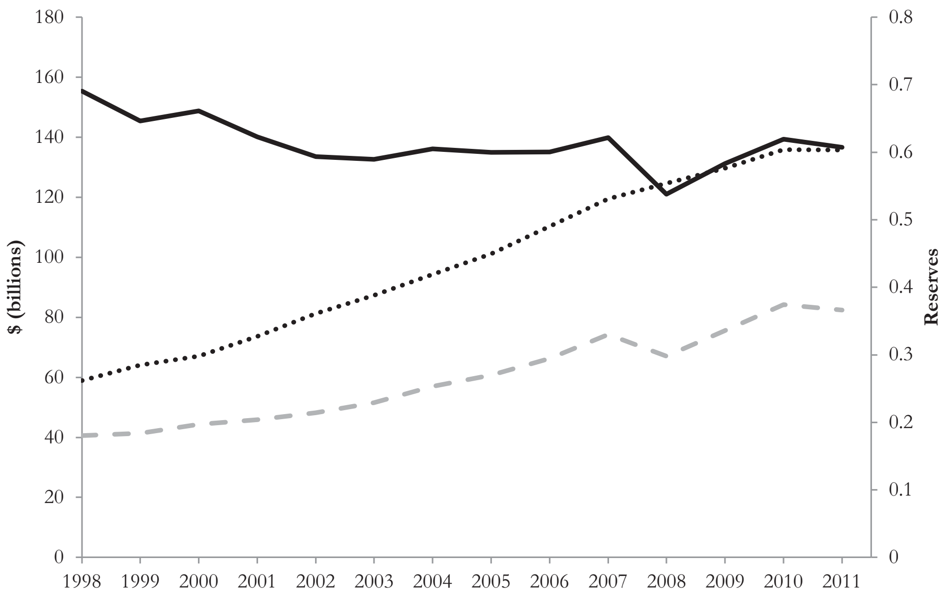
CHANGE IN NET ASSETS, OPERATING COSTS, AND RESERVES NONSYSTEMS HOSPITALS, 1998–2011



Notes: Total fund balances and operating costs for a balanced panel of 733 nonsystem hospitals present in all years from 1998–2011.

FIGURE 1c

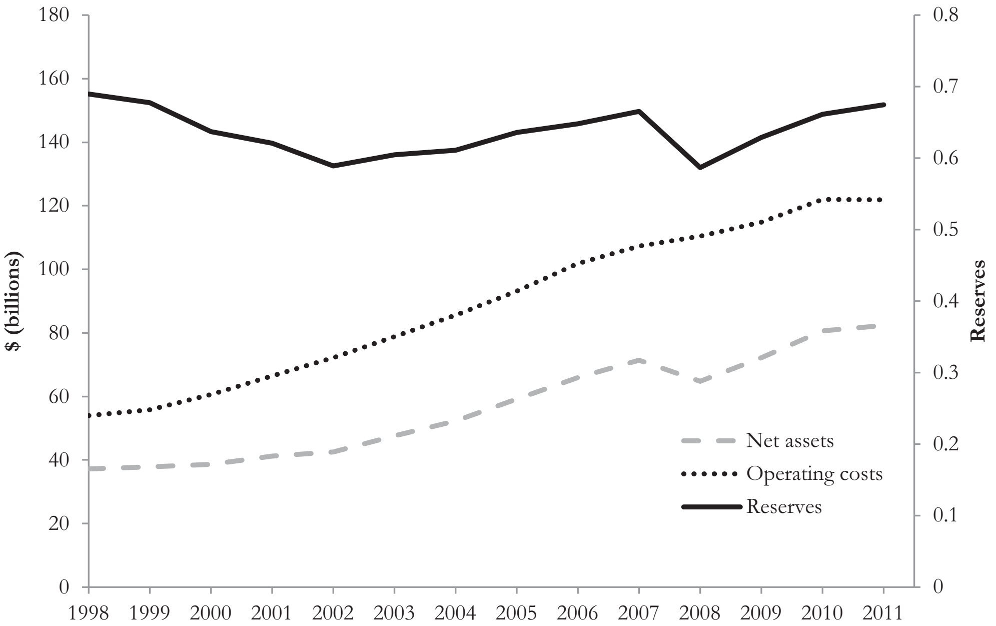
CHANGE IN NET ASSETS, OPERATING COSTS, AND RESERVES SMALL CHAIN HOSPITALS, 1998–2011



Notes: Total fund balances and operating costs for a balanced panel of 161 systems with under seven hospitals in 2007, present in all years from 1998–2011 (with a mean of 3.05 hospitals per system in 2007).

FIGURE 1d

CHANGE IN NET ASSETS, OPERATING COSTS, AND RESERVES LARGE SYSTEM HOSPITALS, 1998–2011



Notes: Total fund balances and operating costs for a balanced panel of 41 systems with seven or more hospitals in 2007, present in all years from 1998–2011.

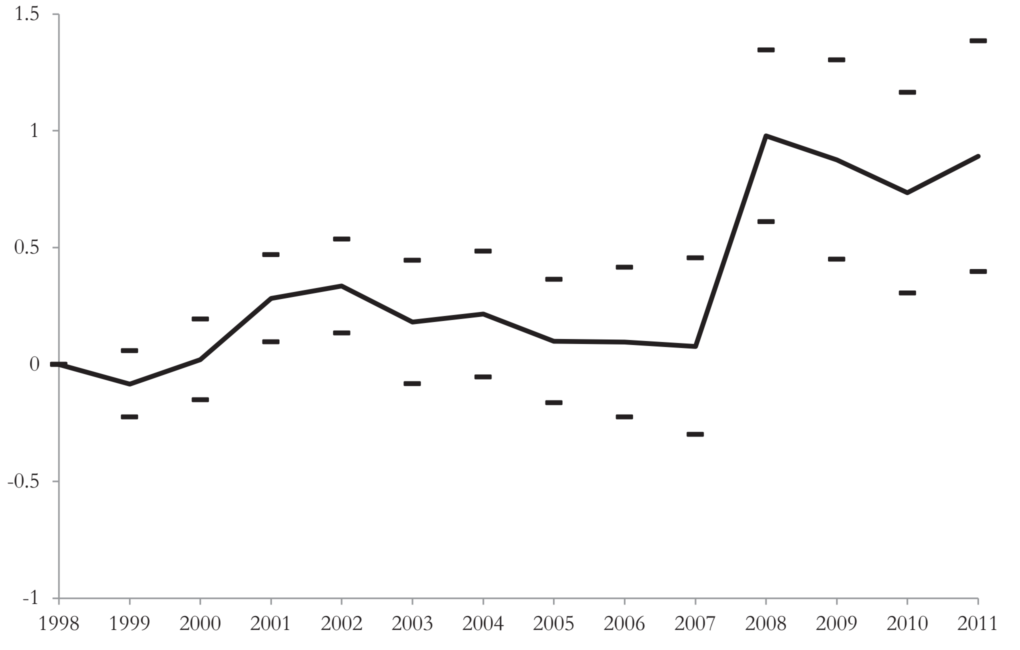
to effectively respond to the investment losses by cost shifting, and if there was not an immediate recovery of investment losses (i.e., firms with big losses in 2008 did not have commensurately larger gains in 2009), then we would expect $\beta_t = 0$ for t $\leq$ 2007 <= and $\beta_t = 1$ for t $\geq$ 2008. Indeed, this is approximately what we observe—particularly for nonsystem hospitals. Specifically, for nonsystem hospitals, $\beta_{2008} - \beta_{2007} = 0.9$. Furthermore, the effect *barely dissipates* over a long time period. In particular, $\beta_{2011} - \beta_{2008} = 0.09$, with a standard error of 0.15. Based on this rate of dissipation, it would take a hospital nearly 35 years (or nearly 8 years at the lower bound of the 95% confidence interval for $\beta_{2011} - \beta_{2008}$) to make up the losses from their financial shock. The inability to meaningfully recoup losses suggests that the minimal price and nonprice cost shifting that we document below will have little aggregate effect on hospital balance sheets. This is consistent with Duggan (2000)'s finding that for private nonprofits, positive financial shocks translated into assets nearly one for one.

A key assumption of our analysis of the causal impact of financial shocks on hospital behavior is that the losses resulting from the 2008 collapse were exogenous. This assumption is broadly supported by the fact that the primary causes of the collapse were far removed from the healthcare market. To further examine the plausibility of our identifying assumption, we undertake three distinct analyses. First, we examine the descriptive statistics of hospitals based on the size of their financial shock. Second, we correlate the estimated financial shocks with a variety of local economic factors—thus addressing whether our estimates simply reflect changing demand conditions. Finally, we show that the changes in assets are not primarily due to revaluations of real property, which might reflect changes in the local economy as opposed to a hospital-specific financial shock.

The first panel of Table 1 contains summary statistics based on whether a hospital had above or below average changes in its net assets. Statistics are provided for a variety of the dependent

FIGURE 2a

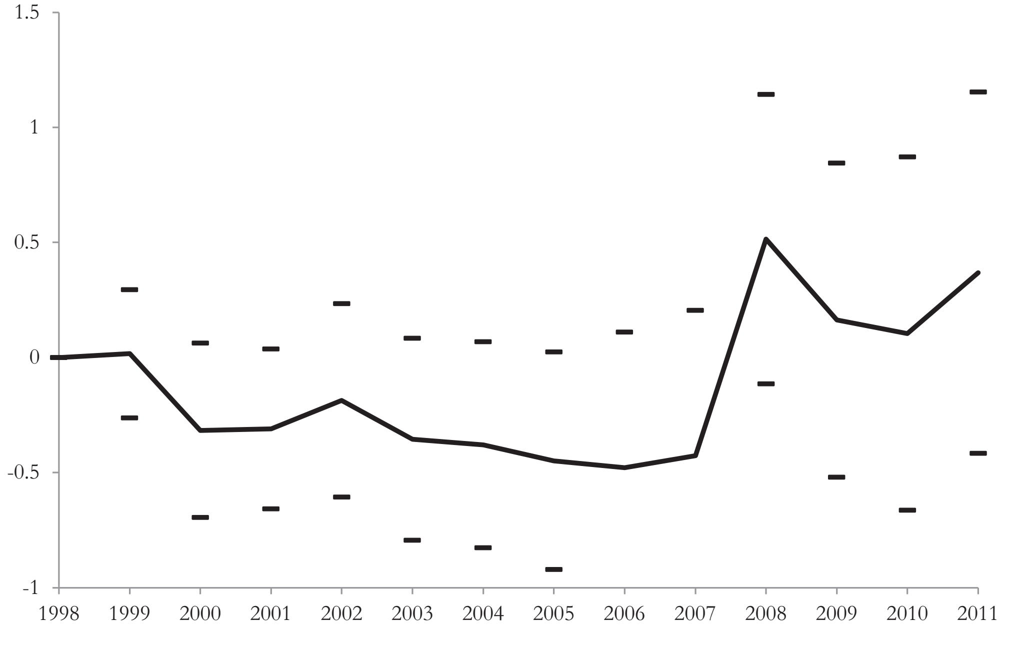
OLS ESTIMATES OF IMPACT OF *FinShock* ON *Reserves* NONSYSTEM HOSPITALS



Unreported covariates include system and year fixed effects. Regressions are weighted by operating costs. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 2b

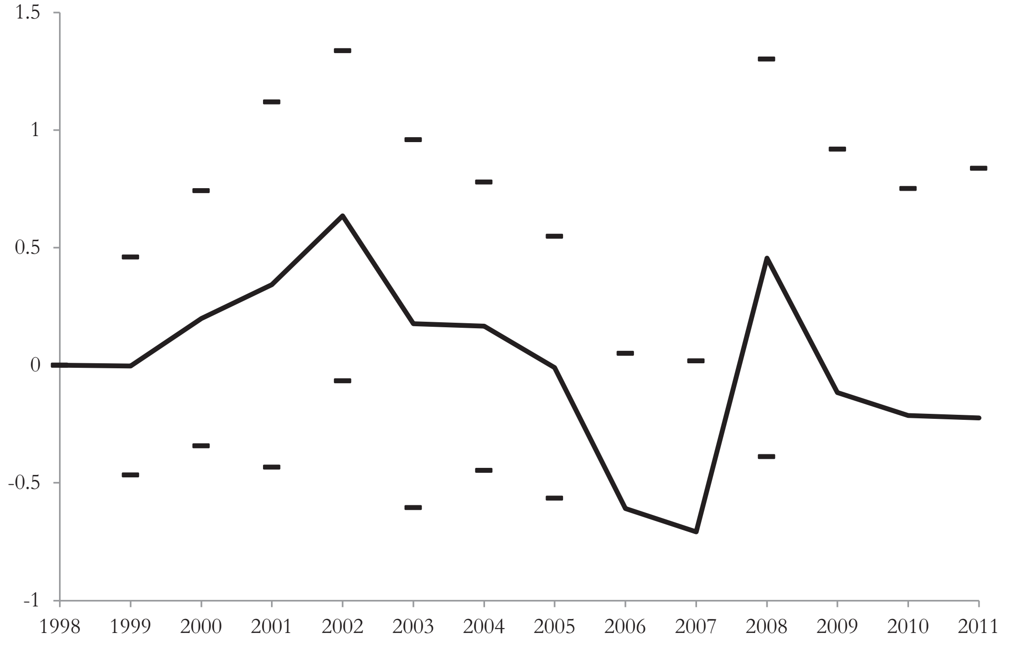
OLS ESTIMATES OF IMPACT OF *FinShock* ON *Reserves* SMALL SYSTEM HOSPITALS



Unreported covariates include system and year fixed effects. Regressions are weighted by operating costs. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 2c

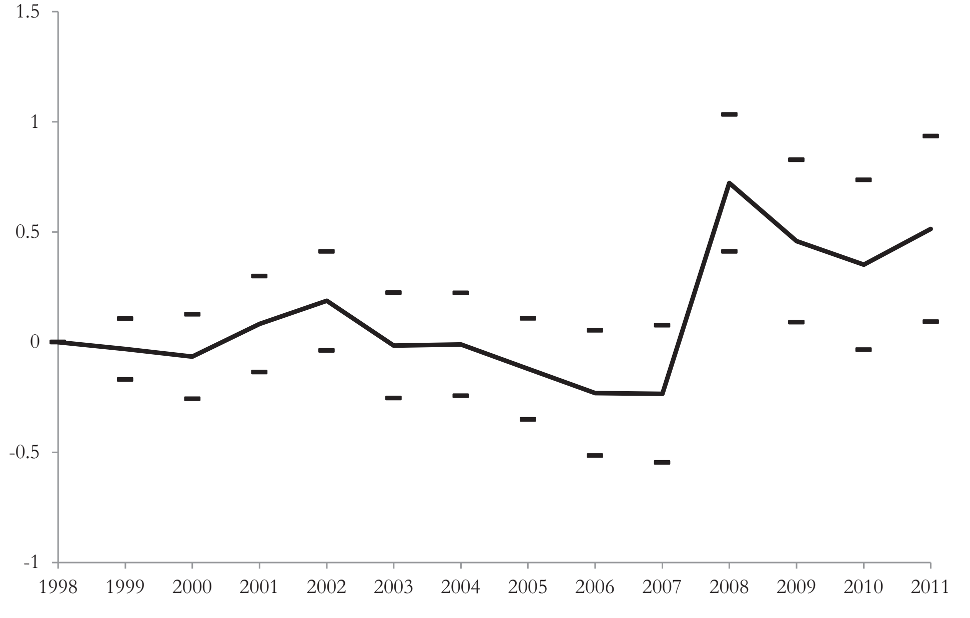
OLS ESTIMATES OF IMPACT OF *FinShock* ON *Reserves* BIG SYSTEM HOSPITALS



Unreported covariates include system and year fixed effects. Regressions are weighted by operating costs. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 2d

OLS ESTIMATES OF IMPACT OF *FinShock* ON *Reserves* ALL HOSPITALS



Unreported covariates include system and year fixed effects. Regressions are weighted by operating costs. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

TABLE 1 Summary Statistics

	Full Sample					US News/AAMC Sample				
	Below Average *FinShock*		Above Average *FinShock*			Below Average *FinShock*		Above Average *FinShock*		
Dependent Variables	Mean	Standard Deviation	Mean	Standard Deviation	P-value	Mean	Standard Deviation	Mean	Standard Deviation	P-value
Price	8135	4059	7527	4406	0.00	12802	5767	12796	6041	0.99
Cost per discharge	6751	1986	6438	1971	0.00	9325	2638	9394	2190	0.76
Salaries per discharge	3494	1876	3337	2258	0.00	5275	2366	5285	1753	0.96
Psychiatric emergency hospital	0.56	0.50	0.48	0.50	0.00	0.80	0.40	0.83	0.38	0.53
Trauma hospital	0.40	0.49	0.41	0.49	0.48	0.69	0.46	0.82	0.38	0.00
Drug and alcohol outpatient services	0.16	0.37	0.15	0.36	0.26	0.23	0.42	0.16	0.37	0.04
Adult cardiac surgery hospitals	0.43	0.50	0.38	0.49	0.00	0.91	0.29	0.92	0.27	0.68
Extracorporeal shock wave lithotripter	0.42	0.49	0.37	0.48	0.00	0.64	0.48	0.68	0.47	0.47
Adult interventionalist cardiac cath.	0.55	0.50	0.44	0.50	0.00	0.95	0.23	0.91	0.28	0.21
Reserves	0.65	0.36	0.60	0.38	0.00	0.60	0.32	0.50	0.30	0.00
Independent Variables										
FinShock	−0.10	0.05	0.00	0.02	0.00	−0.10	0.06	0.00	0.02	0.00
Wage	1.01	0.14	1.00	0.16	0.00	1.04	0.13	1.07	0.15	0.02
CMI	1.41	0.24	1.36	0.25	0.00	1.75	0.20	1.81	0.21	0.01
% deliveries	0.17	0.12	0.17	0.13	0.32	0.14	0.11	0.15	0.11	0.16
Lagged unemployment	0.06	0.01	0.06	0.01	0.00	0.06	0.01	0.06	0.01	0.81
Residents per bed	0.07	0.15	0.06	0.15	0.02	0.35	0.26	0.43	0.25	0.00
Non-Medicare discharges	7706	7546	6660	7320	0.00	19987	10964	20604	9405	0.50
% Medicare	0.41	0.11	0.41	0.12	0.00	0.34	0.08	0.32	0.09	0.01
% Medicaid	0.13	0.09	0.15	0.10	0.00	0.12	0.10	0.15	0.11	0.00
Number of observations	3688		3685			287		220		

Unit of observation is the hospital x year for the years 2003–2006.

and independent variables for the years 2003 to 2006. Overall, the two groups of hospitals are very similar. Although the means of many of the variables are statistically different at a P-value of 0.05, they are of similar magnitude, and the statistical differences are primarily driven by the precision of the estimates. That being said, hospitals with below average investment returns (i.e., larger losses) had slightly higher initial reserves. Similarly, these high-loss hospitals were more likely to have psychiatric emergency departments as well as the three relatively profitable services described above. Importantly, the two groups of hospitals had pre-financial shock price levels that were very similar in magnitude.

A more specific concern about the exogeneity of the decrease in net assets is that they were driven by local economic factors that might themselves directly affect local demand for hospital services and thus outcomes such as prices and service offerings. To address this concern, we note that there is no economically meaningful or statistically significant relationship between a hospital's local unemployment rate and the magnitude of its financial shock. To more systematically demonstrate this fact, we reestimated a specification of equation (1) that includes the local unemployment rate and the Office of Federal Housing Enterprise Oversight (OFHEO) index of housing prices.[18] Figure 1 in Appendix 2 contains the estimated coefficients and 95% confidence intervals for this specification. These estimates are remarkably similar to the main specification in Figures 2(a)–2(d). Beyond these specific economic controls, there are a number of time-varying unobservable economic conditions that might also be of concern. Therefore, we also estimated a specification that accounts for the potentially wide variety of unobservable differences across geographies by including a full set of state by year fixed effects. The estimated coefficients are contained in Figure 2 of Appendix 2, and show that the results are nearly identical to our main specification.

Beyond questions about changes in the local economy, we may be concerned that our measure of net assets includes the value of the hospital's physical plant and might therefore capture, to some extent, the health of the local real estate market. This would be problematic both because hospital responses to changes in the market value of illiquid assets could differ from responses to other wealth shocks, and because it would suggest that our measure of asset losses was strongly tied to factors that might independently affect local demand for medical services (given our earlier estimates, we would be primarily worried about substate factors that are not captured by the state by year fixed-effects specification). To examine whether the financial shock is driven by changes in fixed assets, we reestimated equation (1) for different types of assets. These estimates are given in Appendix 2, Figure 3 and do not show large changes in fixed assets, and therefore, suggest that in our financial data, physical assets are not revalued annually based upon local market prices and are not the source of the large declines in the value of the net assets that we exploit.

Taken together, this discussion and figures contained in Appendix 2 provide clear evidence that the financial shocks for hospitals were not driven by conditions in their local economy. Instead, these changes were the result of different investment decisions made by hospitals prior to the 2008 collapse.

Another concern is that financial losses may be limited to assets that have restricted uses. If this was the case, then the dimensions along which hospitals could respond to losses would be limited. First, we again note the observed change in net assets is not driven by changes in the value of fixed or illiquid assets. There could also be a concern that statutory restrictions on the use of funds could affect our results. However, as of 2007, restricted funds account for less than 5% of hospital net assets. That is not to say that 5% of hospitals have completely restricted endowments, as hospitals have both restricted and unrestricted portions of their endowment. Given the fungibility of dollars across these accounts, it is unclear how much the restriction on the 5% of endowment funds truly constrains hospital behavior. In Appendix 2, we further discuss a number of steps we take to ensure that our results are not driven by restricted endowments.

[18] Because only nonsystem hospitals must have a unique location, we restrict this analysis to that sample.

5. The 2008 stock market collapse and hospital behavior

■ We are interested in how hospitals change their behavior across a variety of dimensions in response to financial shocks. In the analysis below, we begin with a preliminary exploration of the relationship between changes in a hospital's respective net assets and the different dependent variables in all years. Specifically, we estimate the following regression on a sample of data from 2003 to 2011:

$$Y_{it} = \alpha_i + \alpha_t + [\beta X_{it}] + \lambda_t (FinShock_i), \tag{2}$$

where, Y_{it} is the respective dependent variable (e.g., prices), α_i are hospital fixed effects, α_t are year fixed effects, X_{it} are a variety of time-varying hospital-level controls that are chosen for the specific dependent variable, λ_t are a series of year coefficients for the years 2004 to 2011, and $FinShock_i$ is the change in the value of net assets from 2007 to 2008 as described above.[19]

We assess the results of equation (2) by plotting the λ_t coefficients and comparing the values before and after 2008. The λ_t coefficients indicate the relationship between 2008 hospital financial shocks and the average hospital's behavior in each year. For t < 2008, we ask whether there is a relationship between the investment strategy of the hospital that led to large 2008 losses and their past behavior, with respect to the dependent variables. Similarly, for t > 2008, we examine whether hospital financial losses in 2008 are systematically related to the dependent variable and therefore provide evidence of cost shifting.

To obtain a more definitive test of changes in hospital behavior, we then aggregate the λ_t coefficients into a preperiod and postperiod and estimate the following regression:

$$Y_{it} = \alpha_i + \alpha_t + [\beta X_{it}] + \lambda_{post} * I(year > 2008) * (FinShock_i), \tag{3}$$

where $I(year > 2008)$ is an indicator variable for the years after 2008 and all other variables are defined as in equation (2).[20] For each dependent variable below, our estimate of λ_{post} documents the change in behavior following the collapse for a hospital based on its financial shock.

The remainder of this section is structured as follows. First, we estimate the relationship between the financial shock from the 2008 stock market collapse and the prices at the average hospital, and find no effect. Next, we estimate the pricing behavior of a subset of high-quality hospitals that plausibly have greater rents resulting from their market power and find that these hospitals do exhibit price-based cost shifting. We then examine other margins along which hospitals may have responded to stock market losses: operating costs, uncompensated care, and service offerings.

□ **Effect of stock market losses on private prices.** We begin by examining changes in non-Medicare prices following financial shocks. As a preliminary exploration of this topic, we estimate equation (2) with a dependent variable equal to the log of the non-Medicare price described above.[21] If hospitals suffering large financial shocks raised prices in response to their losses at a faster rate than did other hospitals, then λ_t for $t \geq 2008$ should be smaller than λ_t for $t < 2008$. However, if hospitals are unable to raise prices in response to investment losses, these coefficients should be similar before and after the collapse.

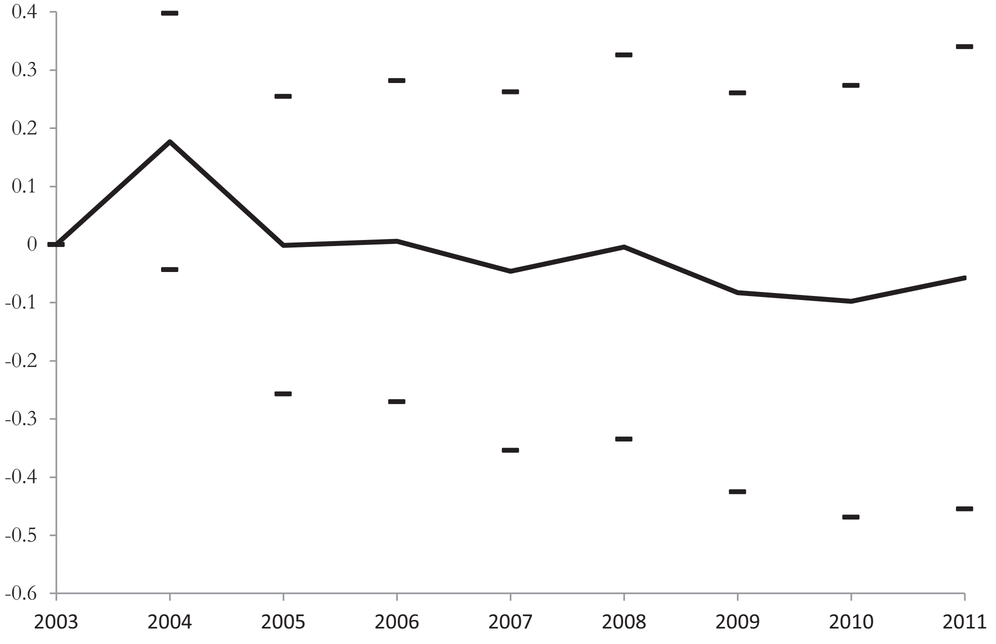
[19] If the regression's dependent variable is an average (e.g., the price per non-Medicare discharge), then we weight each facility by its average value of the dependent variable's denominator (e.g., the facility's average non-Medicare discharges). If the dependent is not an average, then we leave the regression unweighted.

[20] We remove 2008 as a transition year; if we include 2008 in the postperiod, the evidence against cost shifting strengthens.

[21] We log *price* both because the variable is highly skewed and because the log specification does a better job of predicting price changes. (This is based on a comparison of price predictions, and is not a simple comparison of R^2 across log and linear models.)

FIGURE 3a

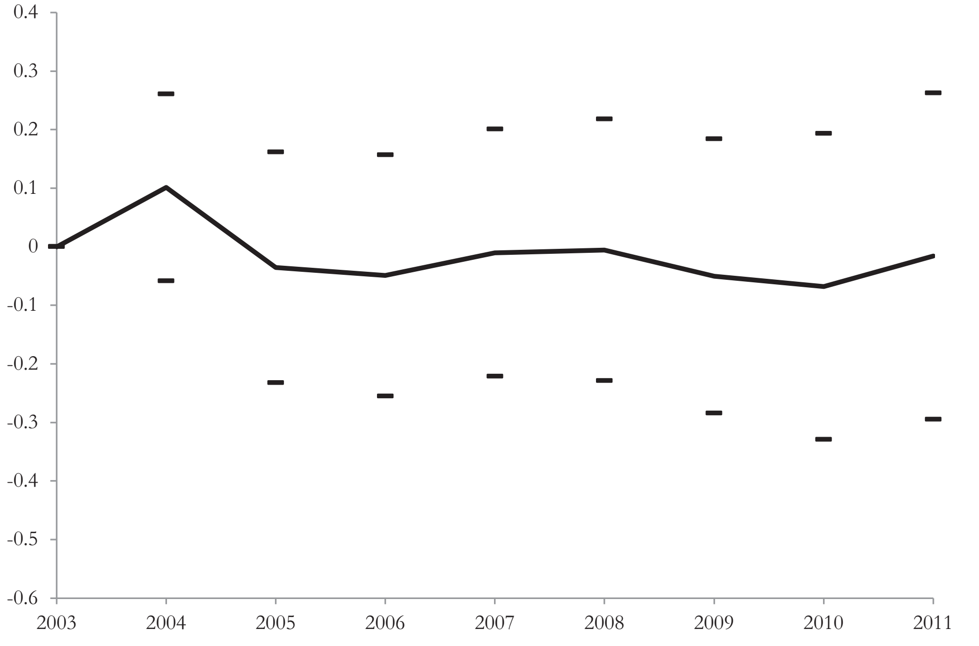
OLS ESTIMATES OF IMPACT OF *FinShock* ON LOG PRICE NONSYSTEM HOSPITALS



Regressions include "preferred" controls as well as facility and year fixed effects. Regressions are weighted by non-Medicare discharges. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 3b

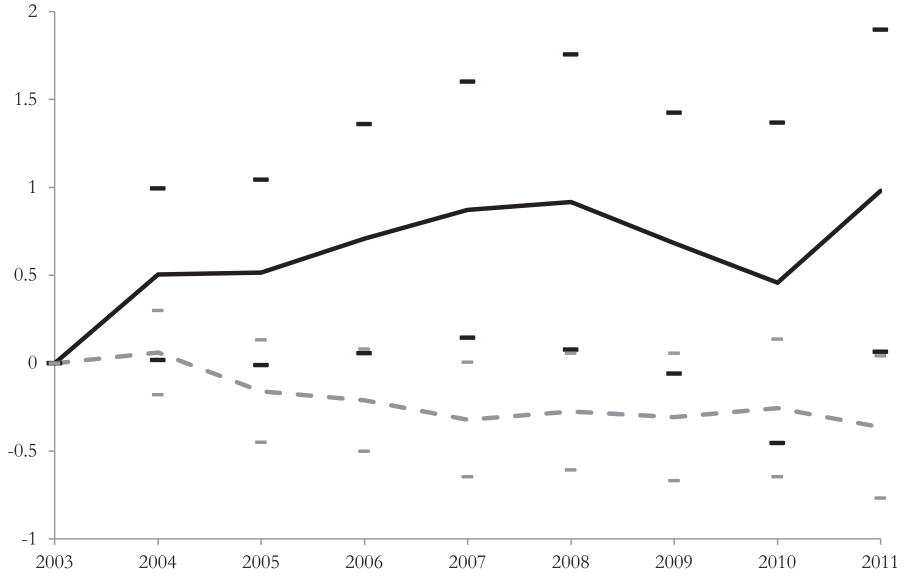
OLS ESTIMATES OF IMPACT OF *FinShock* ON LOG PRICE ALL HOSPITALS



Regressions include "preferred" controls as well as facility and year fixed effects. Regressions are weighted by non-Medicare discharges. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 3c

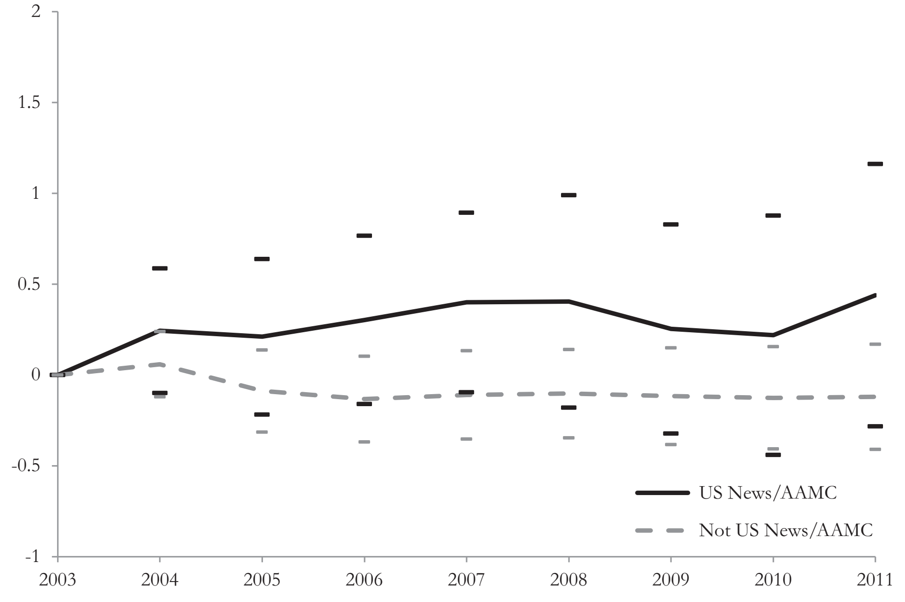
OLS ESTIMATES OF IMPACT OF *FinShock* ON LOG PRICE NONSYSTEM HOSPITALS BASED ON US NEWS/AAMC STATUS



Regressions include "preferred" controls as well as facility and year fixed effects. Regressions are weighted by non-Medicare discharges. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 3d

OLS ESTIMATES OF IMPACT OF *FinShock* ON LOG PRICE ALL HOSPITALS BASED ON US NEWS/AAMC STATUS



Regressions include "preferred" controls as well as facility and year fixed effects. Regressions are weighted by non-Medicare discharges. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

TABLE 2 OLS Estimates of the Impact of *FinShock* on Log Price

	(1)	(2)	(3)	(4)	(5)	(6)
FinShock*(year > 2008)	−0.0864	−0.0404	−0.108	−0.0477	−0.00203	0.0119
	(0.120)	(0.0896)	(0.125)	(0.0921)	(0.145)	(0.113)
ln(wage)			0.318**	0.405***	0.315**	0.404***
			(0.130)	(0.113)	(0.129)	(0.113)
ln(CMI)			0.237**	0.371***	0.239**	0.372***
			(0.107)	(0.0675)	(0.107)	(0.0677)
% deliveries			0.528***	0.476***	0.528***	0.477***
			(0.115)	(0.0776)	(0.115)	(0.0777)
Lagged unemployment			0.518	0.288	0.512	0.287
			(0.595)	(0.394)	(0.595)	(0.394)
Residents per bed			−0.123	−0.0696	−0.122	−0.0713
			(0.456)	(0.296)	(0.457)	(0.296)
Sample	Nonsystem	All	Nonsystem	All	Nonsystem	All
Include FinShock*(year)	N	N	N	N	Y	Y
R^2	0.378	0.393	0.389	0.410	0.390	0.410
N	6133	14380	5952	13932	5952	13932

Unreported covariates include facility and year fixed effects. Regressions are restricted to 2003–2011, excluding 2008. Regressions are weighted by non-Medicare discharges. Standard errors are in parentheses and are clustered on hospital system (with each nonsystem facility its own cluster).
*P-value <= 0.10, **P-value <= 0.05, ***P-value <= 0.001.

Figure 3a presents estimates of λ_t by year for nonsystem hospitals. This figure shows no meaningful change in prices driven by investment losses resulting from the collapse. There is also no pretrend in the λ_t coefficients, suggesting that the average hospital's pricing decisions prior to the collapse were unrelated to the investment strategy resulting in 2008 investment losses. Figure 3b contains a similar analysis for all hospitals in our sample and also reveals no evidence of an impact of the collapse on hospital pricing decisions.

Table 2 contains the estimated coefficients from equation (3) for a dependent variable equal to the log of the non-Medicare price. Estimates from our preferred specification are presented in columns (3) and (4) for nonsystem hospitals and the entire sample, respectively. Regardless of the included controls, our results are consistent with the null hypothesis of no price-based cost shifting to recover from the financial shocks. Considering the magnitude of our estimates, it would be difficult for a hospital to recover its losses through these price responses over any reasonable time horizon. For example, using column (3) as our central estimate, a nonsystem hospital that suffers endowment losses of 1% of annual operating costs increases non-Medicare prices in the postperiod by a statistically insignificant 0.108%. To understand the magnitude of this estimate, recall from Table 1 that about 41% of patients are covered by Medicare, and price-based cost shifting cannot generate higher profits from Medicare patients. Also note that nearly all endowment losses persisted (i.e., factors such as the stock market recovery had little impact on attenuating relative losses). Based on our point estimate, we compute that it would take the average hospital approximately $1/(0.108^*.59) = 15.7$ years for hospitals to recover the losses through higher prices. This is comparable to the average historical price to earnings ratio for the S&P 500.[22] In other words, although indistinguishable from zero, the point estimate is similar to the change in the "flow" of income from assets that hospitals could have anticipated receiving as

[22] If we consider the upper bound of the 95% confidence interval, a nonsystem hospital that suffers endowment losses of 1% of annual operating costs increases non-Medicare prices in the postperiod by 0.354%. Even with this response, it would take nearly five years for a hospital to recover its losses.

TABLE 3 OLS Estimates of the Impact of *FinShock* on Log Price

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: US News/AAMC Sample						
FinShock*(year > 2008)	0.142	0.0255	0.159	0.0637	−0.744*	−0.357
	(0.319)	(0.221)	(0.308)	(0.217)	(0.384)	(0.237)
Sample	Nonsystem	All	Nonsystem	All	Nonsystem	All
Includes full controls?	N	N	Y	Y	Y	Y
Include FinShock*(year)	N	N	N	N	Y	Y
R^2	0.446	0.527	0.457	0.540	0.468	0.542
N	404	994	388	973	388	973
Panel B: Not US News/AAMC Sample						
FinShock*(year > 2008)	−0.152	−0.0484	−0.180	−0.0660	0.225	0.106
	(0.122)	(0.0957)	(0.124)	(0.0979)	(0.145)	(0.127)
Sample	Nonsystem	All	Nonsystem	All	Nonsystem	All
Includes full controls?	N	N	Y	Y	Y	Y
Include FinShock*(year)	N	N	N	N	Y	Y
R^2	0.366	0.365	0.381	0.384	0.383	0.384
N	5729	13386	5564	12959	5564	12959

Unreported covariates include facility and year fixed effects. Regressions are restricted to 2003–2011, excluding 2008. Regressions are weighted by non-Medicare discharges. Standard errors are in parentheses and are clustered on hospital system (with each nonsystem facility its own cluster).
*P-value <= 0.10, **P-value <= 0.05, ***P-value <= 0.001.

a result of their losses. These numbers are also broadly comparable to our estimates of the direct effect of *FinShock* on *reserves*.

□ **Do a subset of hospitals cost shift?** The lack of a price response for the average hospital does not rule out price-based cost shifting among a subset of hospitals. As we discuss above, it is possible that, depending upon how much a hospital can extract in rents, each hospital will choose different ways to redistribute its marginal rents. To address this point, we examine whether there is heterogeneity in a hospital's decision to engage in price-based cost shifting by splitting hospitals using our two measures of market power, which should result in additional rents available for redistribution. In addition, finding evidence of price changes among hospitals with market power would suggest that the lack of a broader price response is not solely because stock market losses are theoretically distinct from other financial shocks considered in the previous literature.

Figure 3c contains the estimated coefficients from two specifications of equation (2) for nonsystem hospitals based on whether the hospital is in the US News\AAMC sample. The solid line depicts the β_t coefficients for the US News\AAMC sample, whereas the dashed line represents the coefficients for the remaining hospitals. There is a definitive pretrend from 2003 up to 2007, where US News\AAMC hospitals with larger 2008 endowment losses decreased their prices compared to hospitals with smaller endowment losses. This pretrend is consistent with these hospitals sharing the gain of earlier positive financial shocks. These positive shocks could be the result of a correlation in the investment returns from strategies that ultimately resulted in greater endowment losses in 2008, with hospitals returning investment gains from earlier periods to privately insured patients in the form of lower prices.[23] Following 2008, there is a clear trend

[23] Unreported analysis supports this channel. Specifically, a nonsystem US News\AAMC hospital with endowment losses of 1% of operating costs in 2008 had previously earned an extra 0.25% of operating costs in investment returns from 2003 up to 2007—the years of the pretrend.

TABLE 4 OLS Estimates of the Impact of *FinShock* on Log Cost per Discharge

	(1)	(2)	(3)	(4)	(5)	(6)
FinShock*(year > 2008)	0.00443	0.00832	−0.0157	−0.00465	0.0432	0.0310
	(0.0676)	(0.0580)	(0.0647)	(0.0539)	(0.0759)	(0.0629)
ln(wage)			0.302***	0.404***	0.301***	0.404***
			(0.0681)	(0.0617)	(0.0679)	(0.0618)
ln(CMI)			0.486***	0.516***	0.487***	0.517***
			(0.0548)	(0.0422)	(0.0548)	(0.0423)
% deliveries			0.450***	0.410***	0.450***	0.410***
			(0.0658)	(0.0421)	(0.0659)	(0.0422)
Lagged unemployment			0.496	0.452*	0.493	0.452*
			(0.315)	(0.241)	(0.314)	(0.241)
Residents per bed			−0.339	−0.0525	−0.339	−0.0532
			(0.271)	(0.175)	(0.271)	(0.174)
Sample	Nonsystem	All	Nonsystem	All	Nonsystem	All
Include FinShock*(year)	N	N	N	N	Y	Y
R^2	0.668	0.663	0.705	0.702	0.705	0.702
N	6228	14571	6080	14150	6080	14150

Unreported covariates include facility and year fixed effects. Regressions are restricted to 2003–2011, excluding 2008. Regressions are weighted by discharges. Standard errors are in parentheses and are clustered on hospital system (with each nonsystem facility its own cluster).
*P-value <= 0.10, **P-value <= 0.05, ***P-value <= 0.001.

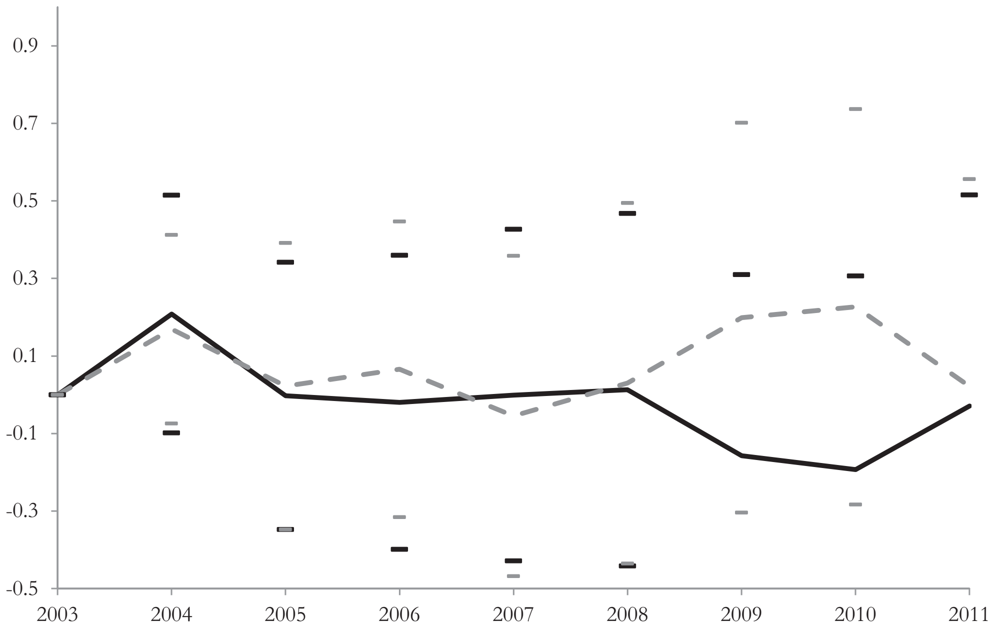
break where high-quality hospitals suffering large investment losses discontinued their previous pattern of decreasing prices. This would be consistent with the "share the pain" feature of the model, where hospitals raise prices in response to a financial shock. In other words, both the pretrend and the post-2008 deviation from this trend provide evidence in support of cost shifting through prices in the US News/AAMC hospital sample.

In order to estimate the statistical significance of this trend break, we reestimated a specification of equation (3), including an interaction between *FinShock* and a linear time trend. In this specification, a statistically significant and negative λ_{post} coefficient would serve as evidence that hospitals suffering large financial shocks broke from the positive pretrend in pricing behavior. This would result in prices that were higher following 2008 than would have been expected in the absence of the investment losses. Columns (5) and (6) of Table 3 contains the estimates from this specification for nonsystem US News\AAMC hospitals and the full sample of US News\AAMC hospitals, respectively. These estimates show marginally statistically significant (P-value = 0.059 and P-value = 0.135) changes in pricing behavior for nonsystem and all hospitals, respectively. This negative coefficient means that US News\AAMC hospitals suffering larger investment losses in 2008 exhibited some cost shifting. For comparison sake, a similar pretrend analysis for all hospitals is contained in columns (5) and (6) of Table 2. These estimates are small and statistically insignificant.

The dashed line in Figure 3c depicts the estimates for the hospitals not included in the US News\AAMC sample. These facilities display neither a pretrend nor evidence of cost shifting. An unreported analysis of these hospitals demonstrated a similar correlation to the US News\AAMC hospitals between 2008 investment losses and returns in earlier years. However, these hospitals are not "sharing the gain" of these earlier returns by lowering prices. Similarly, there is no evidence that they "shared the pain" through lower prices after the stock market crash. Importantly, the hospitals represented by the dashed line comprise approximately 93% of the facilities and treat 80% of the patients in our sample in 2007, demonstrating that the vast majority of patients did not face higher prices as a result of the 2008 financial shock.

FIGURE 4a

OLS ESTIMATES OF IMPACT OF *FinShock* ON LOG PRICE NONSYSTEM HOSPITALS BASED ON WTP



Regressions include "preferred" controls as well as facility and year fixed effects. Regressions are weighted by non-Medicare discharges. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

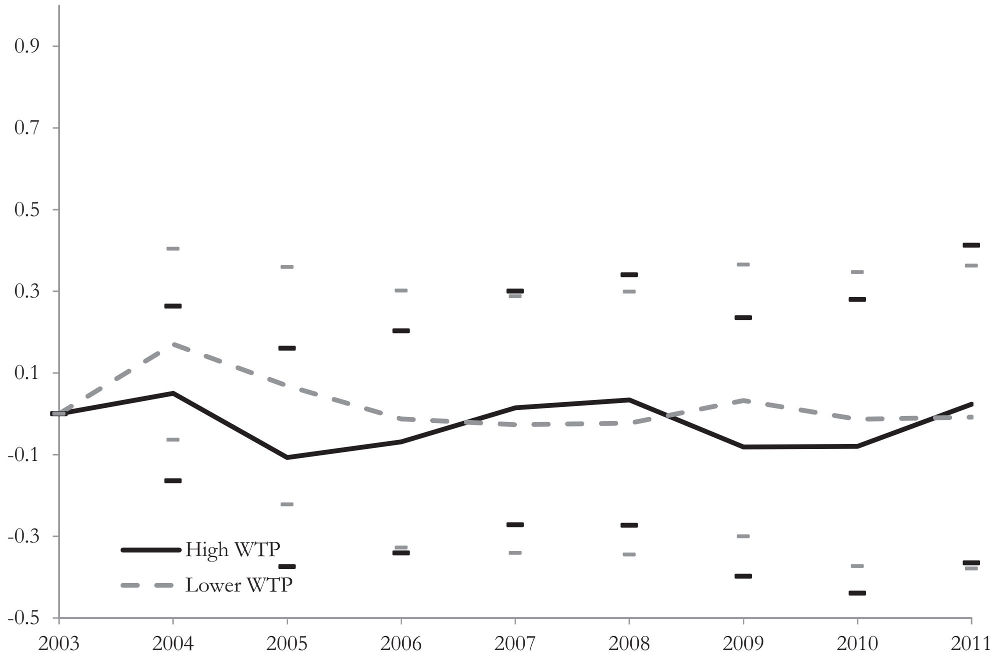
Table 3 continues the investigation of price responses but breaks the sample by US News/AAMC status. Panel A illustrates that the hospitals in the US News/AAMC sample estimates are large and relatively imprecise. At the point estimate of 0.744 in Table 3, Panel A, column (5), the nonsystem hospitals in this sample would have recovered their losses in 2.3 years. Panel B presents the analysis for the remaining sample of hospitals. For these hospitals, the results have the wrong sign and present our strongest evidence against price-based cost shifting by the average nonprofit hospital. Even at the lower bound of the 95% confidence interval for the parameter estimate for *FinShock*, it would take a non-US News/AAMC hospital 28.7 years to earn back its losses. In unreported results, we can reject the null hypothesis that the effect of *FinShock* on prices is the same for the US News\AAMC and non-US News\AAMC sample (P-value = 0.02 for nonsystem hospitals and P-value = 0.08 for all hospitals).

One concern with the above results is that US News\AAMC hospitals with large investment losses were fundamentally different from similar quality hospitals with smaller losses, and our estimates are just picking up a time-varying effect of this difference. To examine this possibility, the second panel of Table 1 contains summary statistics for US News\AAMC hospitals based on the size of the endowment losses. These hospitals are all very similar across a wide variety of characteristics, suggesting that the changes in pricing behavior are not the results of systematic differences in this group of hospitals based on investment returns.

Figure 4a present the estimates from a specification of equation (2) for nonsystem hospitals in the highest and lower two terciles of the WTP measure of hospital market power. Figure 4b provides similar estimates for all hospitals in the highest and lower two terciles, respectively. In Appendix 5, Table 2, we confirm that none of these specifications have statistically significant evidence of cost shifting. Focusing on the nonsystem results, the point estimates suggest a moderate level of price-based cost shifting (but are imprecisely measured) among high WTP

FIGURE 4b

OLS ESTIMATES OF IMPACT OF *FinShock* ON LOG PRICE ALL HOSPITALS BASED ON WTP



Regressions include "preferred" controls as well as facility and year fixed effects. Regressions are weighted by non-Medicare discharges. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

TABLE 5 OLS Estimates of the Impact of *FinShock* on Uncompensated Care as Share of Gross Patient Revenues

	(1)	(2)	(3)	(4)	(5)	(6)
FinShock*(year > 2008)	0.00690	−0.00687	0.00645	−0.00805	0.00651	−0.00380
	(0.00871)	(0.00783)	(0.00872)	(0.00765)	(0.0109)	(0.00950)
ln(wage)			0.0236	0.0737**	0.0236	0.0736**
			(0.0475)	(0.0357)	(0.0475)	(0.0357)
Lagged unemployment			−0.0180*	−0.00282	−0.0180*	−0.00292
			(0.0106)	(0.00894)	(0.0106)	(0.00897)
Sample	Nonsystem	All	Nonsystem	All	Nonsystem	All
Include FinShock*(year)	N	N	N	N	Y	Y
R^2	0.100	0.103	0.108	0.109	0.108	0.109
N	2811	6593	2780	6562	2780	6562

Unreported covariates include facility and year fixed effects. Regressions are restricted to 2003–2011, excluding 2008. Regressions are weighted by facility average gross patient revenues. Standard errors are in parentheses and are clustered on hospital system (with each nonsystem facility its own cluster).
*P-value <= 0.10, **P-value <= 0.05, ***P-value <= 0.001.

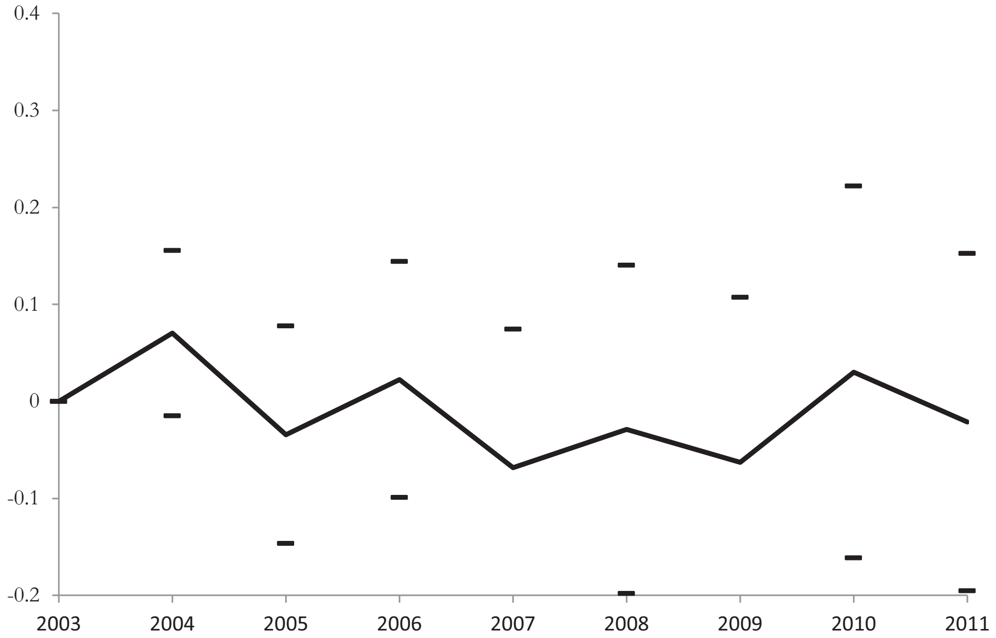
hospitals. There is relatively strong evidence against price-based cost shifting for the remaining hospitals.[24]

Our estimates using two different proxy measures of market power demonstrate that only a small subset of hospitals with substantial market power cost shift using prices after their investment

[24] Specifications 5 and 6 run on the lower two terciles of WTP yield point estimates inconsistent with cost shifting. At the lower bound of the 95% confidence interval for the parameter estimate for *FinShock*, it would take a non-high quality hospital 10 years to earn back its losses.

FIGURE 5a

OLS ESTIMATES OF IMPACT OF *FinShock* ON LOG COST PER DISCHARGE NONSYSTEM HOSPITALS



Regressions include "preferred" controls as well as facility and year fixed effects. Regressions are weighted by non-Medicare discharges. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

losses. Importantly for policy considerations, the US News\AAMC hospitals represent less than 10% of US hospitals.

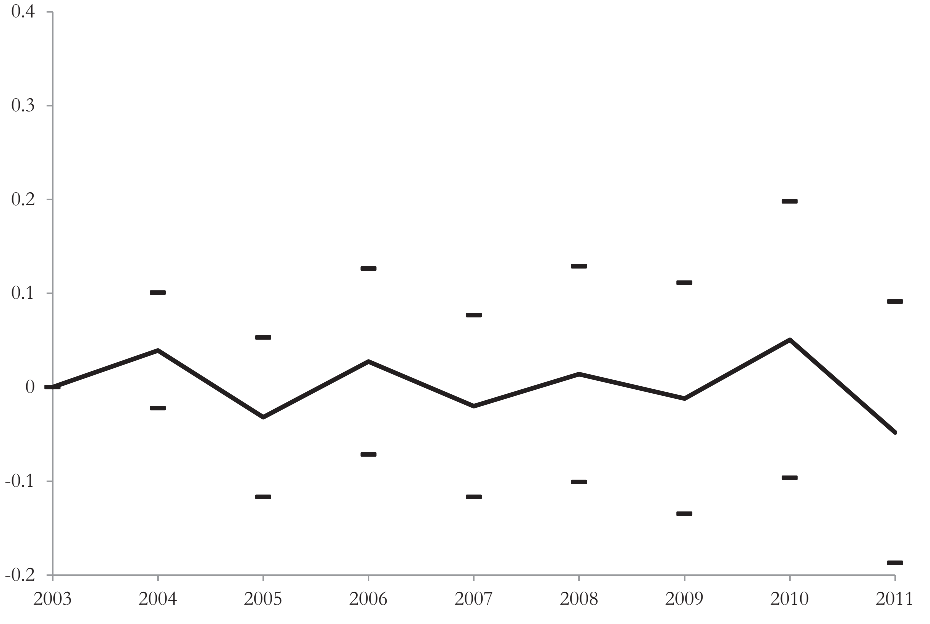
□ **Effect of stock market losses on operating costs per discharge.** In this section, we study whether hospitals responded to a financial shock by cutting costs. Similar to our analysis of price, we estimate two sets of regressions. Figure 5 plots the results from the pretrend analysis using our preferred set of controls from the corresponding regressions in Table 4. As with the other figures, Figure 5a and Figure 5b present the results for nonsystem and all hospitals, respectively. Figure 5c and Figure 5d perform the same analysis, but separate out the US News\AAMC Sample.[25] Overall, there is no evidence of a statistically or economically meaningful adjustment of operating costs per discharge following a financial shock. As a *caveat*, these costs results are less generalizable to other types of profit shocks, such as Medicare and Medicaid price cuts, than our price results. Profit-maximizing hospitals would not respond to wealth shocks with "cost shifting" or "cost cutting" but could be expected to respond to price changes (i.e., Medicare and Medicaid price cuts) by decreasing per patient costs. This is because when margins fall, profit maximizers have incentives to reduce costs/quality.

□ **Effect of stock market losses on uncompensated care.** We next examine whether hospitals reduce their offering of uncompensated care services following a financial shock. Although federal and state regulations mandate that all hospitals treat emergency cases regardless of insurance status, hospitals can exercise discretion beyond this minimum level of service to change

[25] Appendix 5, Tables 3 and 4, present pooled estimates of the effect of endowment losses on cost cutting by US News/AAMC status and by WTP status.

FIGURE 5b

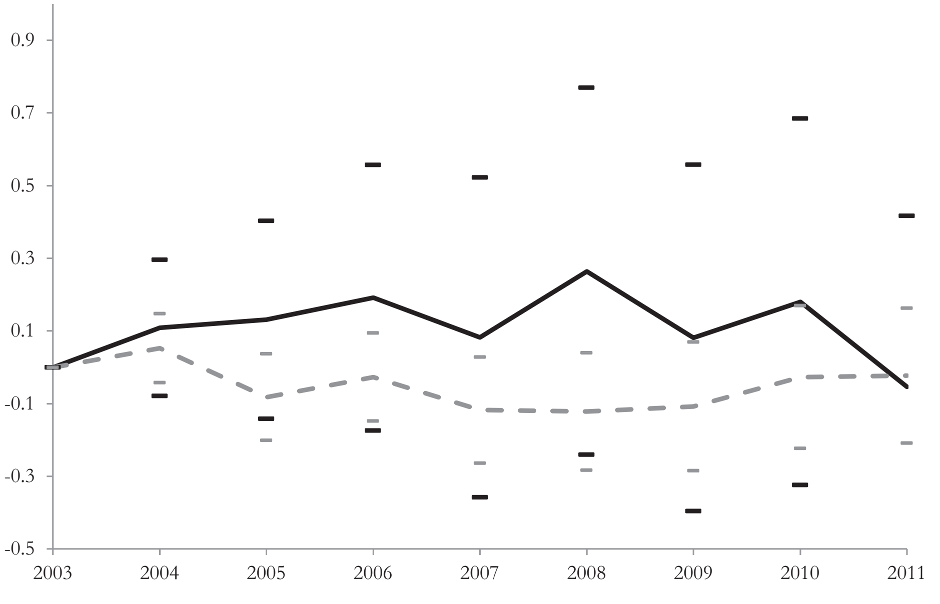
OLS ESTIMATES OF IMPACT OF *FinShock* ON LOG COST PER DISCHARGE ALL HOSPITALS



Regressions include "preferred" controls as well as facility and year fixed effects. Regressions are weighted by non-Medicare discharges. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 5c

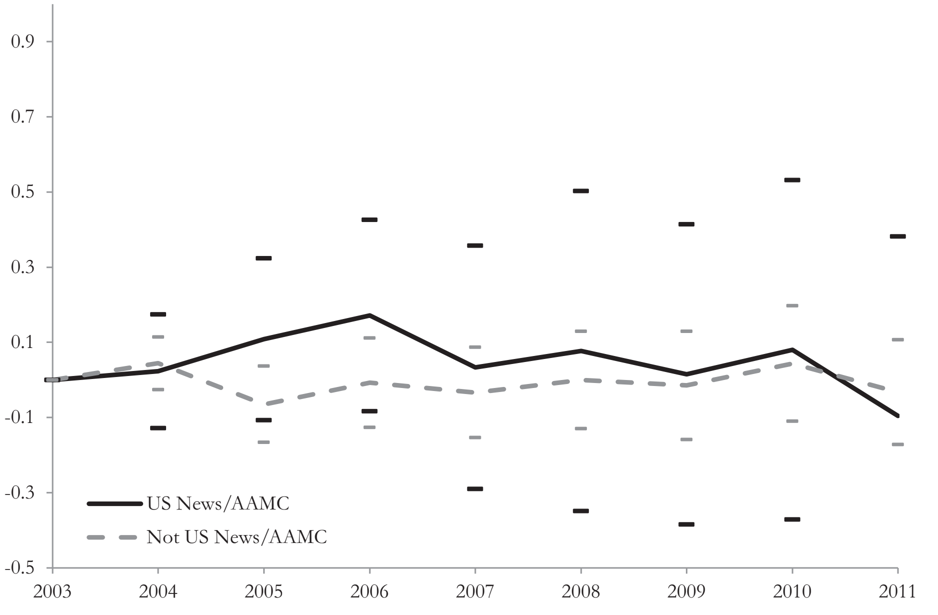
OLS ESTIMATES OF IMPACT OF *FinShock* ON LOG COST PER DISCHARGE NONSYSTEM HOSPITALS BASED ON US NEWS/AAMC STATUS



Regressions include "preferred" controls as well as facility and year fixed effects. Regressions are weighted by non-Medicare discharges. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 5d

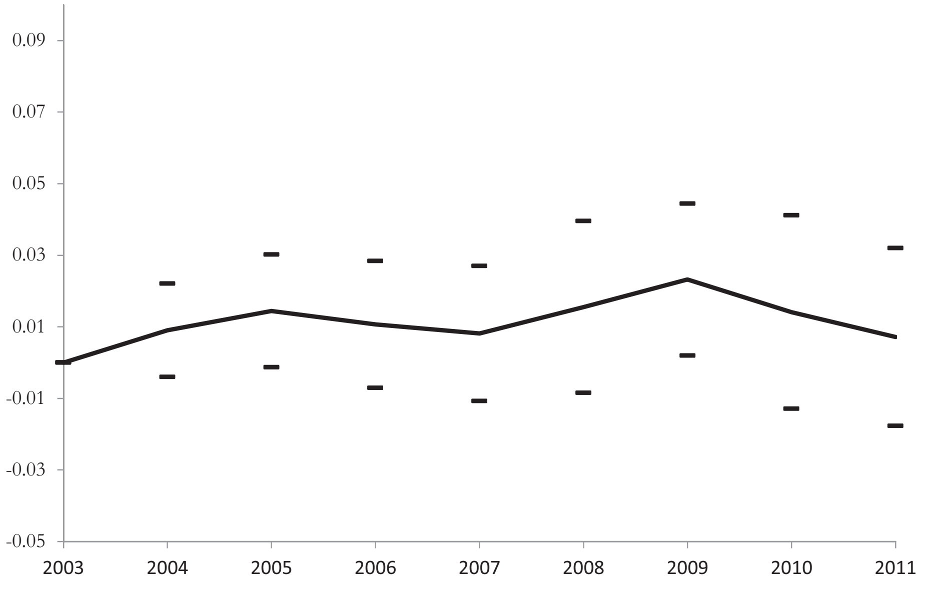
OLS ESTIMATES OF IMPACT OF *FinShock* ON LOG COST PER DISCHARGE ALL HOSPITALS BASED ON US NEWS/AAMC STATUS



Regressions include "preferred" controls as well as facility and year fixed effects. Regressions are weighted by non-Medicare discharges. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 6a

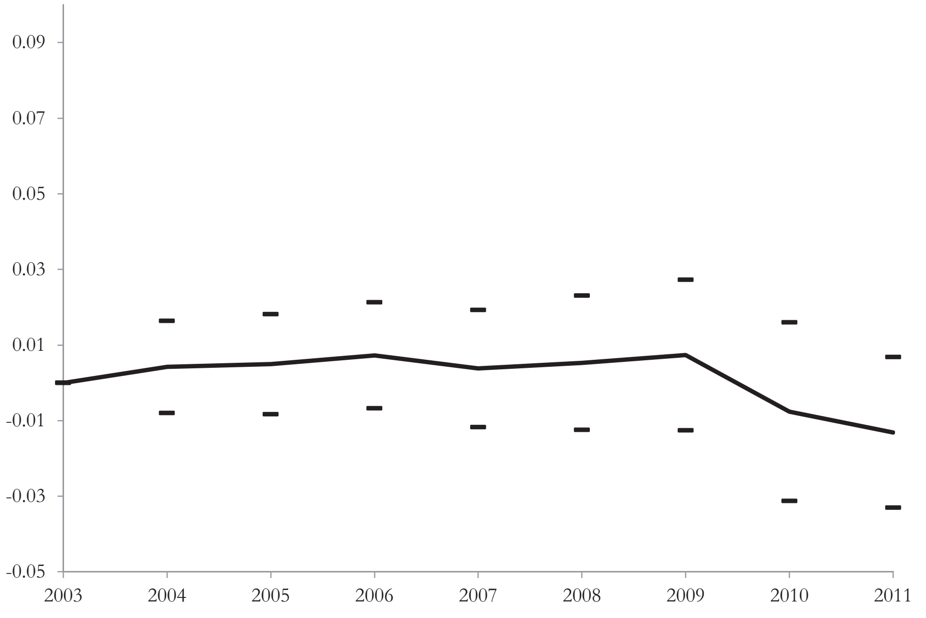
OLS ESTIMATES OF IMPACT OF *FinShock* ON UNCOMPENSATED CARE AS SHARE OF GROSS PATIENT REVENUES, NONSYSTEM HOSPITALS



Regressions include "preferred" controls as well as facility and year fixed effects. Regressions are weighted by non-Medicare discharges. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 6b

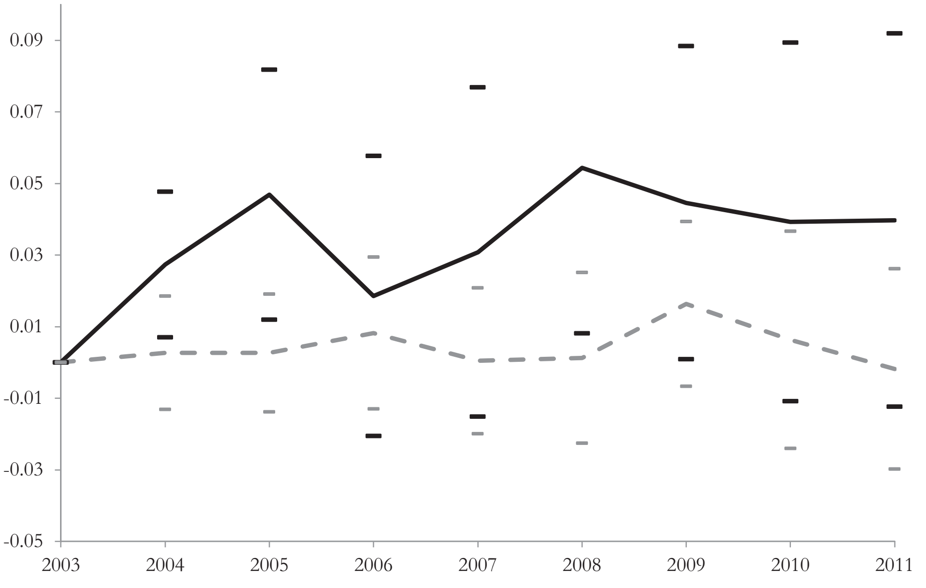
OLS ESTIMATES OF IMPACT OF *FinShock* ON UNCOMPENSATED CARE AS SHARE OF GROSS PATIENT REVENUES, ALL HOSPITALS



Regressions include "preferred" controls as well as facility and year fixed effects. Regressions are weighted by non-Medicare discharges. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 6c

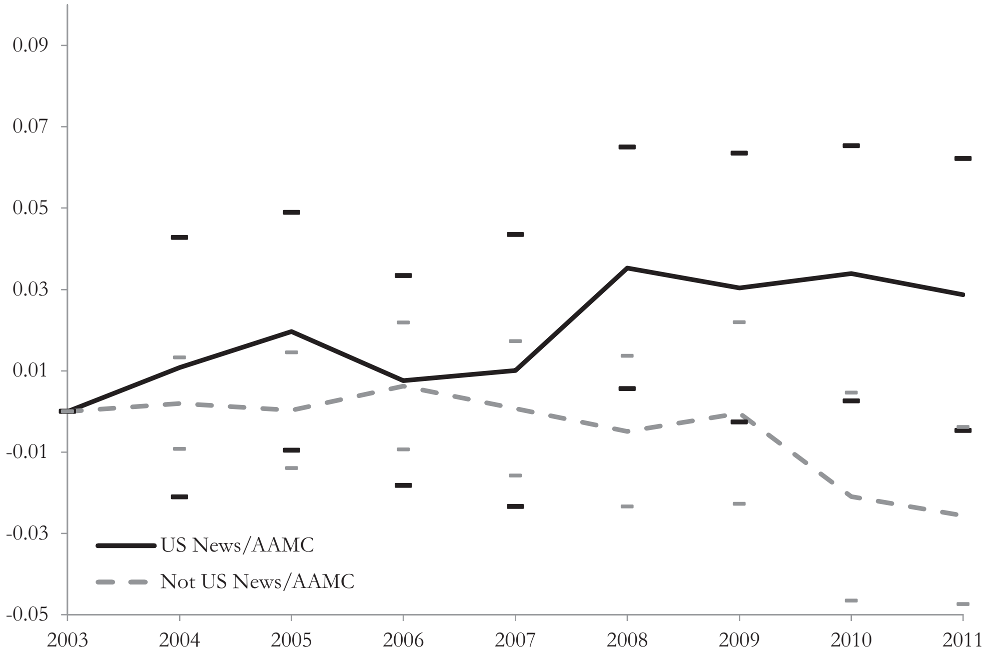
OLS ESTIMATES OF IMPACT OF *FinShock* ON UNCOMPENSATED CARE AS SHARE OF GROSS PATIENT REVENUES, NONSYSTEM HOSPITALS BASED ON US NEWS/AAMC STATUS



Regressions include "preferred" controls as well as facility and year fixed effects. Regressions are weighted by non-Medicare discharges. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 6d

OLS ESTIMATES OF IMPACT OF *FinShock* ON UNCOMPENSATED CARE AS SHARE OF GROSS PATIENT REVENUES, ALL HOSPITALS BASED ON US NEWS/AAMC STATUS



Regressions include "preferred" controls as well as facility and year fixed effects. Regressions are weighted by non-Medicare discharges. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

their exposure to uncompensated care, and this form of public good is one of the more common metrics used to evaluate the community benefit provided by a hospital. We gathered data from the 15 states that collect hospital-level uncompensated care data.[26]

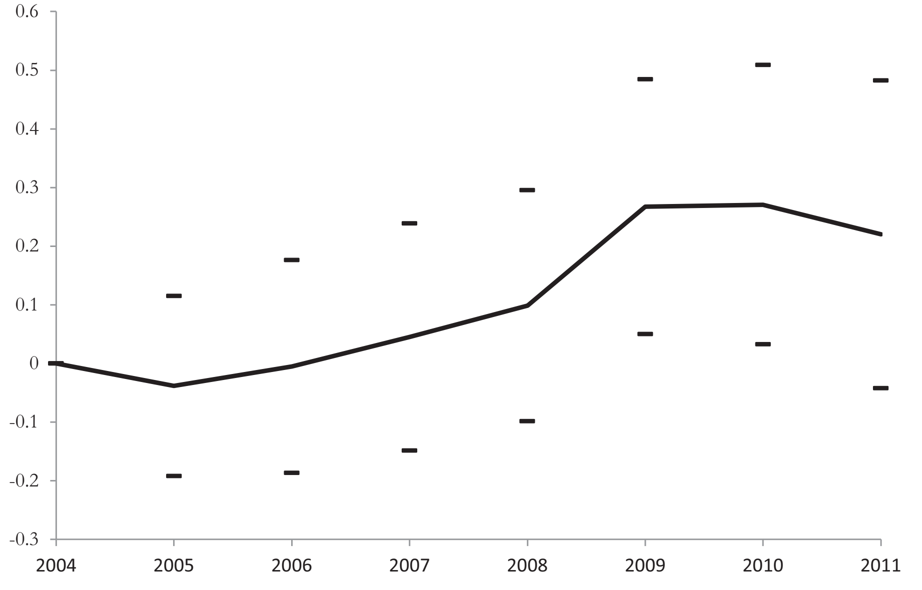
Within our sample, hospital uncompensated care charges account for an average of 4.8% of total charges, with a standard deviation of 3.3% of charges. Figures 6a and 6b present plots of β_t by year for the metric uncompensated care charges as a percentage of total charges for nonsystem hospitals, and all hospitals, respectively. If hospitals decreased the provision of uncompensated care in response to endowment losses, then we would observe $\beta_t > 0$ for 2008 and the following years. However, we find no evidence of decreased uncompensated care provision after 2008 among hospitals with larger stock market losses. Examining the magnitude of our estimates, we can rule out responses that meaningfully contributed to restoring a facility's endowment. If a hospital were to fully recover from its stock market losses in one year by decreasing the provision of charity care, then we would observe $\beta_t = 1$ for that year. The upper bound of the 95% confidence interval for column (4) of Table 5 of the full sample of hospitals is 0.007. This means that within our sample, charity care did not decline enough to make up for a meaningful share of the losses.

The limited response of uncompensated care provision to financial shocks is, in some sense, unsurprising. First, hospitals control only a portion of their uncompensated care costs (Garthwaite, Gross, and Notowidigdo, 2015). Second, given the level of uncompensated care an average hospital in our sample provides, there is limited scope for recouping large financial losses. A hospital losing an extra one standard deviation of endowment relative to operating costs would

[26] As we discuss further in Appendix 3, although these data are a marked improvement over what is available in the Cost Reports, different states have subtle differences and ambiguities in what uncompensated care data they collect, meaning that these results should be interpreted with caution.

FIGURE 7a

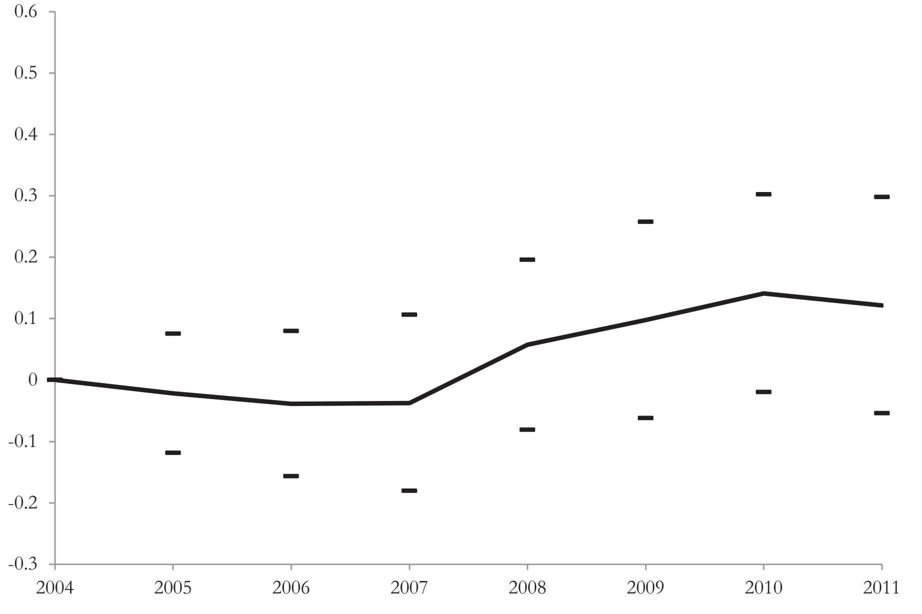
OLS ESTIMATES OF IMPACT OF *FinShock* ON SHARE OF UNPROFITABLE SERVICES OFFERED, NONSYSTEM HOSPITALS



Regressions include "preferred" controls as well as facility and year fixed effects. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 7b

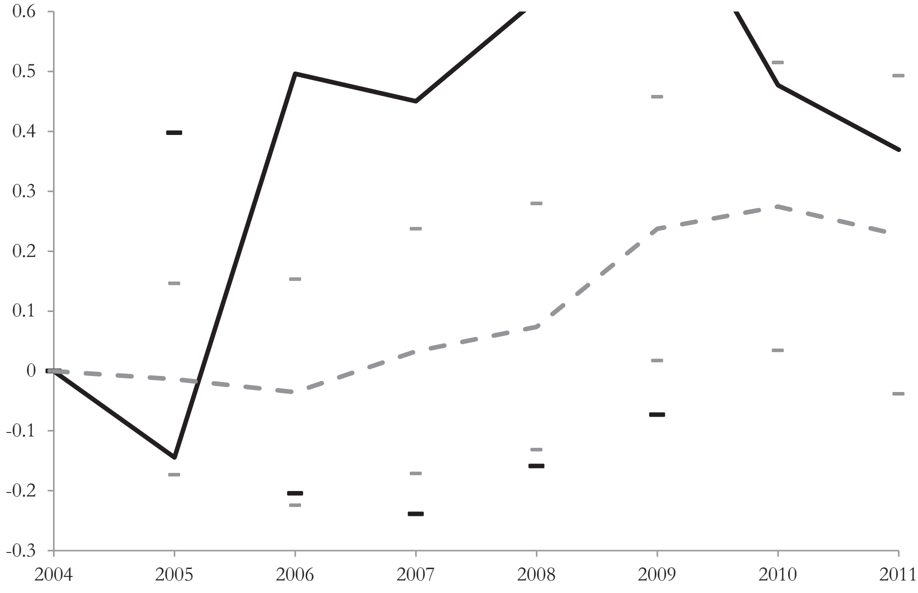
OLS ESTIMATES OF IMPACT OF *FinShock* ON SHARE OF UNPROFITABLE SERVICES OFFERED, ALL HOSPITALS



Regressions include "preferred" controls as well as facility and year fixed effects. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 7c

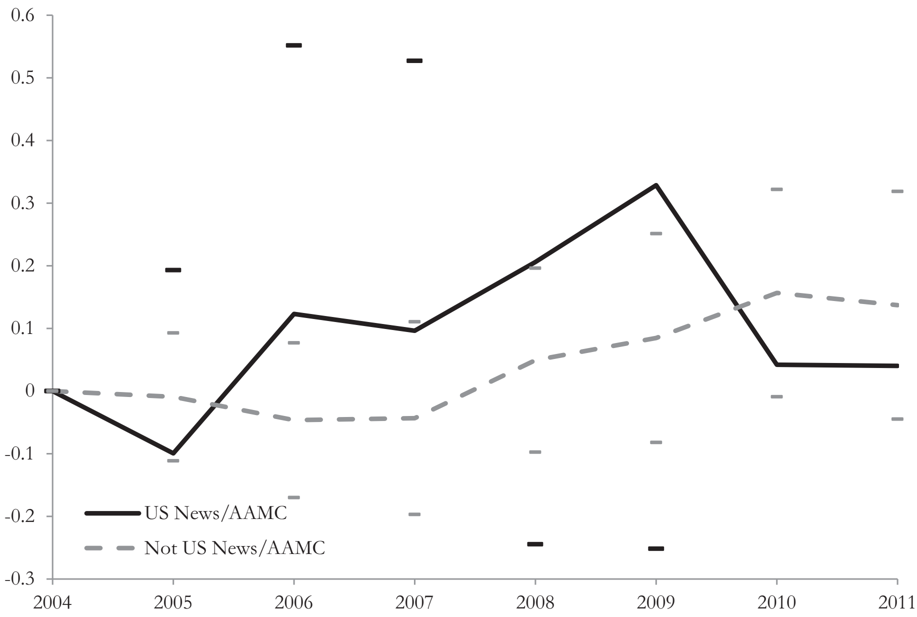
OLS ESTIMATES OF IMPACT OF *FinShock* ON SHARE OF UNPROFITABLE SERVICES OFFERED, NONSYSTEM HOSPITALS BASED ON US NEWS/AAMC STATUS



Regressions include "preferred" controls as well as facility and year fixed effects. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 7d

OLS ESTIMATES OF IMPACT OF *FinShock* ON SHARE OF UNPROFITABLE SERVICES OFFERED, ALL HOSPITALS BASED ON US NEWS/AAMC STATUS



Regressions include "preferred" controls as well as facility and year fixed effects. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

need to decrease uncompensated care by approximately two standard deviations, or approximately two times the median uncompensated care in the sample to make up the relevant funds over the course of a year. For the median hospital, it is, of course, impossible to recoup its losses in a year and given the lack of control over the determinants of a large portion of uncompensated care, it is not clearly feasible to do so over several years. Finally, uncompensated care costs are often the focus of attention for quantifying a hospital's community benefit—particularly in states where these figures are publicly released—and therefore hospitals may be less likely to adjust along this dimension.

In addition to being small relative to hospital losses, adjustments to uncompensated care resulting from the collapse were also small relative to baseline uncompensated care levels. At the upper bound of the 95th confidence interval (0.007), a one standard deviation (0.07) greater endowment loss is associated with 1/70th of a standard deviation change in our uncompensated care measure. Overall, these results suggest that the average hospital did not meaningfully alter uncompensated care provision in response to the collapse.

Figures 6c and 6d present a graphical analysis of whether US News/AAMC hospitals responded differently. We continue to find no evidence that hospitals with larger endowment losses decreased charity care. Among the US News/AAMC sample, the pretrends are sufficiently noisy that it is difficult to determine whether there was a change after the stock market crash. Appendix 3, Table 1, provides pooled estimates. For the sake of consistency with the main analysis, we again interpret column 4. At the upper bound of the 95th confidence interval, the effect for this sample is approximately seven times as large as the effect on average, and therefore more meaningful in terms of its effect on charity care provision. Once again, however, given the low level of charity care provision relative to a hospital's operating costs, we can again rule out changes to charity care that would have allowed hospitals to recover a meaningful share of losses.[27]

□ **Effect of stock market losses on hospital service offerings.** The final margin for cost shifting that we consider is the choice of service offerings. One mechanism for hospitals to share their surplus with society is to offer products and services that are not fully profit-maximizing but improve social welfare. As suggestive evidence of this fact, previous work has found that nonprofit hospitals are more likely to offer services that are relatively unprofitable (Horwitz, 2005). To examine this question, we again estimate equations (2) and (3) using the full set of control variables. We present the resulting estimates in Figure 7.[28] Figure 7a examines the effect of the stock market crash on unprofitable service offerings by nonsystem hospitals, whereas Figure 7b examines the unprofitable offerings of system hospitals. The results are broadly similar, but for reasons we have already discussed, we focus our comments on the nonsystem results.

There is some evidence of a pretrend, but from 2008 to 2009, there is a notable change in the pattern of the estimates, suggesting that hospitals suffering larger financial losses in 2008 were relatively less likely to offer unprofitable services in later years.

Table 6 confirms that these results are statistically significant: the average hospital suffering a large financial shock is more likely to eliminate some unprofitable service offerings than a similar hospital suffering a smaller shock. They are also economically meaningful. Using column (3) as our central estimate, the share of the three unprofitable services offered by a hospital suffering the average endowment loss falls by two percentage points.

This raises two questions. First, are hospitals necessarily eliminating unprofitable services, or are they just cutting back in general? Wealth shocks could cause profit-maximizing firms that use internal capital markets to consider eliminating all services. On the other hand, perhaps

[27] Recall that the variable *Price* includes uncompensated care patients. Therefore, based upon our price analyses, high-quality hospitals might be raising private patient prices or decreasing uncompensated care. The small estimates for changes in uncompensated care provision suggests the results are driven by price changes.

[28] A large number of the controls are potentially endogenous in this regression. Although theoretically a concern, Table 6 confirms that the results are unaffected when we exclude all controls.

TABLE 6 OLS Estimates of the Impact of *FinShock* on Unprofitable Service Offerings

	(1)	(2)	(3)	(4)	(5)	(6)
FinShock*(year > 2008)	0.269**	0.136**	0.251**	0.145**	0.239**	0.172**
	(0.0867)	(0.0596)	(0.0876)	(0.0603)	(0.117)	(0.0872)
ln(wage)			0.175	−0.0221	0.175	−0.0221
			(0.111)	(0.0728)	(0.111)	(0.0728)
ln(CMI)			−0.208**	−0.0607	−0.208**	−0.0606
			(0.0728)	(0.0467)	(0.0728)	(0.0467)
% deliveries			0.0155	0.0717*	0.0154	0.0720*
			(0.0710)	(0.0423)	(0.0712)	(0.0424)
Lagged unemployment			−0.357	−0.147	−0.357	−0.147
			(0.360)	(0.249)	(0.360)	(0.249)
Residents per bed			0.0932	0.0323	0.0932	0.0325
			(0.146)	(0.126)	(0.146)	(0.126)
Sample	Nonsystem	All	Nonsystem	All	Nonsystem	All
Include FinShock*(year)	N	N	N	N	Y	Y
R^2	0.007	0.004	0.014	0.005	0.014	0.005
N	4953	11691	4759	11185	4759	11185

Unreported covariates include facility and year fixed effects. Regressions are restricted to 2003–2011, excluding 2008. Regressions are weighted by discharges. Standard errors are in parentheses and are clustered on hospital system (with each nonsystem facility its own cluster).
*P-value <= 0.10, **P-value <=0.05, ***P-value <=0.001.

the same hospitals that eliminate money-losing services begin offering more profitable services. Figure 8 and Table 7 present analyses focused on three services believed to be relatively profitable (Horwitz, 2005). These graphs show neither a large pretrend nor a strong reaction to the collapse. Neither the nonsystem hospitals nor the full sample alter their provision of relatively profitable services in response to the 2008 financial shock. The estimates are, however, admittedly imprecise, making it impossible to rule out economically meaningful responses. Comparing column 3 of Table 6 and column 3 of Table 7, we are able to rule out equality of the coefficients for profitable and unprofitable services (P-value = 0.0191).

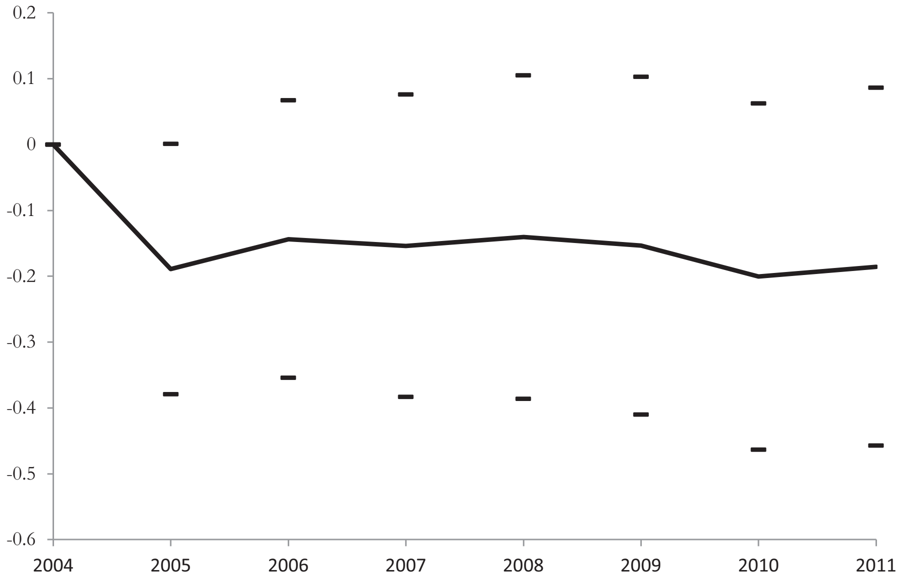
In Figures 7c and 7d, we investigate whether hospitals with market power were more likely to cut back on offering unprofitable services. These figures suggest that, if anything, the pattern in the combined results is driven by the sample of hospitals with less market power. The pattern is extremely volatile and extremely noisy for the market power sample. Figure 8c and 8d illustrate that the pattern is also extremely volatile for profitable services for the market power sample. Appendix 4, Tables 2 and 3, continue to find evidence of that the nonmarket power sample cut unprofitable services but not profitable services in response to the stock market crash, but finds no statistically significant evidence of service cutting among the high-market power sample.[29]

This pattern stands in contrast to the pricing results and to a lesser extent to the charity care results. There could be a number of reasons for the contrasting results. First, note that the estimates for the market power sample are extremely imprecise and volatile across specifications. The small sample size, combined with the discrete nature of the dependent variable means that the results will be driven by a very small number of observations. Further to this point, the results for the market power sample are sufficiently imprecise that we are unable to rule out any meaningful hypotheses. Alternatively, recall from Table 1 that the market power hospitals are much more likely to offer services than the nonmarket power. This may reflect different preferences for offering these services or different relative profitabilities from offering these services for the market power sample relative to other hospitals. More concretely, there could be nonhomotheticity in hospital

[29] For the sake of completeness, Appendix 4, Tables 4 and 5, reexamine these results but instead split hospitals by their WTP.

FIGURE 8a

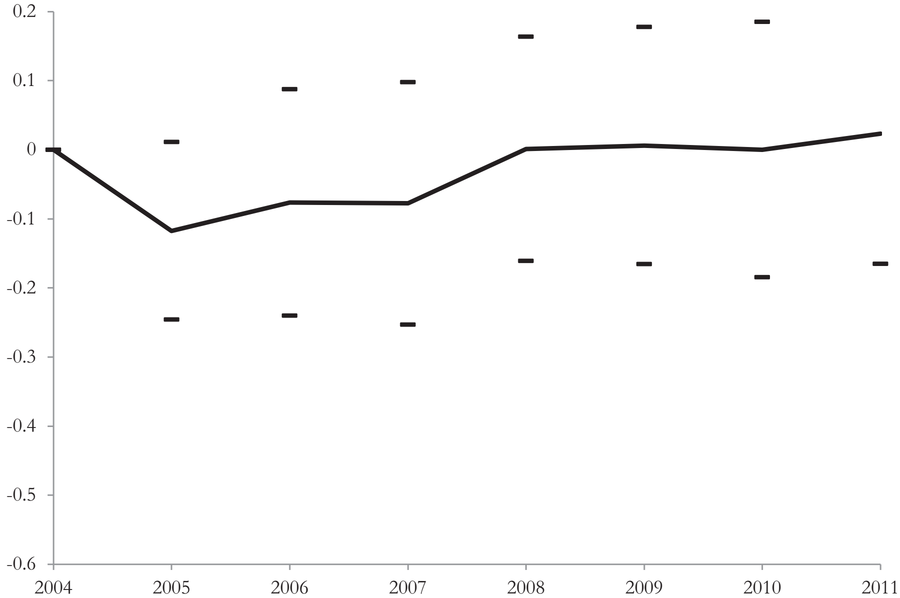
OLS ESTIMATES OF IMPACT OF *FinShock* ON SHARE OF PROFITABLE SERVICES OFFERED, NONSYSTEM HOSPITALS



Regressions include "preferred" controls as well as facility and year fixed effects. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 8b

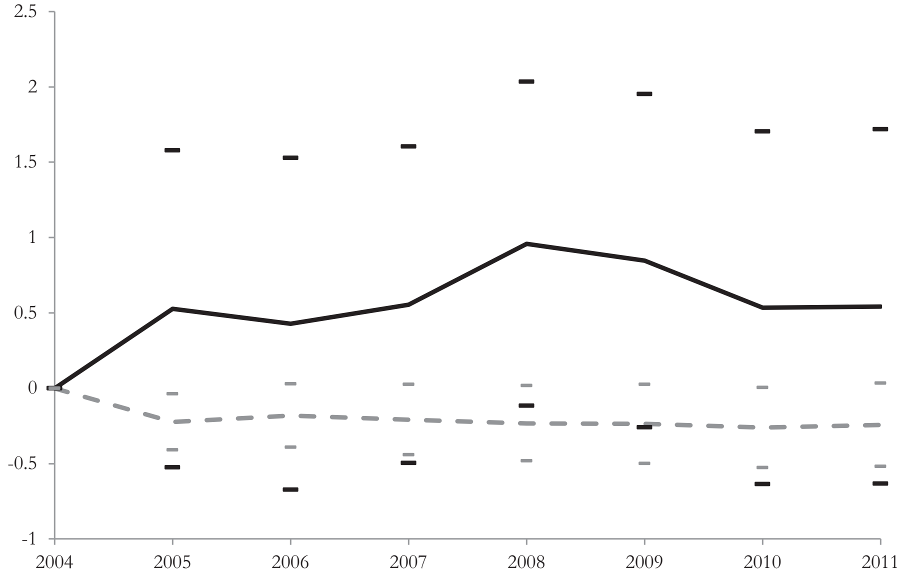
OLS ESTIMATES OF IMPACT OF *FinShock* ON SHARE OF PROFITABLE SERVICES OFFERED, ALL HOSPITALS



Regressions include "preferred" controls as well as facility and year fixed effects. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 8c

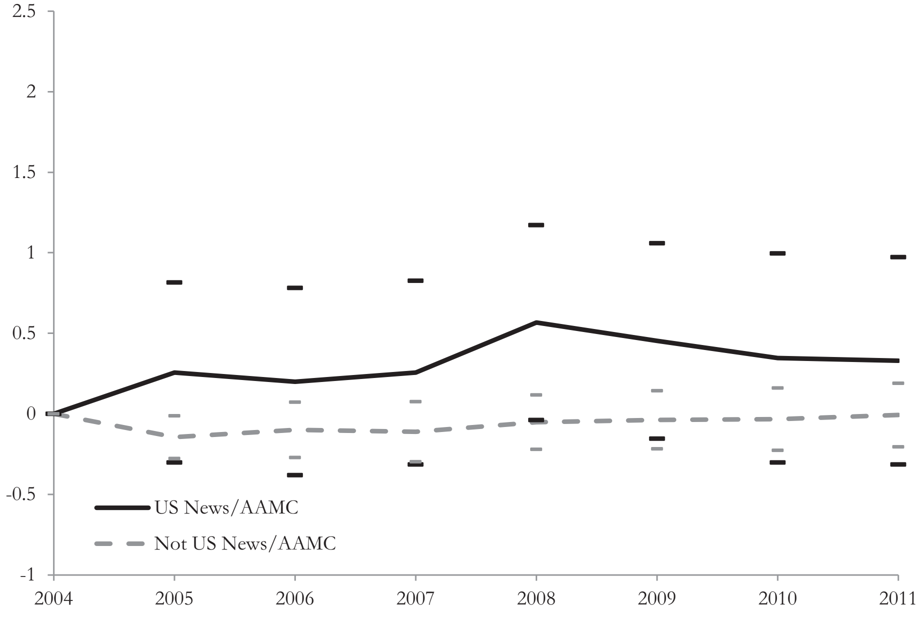
OLS ESTIMATES OF IMPACT OF *FinShock* ON SHARE OF PROFITABLE SERVICES OFFERED, NONSYSTEM HOSPITALS BASED ON US NEWS/AAMC STATUS



Regressions include “preferred” controls as well as facility and year fixed effects. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

FIGURE 8d

OLS ESTIMATES OF IMPACT OF *FinShock* ON SHARE OF PROFITABLE SERVICES OFFERED, ALL HOSPITALS BASED ON US NEWS/AAMC STATUS



Regressions include “preferred” controls as well as facility and year fixed effects. Standard errors are clustered on hospital system (with each nonsystem facility its own cluster).

preferences about how to distribute rents, with hospitals first prioritizing service offerings, and only then distributing rents in the form of lower prices.

□ **Summary of results.** We examine a number of different dependent variables and samples in this article and find that nonprofit hospitals adjusted along some dimensions but not along others. When trying to interpret our results in their totality, there are two overarching questions. First, how likely is it that the different responses that we observe might just result from chance? Second, what model of hospital behavior best explains the combination of facts that we uncover?

Roughly speaking, our null hypothesis is that hospitals do not respond to financial shocks by taking steps that increase profits at the expense of patient welfare. We studied this hypothesis using one "all in" dependent variable (*reserves*) and then broke this aggregate response into four additional dependent variables, which represent specific margins that could be adjusted following a shock (*Price, Cost per Discharge, Uncompensated Care, and Unprofitable Services*). There are at least three different alternative hypotheses that we could consider. A first alternative hypothesis is that the effect of *FinShock* on *reserves* does not entirely persist over time. If the effect does not persist, this would imply that hospitals suffering larger losses took steps to at least partially recover their losses. An alternative null hypothesis is that none of the specific outcome measures that we study—price, etc.,—enter into the utility functions of hospitals. If this were the case, then inference is best considered using a test of joint significance. Indeed, if all of these measures enter the hospital's utility function, and all are "marginal" prior to a financial shock, then hospitals should, at the margin, be adjusting all of these dimensions following an unexpected asset loss.

Finally, we might consider the alternative hypothesis that hospitals respond along some specific dimensions but not necessarily all dimensions. This would require us to be more specific about the mechanisms governing hospital behavior. For example, if markets provide socially optimal incentives to a hospital when choosing a quality level, then a hospital that is maximizing a combination of profits and patient welfare will not adjust quality. However, they may adjust some other dimension, such as uncompensated care. As another example, if lower prices are not passed through to consumers via lower insurance premiums and are instead captured by insurers, then hospitals might always choose the profit-maximizing price, and would therefore not adjust to financial shocks by changing their prices. If one wants to examine the alternative hypothesis that hospitals respond along some, but not all, dimensions, then the correct test is dependent variable by dependent variable. In that case, we encounter a question relating to multiple hypothesis testing, that is, the probability of a false positive increases with the number of hypothesis tests. Given that we also examine heterogeneity in response based upon whether a hospital is likely to have substantial market power, the potential for false positives is even higher than this correction would suggest.

To sort out these alternatives, we begin by restating the finding that the effect of *FinShock* on *reserves* is remarkably persistent over time. Indeed, based on the observed rate of dissipation, it would take a hospital nearly 35 years to recover its losses. However, much more rapid adjustments (i.e., eight years) are within the confidence interval, making it difficult to rule out some amount of adjustment. Moreover, given the number of ways in which hospitals might adjust, this finding does not allow us to rule out the possibility that hospitals are adjusting, but that the scope for adjustment along specific margins is small relative to *FinShock*. In either case, these results show that hospitals do not appear to be able to fully recover their losses by adjusting pricing or along other dimensions.

We next consider the responses on the four dimensions that we study. Table 8 summarizes the significance levels of the relevant tests that we conducted. The evidence suggests that the average nonprofit responded to the financial shock along just one dimension—unprofitable service offerings. At the same time, hospitals that may have bargaining power responded along two dimensions. They engaged in price-based cost shifting and reduced uncompensated care (the

TABLE 7 OLS Estimates of the Impact of *FinShock* on Profitable Service Offerings

	(1)	(2)	(3)	(4)	(5)	(6)
FinShock*(year > 2008)	−0.0798	0.0722	−0.0588	0.0762	0.0846	0.118
	(0.0902)	(0.0775)	(0.0924)	(0.0759)	(0.132)	(0.121)
ln(wage)			0.0954	0.0171	0.0943	0.0170
			(0.108)	(0.0813)	(0.108)	(0.0813)
ln(CMI)			0.219**	0.297***	0.219**	0.297***
			(0.0828)	(0.0572)	(0.0829)	(0.0572)
% deliveries			−0.250**	−0.126**	−0.248**	−0.126**
			(0.0925)	(0.0629)	(0.0927)	(0.0629)
Lagged unemployment			0.732*	0.302	0.733*	0.303
			(0.424)	(0.287)	(0.424)	(0.287)
Residents per bed			0.0815	0.0956	0.0814	0.0958
			(0.151)	(0.102)	(0.151)	(0.102)
Sample	Nonsystem	All	Nonsystem	All	Nonsystem	All
Include FinShock*(year)	N	N	N	N	Y	Y
R^2	0.061	0.043	0.071	0.051	0.071	0.051
N	4951	11686	4757	11180	4757	11180

Unreported covariates include facility and year fixed effects. Regressions are restricted to 2003–2011, excluding 2008. Regressions are weighted by discharges. Standard errors are in parentheses and are clustered on hospital system (with each nonsystem facility its own cluster).
*P-value <= 0.10, **P-value <= 0.05, ***P-value <= 0.001.

TABLE 8 Summary of Statistical Significance of the Results

	P-value from Main NonSystem Hospital Specification		
	All Hospitals	US News/AAMC	Not US News/AAMC
Dependent variable:			
Log price	0.495	0.030	0.940
Log cost per discharge	0.443	0.672	0.282
Uncompensated care as share of gross patient Revenues	0.810	0.072	0.976
Unprofitable service offerings	0.011	0.326	0.010
Overall	0.131	0.052	0.150

Notes: The reported P-values test the one-sided hypothesis that hospitals do not respond to the financial shock by increasing profits at the expense of patient welfare. Each number is based on column (3) of the relevant table, except for for the price analysis, which uses column (5). The Overall test is produced using Fischer's method.

latter estimate is borderline significant). If we multiply these P-values by four adjust to account for multiple hypothesis testing, then only the unprofitable services results are statistically significant at conventional levels.

Table 8 also presents significance levels for joint tests of all the coefficients. Hospitals with bargaining power appear to respond to the financial shock, but the remaining hospitals do not, with a joint significance level of just 0.15. Thus, if we are testing the alternative hypothesis that patient utility, broadly construed, enters into the hospital's utility function, we are unable to prove this hypothesis at conventional levels of significance.

Considering all of these facts, our results are broadly consistent with a model in which nonprofits behave differently than for-profits, albeit in ways that seem to have only a small effect on overall profitability. Furthermore, the channels through which nonprofit hospitals redistribute rents to society on the margin may vary with the amount of rents available to the hospital. This pattern provides a starting point for future work examining the behavior of nonprofits.

6. Conclusion

■ As the size of the nonprofit sector has grown, economists and policy makers have renewed their interest in the objective functions of these firms. A common concern is whether nonprofits actually provide the community benefit mandated by their preferential tax status, or if instead they are merely for-profit firms in disguise (Weisbrod, 1988). In the hospital sector, this view is also prominently shared by many policy makers. For example, in 2005, Internal Revenue Service (IRS) Commissioner Mark Everson said in testimony before the Senate Finance Committee that "We at the IRS are now faced with a healthcare industry in which it is increasingly difficult to differentiate for-profit from nonprofit healthcare providers."

We contribute to this debate by examining the reactions of hospitals to the large and plausibly exogenous financial shock caused by the 2008 stock market collapse. Investment gains are an important component of a typical hospital's operating budget. The collapse caused large endowment losses for many nonprofit hospitals, with great variation in the magnitude of the losses across hospitals and within local geographic areas. This exogenous variation in wealth provides a unique opportunity to examine hospital responses to lump-sum financial shocks.

We first observed that the investment losses persisted long after the 2008 collapse; any efforts by hospitals to recoup their losses were modest, ineffective, or both. For example, we find no evidence that the average hospital raises prices in response to financial losses. When we examine a smaller sample of hospitals that likely have some market power over private insurers, and as a result a greater amount of rents to redistribute, we find that these hospitals raised their prices compared to what they would have been in the absence of the financial shock. Given that these hospitals represent only less than 10% of all facilities and treat less than 20% of patients in our sample, it is unclear how important their response is for the average privately insured patient. Equally important, among the remaining 90% of facilities, we are able to rule out economically meaningful cost shifting.

Existing cost shifting theories have primarily focused on these price responses. Motivated by theoretical work on the objective function of nonprofit firms, we propose and test an extension of existing theory in which nonprofit hospitals "cost shift" along nonprice dimensions. We find that hospitals curtailed the offering of unprofitable services such as trauma centers and alcohol and drug treatment facilities. This is important, because nonprofit hospitals are expected to provide community benefits, such as the provision of these unprofitable services, in exchange for large tax breaks. On the other hand, we find no evidence of decreased uncompensated care, another important type of community benefit. Nor do we find evidence that hospitals cut costs, which stands in contrast with how universities responded to the financial crisis. Although nonprice responses may have important consequences, the 2008 endowment losses were persistent, suggesting that these adjustments had a limited impact on a hospital's bottom line. It is also perhaps noteworthy that our sample hospitals survived these losses; perhaps they were "saving for a rainy day" during the years leading up to the 2008 market collapse.

By documenting these nonprice responses, our study is among the first to explore the variety of avenues by which nonprofit hospitals adjust their operations to react to financial shocks. More broadly, our results also speak to the activities of nonprofit organizations in general. We find evidence consistent with nonprofit organizations maximizing some form of consumer welfare rather than simply acting as disguised and tax-preferred for-profit firms.

These nonprice reactions also provide valuable information for evaluating the incidence of policies generating financial shocks for hospitals. Rather than simply impacting the prices paid by privately insured patients, these policies can result in broad changes in the quality and availability of health services for *all* patients. For example, the closing of trauma centers can limit access to critical health services for vulnerable and disadvantaged populations. Hsia and Chen (2011) document that the closures of trauma centers between 2001 and 2007 have already increased the travel time to such a facility for communities with high numbers of uninsured, poor, and African-American residents. Future closures of trauma centers or other unprofitable services resulting from financial shocks to hospitals could exacerbate these disparities.

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