Can Nonprofits Save Lives Under Financial Stress? Evidence from the Hospital Industry

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Abstract

Previously dominated by nonprofit hospitals, the U.S. hospital industry has seen a dramatic growth of for-profit hospitals. We show that the vulnerability of for-profit hospitals to external financing shocks can generate adverse consequences for local communities. Using confidential patient-level discharge data, we show that negative shocks to hospitals' debt capacity lead to a greater increase in patient mortality in for-profit hospitals than in nonprofit ones. This differential effect is not driven by differences in patient characteristics or patient-hospital sorting. It is concentrated among vulnerable patient populations, namely those without private insurance and greater health risks. We elucidate a mechanism: coerced precautionary savings of nonprofit hospitals. To qualify as a nonprofit entity in the U.S., a hospital must conform to nondistribution laws, which prohibits distribution of earnings to ownership. Likely due to these nondistribution laws, nonprofit hospitals hold deeper cash reserves and thus maintain spending on medical staff and equipment during adverse financing shocks. Overall, our evidence suggests that nonprofit hospitals are less affected by capital market shocks and can better serve social interests during financially challenging times. Furthermore, these findings suggest that the secular shift of hospitals towards a for-profit model may weaken the resiliency of the U.S. healthcare system.

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1 Introduction

In recent years, the U.S. hospital industry has experienced a dwindling share of nonprofit hospitals, together with a rapid growth of for-profit ones. As shown in Figure 1, the number of for-profit hospitals has nearly doubled over the past two decades, representing around a quarter of U.S. hospitals in 2022. Nonprofit organizations are characterized by tax exemptions and non-distribution rules: Their profits cannot be paid out to owners, but can be exempt from corporate income taxes. Despite the tax exemption, nonprofit hospitals do not outperform for-profit hospitals in key dimensions of healthcare quality (Horwitz, 2005; Horwitz and Nichols, 2009), which has fueled policy debates regarding the societal value of nonprofit hospitals.[1]

In this study, we highlight an overlooked factor in this debate, which is the ability of nonprofit and for-profit hospitals to deliver quality healthcare under financial stress. Evaluating this resilience is crucial, as it informs us of the stability of healthcare systems during financially challenging times, and the role of hospital ownership in shaping communities' access to healthcare in the face of economic downturns and healthcare crises.

We compare the quality of healthcare by nonprofit and for-profit hospitals when they face large, negative shocks in accessing the external credit market. Prior literature reveals that hospitals depend heavily on external credit to finance their healthcare services, making the access to credit essential for the provision and quality of care (Adelino et al., 2015; Aghamolla et al., 2023). Yet, it is not obvious whether nonprofit or for-profit hospitals should be more resilient to credit market shocks. On the one hand, the non-distribution rule and tax exemption may lead to higher liquidity reserves inside nonprofit hospitals, enabling them to maintain higher quality care during financial turbulence. On the other hand, nonprofit hospitals may deliver worse healthcare because of having

[1] See academic research such as Plummer et al. (2024) and Bai et al. (2023), the federal budget report here in June 2024, and the response by Rick Pollack, President and CEO of American Hospital Association.

wasteful expenditure and a more entrenched governance structure (Lewellen et al., 2022). Finally, it is possible that nonprofit and for-profit hospitals respond similarly to negative financing shocks, as research reveals the similarity of nonprofit hospitals' operating decisions to for-profit hospitals.[2]

Our study leverages large-scale, granular, patient discharge data from hospitals in the state of California during the period of 2004–2014. The dataset provides de-identified inpatient discharge records for all California-licensed hospitals, and contains detailed information on patient demographics, medical procedures, and reasons for discharge. Our full sample consists of 34.2 million patient discharges across 542 hospitals. Our main outcome variable is patient mortality, which is commonly used as a measure of healthcare quality (e.g., Ho and Hamilton, 2000; Propper et al., 2004; Cooper et al., 2011; Gaynor and Town, 2011; Aghamolla et al., 2023). This dataset allows us to compare the outcomes of patients discharged in the same year with similar demographics and health conditions.

We utilize the expiration of long-term debt at the onset of the Global Financial Crisis (GFC) as plausibly exogenous shocks to hospitals' access to external credit markets (Duchin et al., 2010; Almeida et al., 2011; Carvalho, 2015). As the cost of debt financing rose rapidly during the GFC, hospitals that have a high fraction of long-term debt maturing during the GFC likely faced significant difficulty rolling over their debt. Our identifying assumption is that the maturity structure of hospital debt is determined prior to the inception of the financial crisis and independent of patient health and patient composition. Following Almeida et al. (2011), we define "treated" ("control") hospitals as ones with more (less) than 20% of their long-term debt maturing in 2008, and match treated and control hospitals based on leverage ratios and size. The matching process ensures that we compare hospitals with similar level of indebtedness at the onset of the Crisis. We also verify

[2]For example, Adelino et al. (2015) and Adelino et al. (2022) document that nonprofit hospitals exhibit similar cash flow-investment sensitivity as for-profit corporations. Nonprofit hospitals also adjusted treatment towards more lucrative options during the 2008 Financial Crisis, likely to pursue profit.

that, among treated hospitals, nonprofit and for-profit hospitals have similar fraction of short-term debt coming due at the onset of the crisis (2008), suggesting a similar "dosage" of treatment.

On average, patient mortality increases by around 0.1 percentage points more in treated hospitals during the GFC than in matched control hospitals. This effect is statistically significant and economically meaningful, accounting for around 4% of the sample average of mortality rates. Our main empirical analysis focuses on the differential effects of external financing shocks on nonprofit and for-profit hospitals, and reveals significant differences. Specifically, the increase in patient mortality during hospitals' financial stress is primarily driven by for-profit hospitals and absent in nonprofit ones. The differential increase in patient mortality is about 0.4 percentage points, a magnitude that is four times the average effect.

It is worth noting that our results survive the control of high-dimensional fixed effects, including hospital-by-diagnosis fixed effects and diagnosis-age-gender-year fixed effects. The first set of fixed effects allows us to track the change in mortality rates among patients in a given hospital with a certain type of diagnosis from before to after the Crisis. The second set helps us compare patient outcomes at nonprofit and for-profit hospitals in the same year, who have similar demographics (age and gender) receiving the same diagnosis. These fixed effects alleviate multiple concerns related to confounding effects such as patient heterogeneity and hospital fixed traits. In later analysis, we further augment our baseline specification by imposing the interactive fixed effects of hospital referral region (HRR) with patient age, gender, diagnosis, and year, as well as the interactive fixed effects of patient comorbidity, age, gender, diagnosis, and year. These analyses further eliminate concerns regarding effects being driven by changes in patient risk profile or market mix.

A remaining concern could be that higher-risk patients may be more likely to choose for-profit hospitals facing negative financing shocks. To address potential concerns related to patient-hospital sorting, we repeat our analysis using a sample of patients admitted from hospitals' emergency department, provided that those patients likely had little flexibility in choosing the hospitals for treatment. Our results continue to hold, generating even larger magnitudes in this sample. Finally, we perform dynamic regressions to confirm that patient mortality rates do not exhibit pre-trends for either for-profit or nonprofit hospitals prior to the financial crisis. During the GFC, patient mortality rates jump up in treated for-profit hospitals, but not in treated nonprofit hospitals.

Why are nonprofit hospitals able to maintain lower death rates than for-profit hospitals that face the same external financing constraints? There are at least two possibilities: First, nonprofit hospitals may perform different procedures on patients of a given diagnosis. Second, they may prescribe the same procedure as for-profit hospitals, but perform them with higher quality and effectiveness. We seek to distinguish these possibilities by imposing medical procedure fixed effects, and interact them with hospital fixed effects as well as patient demographics, diagnosis, and year fixed effects. By comparing mortality rates of patients with the same health risk receiving the same procedure, we can hone in on the effectiveness of hospital treatment. We continue to find a differential mortality rates across nonprofit and for-profit hospitals with these fixed effects. Thus, our results are unlikely to be driven by nonprofit and for-profit hospitals treating patients with different procedures, but may originate from the quality of the treatment.

The quality of medical treatments may be influenced by hospitals' medical staff and physical assets in place. We thus look into the changes in spending on medical staff and equipment by nonprofit and for-profit hospitals around negative financing shocks. Medical staff, including nurses and physicians, represent the most valuable human capital in delivering patient care. They are also the costliest personnel inside hospitals. Facing funding shortages, hospitals may have incentives to cut costs by reducing the expenditure in medical staff. This can be achieved by terminating contracts with existing nurses and physicians, reducing the recruitment of new ones, or restricting wage growth. Consistent with this conjecture, we find a greater reduction in wage expenditures for medical staff in for-profit hospitals than in nonprofit hospitals under financial stress. We also find a greater reduction in the investment in medical equipment by treated for-profit hospitals than nonprofit ones. The drastic reduction in personnel and equipment is consistent with the decline in healthcare quality at constrained for-profit hospitals.

Why can nonprofit hospitals better sustain investment in human and physical capital under financial stress? We explore two explanations. First, due to their tax-exempt status and non-distribution rules, nonprofits may carry higher cash reserves, which serves as a natural cushion against external financing shocks. Consistent with this intuition, we find that nonprofit hospitals have significantly higher cash holdings than for-profit hospitals, and cash-rich hospitals experience significantly lower increase in patient mortality after financing shocks.

It is also possible that nonprofit hospitals receive more liquidity infusions from the government or donors during the financial crisis. To evaluate this explanation, we examine whether the financing cash flows evolve differently between nonprofit and for-profit hospitals under financial stress. We do not find this to be the case. There is no differential change in financing cash flows between treated nonprofit and for-profit hospitals compared to their respective control group. Among nonprofit hospitals, we do not detect any differential changes in donations or endowment between treated and control hospitals. This evidence suggests that liquidity infusion from government or donors is unlikely to explain why nonprofit hospitals can sustain their human and physical capital under financial stress.

We next investigate the heterogeneity of our effects across patient types. In particular, we focus on patient characteristics that indicate their socioeconomic status and health conditions. First, we compare the effects for patients with private and public insurance. Patients with public insurance often have less comprehensive coverage, lower access to providers, and likely lower socioeconomic status. We find that, holding fixed patient demographics and diagnoses, mortality rates of patients with public insurance rise more under hospitals' financial stress. The differential effects of hospital financial stress between nonprofit and for-profit hospitals are also concentrated among patients with public insurance.

We next compare patients with better or worse health conditions. Patients with worse health conditions (i.e., having high-risk diagnoses and comorbidities) have more complex and severe health conditions and require more intense medical attention. We expect those patients to be more affected by the availability of core medical staff and thus by hospital financial conditions. Consistent with this conjecture, hospitals' financial stress affects high-risk patients significantly more than it does low-risk patients. Again, the mortality gap between nonprofit and for-profit hospitals under negative financing shocks is concentrated on patients with high-risk diagnosis. Taken together, our evidence suggests that, under financial stress, nonprofit hospitals can better serve more vulnerable patient populations with less resources to access healthcare than for-profit hospitals.

We assess the external validity of our baseline findings using two additional experiments. The first analysis utilizes a "reverse" shock that relaxes hospitals' external financing constraints. Specifically, we exploit a 2013 revision to S&P's accounting methodology, whereby the S&P switched from gross debt to net debt (debt−cash) in computing firm leverage.[3] This revision artificially reduced the leverage ratios of high-cash firms, and increased those firms' debt capacity. Liu and Shivdasani (2022) show that this rating revision substantially increased the borrowing of cash-rich firms. We document the same effect for cash-rich hospitals. More importantly, this increase in debt capacity significantly reduced patient mortality in for-profit hospitals, but not in nonprofit hospitals.

The second analysis takes advantage of the fluctuation in real estate values held by hospitals, following the methodology used in Glaeser et al. (2008), Chaney et al. (2012), and Carvalho (2018).

[3]This methodology follows Liu and Shivdasani (2022) and is similar to studies using changes in rating agencies' accounting policies as sources of exogenous variation in issuers' financial constraints (e.g., Adelino et al., 2015; Fracassi and Weitzner, 2023).

Specifically, given that real estate assets are common collateral underlying debt financing, changes in real estate prices can affect hospitals' debt capacity. To isolate the effect of real estate price innovations from endogenous local dynamics, we use the interaction of land availability and national real estate price shocks as an instrument for the variation in the local real estate prices. Consistent with our baseline results, patient mortality rates are only sensitive to hospitals' debt capacity in for-profit hospitals, but not nonprofit ones.

Together, results from these alternative experiments corroborate our main finding that patient outcomes in nonprofit hospitals are less sensitive to external financing constraints.

Our paper contributes to several strands of the literature. First, it adds to the discussion of the effect of privatization and profit-orientation in the healthcare sector. Existing studies examine the effect of hospital ownership on healthcare quality, service mix and efficiency, and arrive at mixed conclusions (Eggleston et al., 2008; Horwitz, 2005; Horwitz and Nichols, 2009). Studies examining hospitals' switching from nonprofit to for-profit status find improvement in profitability but declines in healthcare quality (e.g., Ramamonjiarivelo et al. 2016, Ramamonjiarivelo et al. 2020, Duggan et al. 2023, Herpfer et al. 2024). Other studies discuss the governance structure of nonprofit hospitals, and find that manager incentives are less aligned with firm objectives in nonprofit than for-profit organizations (Ballou and Weisbrod, 2003; Erus and Weisbrod, 2003; Lewellen et al., 2022).[4] This literature does not discuss how nonprofit and for-profit hospitals respond differently to external financing shocks, and we fill this gap. Our findings provide a "bright side" point of view for nonprofit hospitals. That is, under financial stress, nonprofit hospitals are better at preserving core medical employees and maintaining patient welfare compared to for-profit hospitals.

Second, our paper relates to the studies on the effect of financing shocks on hospital operations

[4]A literature in Accounting discusses the incentives for nonprofit hospitals to manage earnings, and how their donors respond to their disclosure quality (e.g., Leone and Van Horn 2005, Krishnan and Yetman 2011 and Yetman and Yetman 2013).

(Adelino et al., 2015; Dranove et al., 2017; Adelino et al., 2022; Aghamolla et al., 2023). This literature documents that similar to for-profit corporations, nonprofit hospitals exhibit positive investment-to-cash flow sensitivity and switch to more profitable operations under financial stress. Contrary to their findings, we find drastically different effects of financial shocks on patient outcomes between nonprofit and for-profit hospitals. Our findings highlight the important role of corporate objectives in affecting stakeholders during periods of financial stress. In this regard, we also add to the burgeoning literature studying how financing constraints affect non-equity stakeholders of the firm, such as the environment, employees, and customers (Xu and Kim, 2022; Benmelech et al., 2021; Kini et al., 2017).

Finally, our paper is related to the recent studies on the role of private equity (PE) firms in the healthcare industry (Gandhi et al., 2023; Gupta et al., 2023; Liu, 2022; Gao et al., 2023). While all studies document that PE acquisitions are associated with improved profitability and operational efficiency at healthcare institutions, they generate mixed evidence regarding how such acquisitions affect the quality of care.[5] With the exception of Gao et al. (2023), these studies do not directly compare for-profit and nonprofit hospitals. We add to this literature by studying the differential impact of external financing shocks across these ownership types.

2 Data and Sample

Our analysis relies on two main data sources: the Patient Discharge Data (PDD) and hospital financial information, both maintained by the California Department of Health Care Access and Information (HCAI). We describe these two sources of data in detail below.

[5]In the nursing home industry, Gandhi et al. (2023) document positive effects of PE firms on patients in highly competitive markets, while Gupta et al. (2023) find that PE ownership reduces the quality of care. Liu (2022) and Gao et al. (2023) do not find changes in healthcare quality in hospitals acquired by PE firms.

2.1 Patient Discharge Data

Our primary data source is the Patient Discharge Data (PDD) that consists of confidential de-identified patient-level records measured at the inpatient discharge level for all California-licensed hospitals. An inpatient discharge record is created in the PDD database when a patient admitted to an in-patient hospital unit is discharged, where death is one of 13 types of discharges.[6]

The PDD provides information regarding year and type of discharge, patients' diagnoses and procedures received during their course of stay, as well as certain patient-level characteristics that are necessary for modeling health outcomes, such as gender, age range, and insurance type used by the patient. Some patient-level characteristics, such as race and exact age, are omitted from our cut of the PDD data due to concerns with potential re-identification.

Our main outcome variable is patient death, the most direct measure of an adverse outcome available in the PDD and a commonly used measure of healthcare quality in the health economics literature (e.g., Ho and Hamilton, 2000; Propper et al., 2004; Cooper et al., 2011; Gaynor and Town, 2011; Aghamolla et al., 2023). We define an indicator *Death*, which equals to one if a patient's visit to a hospital ends in the patient's death, and zero otherwise.

Other key variables used in the PDD includes *Female*, an indicator for whether the patient is female; *Age Category*, the age of the patient at the time of admission, divided into five-year categories as provided by the HCAI[7]; *Private Insurance*, an indicator for patients not having any of the following public insurance types: Medicare, MediCal (the counterpart of Medicaid in California),

[6]Discharge types include: (1) Routine discharges, (2) Acute care within admitting hospital, (3) other care within admitting hospital, (4) skilled nursing/intermediate care within admitting hospital, (5) acute care at another hospital, (6) other care at another hospital, (7) skilled nursing/intermediate care at another facility, (8) residential care facility, (9) prison/jail, (10) left against medical advice, (11) death, (12) home health service, and (13) other.

[7]The age categories are specified as follows: 1 = under 1, 2 = 1-4 years, 3 = 5-9 years, 4 = 10-14 years, 5 = 15-19 years, 6 = 20-24 years, 7 = 25-29 years, 8 = 30-34 years, 9 = 35-39 years, 10 = 40-44 years, 11 = 45-49 years, 12 = 50-54 years, 13 = 55-59 years, 14 = 60-64 years, 15 = 65-69 years, 16 = 70-74 years, 17 = 75-79 years, 18 = 80-84 years, 19 = 85+ years.

county indigent programs, workers' compensation, and other government or indigent programs; *High-Risk Diagnosis*, an indicator variable that equals one if a patient's primary diagnosis has a mortality rate in the top quartile (greater than 2%), and zero otherwise; and *Has Comorbidity*, an indicator variable taking the value one if a patient has at least one of 17 conditions that comprise the Charlson Comorbidity Index.[8]

2.2 Hospital Financial Data

We also extract annual hospital financial data from the HCAI, which covers all California-licensed hospitals. This database contains standard finance and accounting information such as assets, earnings, and capital structure information, including debt maturities and real estate asset holdings. It also tracks staff expenses, such as wages for physicians and nurses.

Critically for our study, the HCAI hospital database identifies the nonprofit status of a hospital. Nonprofit hospitals are restricted from distributing profits and are tax-exempt so long as they meet this distribution constraint and provide a community benefit, such as an emergency room open to all patients regardless of their ability to pay. Nonprofit hospitals are typically affiliated with universities, governments, or religious organizations. In contrast, for-profit hospitals are permitted to distribute profits to owners but must pay taxes. Hospitals are identified by a unique facility number, which can be linked to the PDD.

Combining the hospital financial and patient data leads to a sample of 34.2 million non-neonatal patient discharges spanning the period of 2005 to 2014. Among this sample, 27.6 million patient discharges come from 339 nonprofit hospitals and 6.6 million patient discharges come from 203

[8]These comorbidities are myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, connective tissue disease-rheumatic disease, mild liver disease, diabetes without chronic complications, diabetes with chronic complications, paraplegia and hemiplegia, renal disease, cancer, moderate or severe liver disease, metastatic carcinoma, HIV/AIDS (Charlson et al., 1987; Deyo et al., 1992).

for-profit hospitals.

From the hospital financial data, we define *Leverage* as the ratio of long-term and short-term debt over total assets, *Size* as the number of available beds, *Profitability* as net income divided by total assets (or ROA), and *Cash/Assets* as cash and cash equivalents divided by total assets. In addition, we observe hospital-level measures of wage expense for patient-care staff (e.g., doctors and nurses) and other hospital staff, as well as investment in medical equipment.

2.3 Other Data Sources

We obtain data on MSA-level land availability from Saiz (2010). In this data, the share of undevelopable land is measured as the share of land that is covered in water or steep gradients, which are considered unsuitable for real estate development. We measure fluctuations in national housing prices using the Housing Price Index (HPI), which is maintained by the Federal Housing Finance Administration (FHFA).

We identify a hospital's S&P-rated status using Mergent FISD, a database that tracks bond issuance and their ratings. We match bonds to hospitals and denote a hospital as S&P-rated if it has an outstanding S&P-rated bond at the time of observation.

2.4 Summary Statistics and Descriptive Analyses

Our full sample represents 34 million patient discharges from all California hospitals with available financial data from 2005–2014, excluding newborns. Panel A of Table 1 presents descriptive statistics for key variables in this broad sample. The average patient mortality is 2.3%. Over half of the patients are female, largely driven by childbirth admissions. The average age category is 12, indicating an average age of 50–54. Privately insured patients represent 31% of the sample, while 27% and 45% of patients are admitted with a high-risk diagnosis or comorbidity, respectively. The average hospital has 331 beds, with leverage ratios of 35% and ROA of 5%.

Table 1 About Here

In Panels B and C, we present summary statistics for nonprofit and for-profit hospitals, respectively. Both types of hospitals have an average mortality rate of 2.3%. They have similar patient demographics, with female patients accounting for around 60% of the patient population, and the average age category being around 12 (50–54 years old). For-profit and nonprofit hospitals have similar patient risk profiles, with around 25-27% of patients having high-risk diagnoses and around 45% of patients having common comorbidity present. At the same time, patients at nonprofit hospitals are more likely to have private insurance (32%) than those at for-profit hospitals (27%).

In terms of hospital financial conditions, nonprofit hospitals are larger than for-profits in terms of bed counts. Nonprofit hospitals appear less profitable than for-profit hospitals, but have similar leverage ratios as for-profit hospitals.

In Figure 2, we explore the time-series variation in patient mortality by hospital nonprofit status. In the years prior to the Financial Crisis, for-profit hospitals had similar or lower mortality rates compared to nonprofits. However, mortality rates at for-profit hospitals spiked in 2008 and remained elevated relative to nonprofits till 2011. Mortality rates at for-profits finally fell to below nonprofit levels in 2012. While these trends are merely suggestive, they imply that patients at for-profit hospitals were more affected by the turbulence in the capital markets than those at nonprofit hospitals.

Figure 2 About Here

In Figure 3, we plot the distribution of patient mortality rates across broad diagnosis sections for nonprofit and for-profit hospitals. Diagnosis sections are ranked from the highest mortality risk to the lowest mortality risk from the top to the bottom of the figure, whereby riskiness of a diagnosis is measured based on average mortality rates of patients with that diagnosis. While the two types of hospitals have similar patient mortality rates overall, they differ across diagnosis sections. Nonprofits have lower mortality rates for the diagnoses with the lowest survival rates, namely infectious diseases (e.g., HIV/AIDS, tuberculosis, rabies) and respiratory system diseases (e.g., pneumonia, influenza). These descriptive statistics suggest that nonprofits have better outcomes for patients with higher-risk diagnoses. Later in the paper, we examine whether and how external financing shocks affect patient mortality across high-risk and low-risk patients.

Figure 3 About Here

3 Empirical Methodology

To derive causal inferences of the effect of external financing shocks on patient mortality, we utilize several shocks to hospitals' access to the debt markets that are arguably unrelated to pre-existing patient conditions. Our primary method exploits differences in hospitals' long-term debt maturing during the 2008 Global Financial Crisis (GFC) as a source of exogenous variation in their external financing constraints (Duchin et al., 2010; Almeida et al., 2011; Carvalho, 2015; Kini et al., 2017; Benmelech et al., 2019). The rationale behind this method is that, at the onset of the GFC, the cost of issuing corporate bonds rose dramatically, and firms that needed to refinance their debt during that period either had to delay or had to raise new debt with significantly higher rates. To the extent that long-term debt have a pre-scheduled maturity date and the crisis was largely unexpected by most corporations, the expiration of long-term debt during 2008 serves as plausibly exogenous variation in firms' propensity to face challenges in raising debt during the crisis.[9]

We define *treated* hospitals to be ones for whom over 20% of long-term debt was scheduled to

[9] Predicting recessions is notoriously difficult, and the financial crisis was no exception. Drautzburg (2019) notes that the consensus GDP growth forecast in Q4 2007 was 2.2% over the next four quarters, in contrast to the actual growth of 0.6%.

mature in 2008, as of 2007. Our identifying assumption is that the expiration of long-term debt for hospitals in 2008 should not be correlated with pre-existing individual patient conditions. We later verify this assumption by showing that patient characteristics are unrelated to the expiration of long-term debt during 2008.

We sharpen our identification by matching treated hospitals with other hospitals based on ex-ante financial characteristics that are associated with hospital quality and propensity to use long-term debt financing. We match on size and leverage using nearest neighbor matching as of 2007.[10] Specifically, treated hospitals are matched to the three nearest control hospitals based on Mahalanobis distance calculated on size and leverage in 2007, the year before the GFC. We further apply a 0.1 standard deviation caliper to ensure that control hospitals are a tight match for treated hospitals. Our matching procedure follows other studies in hospitals using nearest neighbor Mahalanobis distance matching (e.g., Schmitt, 2017; Prager and Schmitt, 2021; Gao et al., 2023). Hospitals without matches are dropped from the sample.[11] We further refine our sample to remove status-switchers. The switching of for-profit status can be driven by hospital conditions, market demand, and acquisitions, which are endogenous to the treatment (external financing constraints) that we study. We thus remove all hospitals that switched status after 2008. For hospitals that switched status before 2008, we drop their pre-switching observations since their status is not affected by the treatment.

The resulting dataset is patient-level data with matched hospitals, which we label the "Crisis Sample." The sample is restricted to matched treated and control hospitals with data on debt maturity. The sample spans from 2005 through 2010, which gives us three pre-Crisis years and three post-Crisis years. This sample consists of 7.1 million patient discharges across 177 unique

[10] Size is measured as hospital beds available.

[11] In subsequent robustness analyses (Section 4.3), we show that our findings remain unchanged in the full sample without matching and in a matched sample constructed with an additional matching criteria on nonprofit status.

hospitals in the state of California, wherein 5.8 million patient discharges come from 125 unique nonprofit hospitals, 1.3 million patient discharges come from 52 for-profit hospitals.

In Table 2 Panel A, we present the covariate balance statistics on hospital level characteristics for the Crisis Sample. Hospital characteristics are measured in 2007, the year prior to the Crisis. Based on these statistics, we find no statistically distinguishable difference between treated and control hospitals on size, leverage, profitability, and cash holdings. Panel B provides the covariate balance statistics for the samples of nonprofit and for-profit hospitals separately. Similar to the pooled sample, treated and control hospitals are statistically similar both in the nonprofit and for-profit samples. These covariate balancing statistics suggest that treated and control hospitals in the Crisis Sample are comparable on key observable characteristics, making this sample conducive to a difference-in-difference analysis.

TABLE 2 ABOUT HERE

We also verify that under our definition of treatment (i.e., over 20% of long-term debt near maturity), nonprofit and for-profit hospitals experience similar degrees of financial difficulty. Specifically, in 2007, the year before the Financial Crisis, treated nonprofit hospitals have an average of 29% long-term debt-to-asset ratio, and 39% of long-term debt has one-year till maturity. These statistics are 33% and 42% for for-profit hospitals.

We examine the effect of long-term debt maturity during the 2008 Financial Crisis on the patient mortality at nonprofit and for-profit hospitals using two methodologies. First, we employ a difference-in-difference model for patient discharges at nonprofit and for-profit hospitals separately. Specifically, we estimate the following equation:

$$Death_{i,j,t} = \beta Treated_j \times Post_t + \phi_{j,d} + \alpha_{c,t} + \epsilon_{i,j,t}, \tag{1}$$

where i indicates a patient discharge, j indicates a hospital, t represents the year, d denotes a primary diagnosis, and c represents a bin for each diagnosis-age category-gender type. Here, diagnoses are defined according to the ICD-9-CM code.[12] As described above, *Treated* is an indicator variable taking the value one for hospitals with greater than 20% of long-term debt maturing at the onset of the Financial Crisis in 2008, and zero otherwise. *Post* is an indicator variable for patient discharges in or after 2008.

Our estimation controls for hospital-diagnosis fixed effects ($\phi_{j,d}$) and diagnosis-age category-gender fixed effects ($\alpha_{c,t}$). The hospital-diagnosis fixed effects remove confounding factors related to patients selecting hospitals based on their specializations. Such concerns may arise if hospitals specializing in treating high mortality rate diseases also have more long-term debt outstanding, leading to an association between patient mortality and external financing constraints during the Crisis. The diagnosis-age-gender fixed effects help us account for time-varying dynamics related to these patient characteristics. We cluster standard errors at the hospital-by-year level.

In addition to the difference-in-difference analysis, we also pool the sample of patient discharges at nonprofit and for-profit hospitals and estimate the following triple-difference regression:

$$\begin{aligned} Death_{i,j,t} = {} & \beta Treated_j \times Post_t + \gamma Treated_j \times Post_t \times Nonprofit_j \\ & + \psi Post_t \times Nonprofit_j + \phi_{j,d} + \alpha_{c,t} + \epsilon_{i,j,t}. \quad (2) \end{aligned}$$

The key coefficient of interest is γ, which informs us of the differential effect of external financing shocks induced by the Crisis on patient mortality between nonprofit and for-profit hospitals. This equation contains the same controls and fixed effects as in Equation 1. Standard errors are clustered by hospital-year.

[12] See Internet Appendix Table B.1 for the ICD-9-CM diagnosis section classification scheme.

Finally, we consider the possibility that patients in poor health may sort into highly levered, for-profit hospitals following the GFC. To address this concern, we conduct an additional analysis by estimating Equation 2 using the sample of patients admitted from the hospital's emergency department. This sample of patients likely had little choice as to which hospital to go, thus alleviating the selection concern.

4 Main Results

4.1 Baseline Results

Table 3 presents the results from the above analyses. Columns (1) and (2) report the results from estimating Equation 1 for nonprofit and for-profit hospitals, respectively. The coefficient of *Treated* × *Post* suggests that having long-term debt maturing during the GFC significantly increases the patient mortality of for-profit hospitals but not that of nonprofit hospitals.[13] In column (3), we formally compare these two effects by pooling both hospital types together and estimating Equation 2. We find that the patient mortality of treated for-profit hospitals increases by 0.4 percentage points more than treated nonprofit hospitals during the financial crisis. This differential change in patient mortality represents a 17% increase in patient mortality relative to the unconditional average mortality rate (2.3 percentage points), a magnitude that is both economically and statistically significant. In column (4), we restrict the sample of patient discharges to those admitted from hospitals' emergency rooms. These patients are unlikely to have flexibility in selecting hospitals based on their financial conditions. *Treated* × *Post* × *Nonprofit* continues to generate a negative and significant coefficient in this sample. The estimate suggests a larger magnitude: ER patients in treated nonprofit

[13]In Appendix Table B.2, we estimate the average effect of the same external financing shock on patient mortality for the full sample of patient discharges, including those from nonprofit and for-profit hospitals. We find that negative financing shocks increase overall patient mortality.

hospitals exhibit 0.8 percentage point lower death rates than those in treated for-profit hospitals.

Table 3 About Here

4.2 Dynamic Effects

In this section, we examine the dynamic effects of hospitals' access to credit on their patient mortality for nonprofit and for-profit hospitals. This analysis helps address the concern that our findings may be driven by fixed or persistent trends in patient outcomes that vary by hospitals' financing structure. If that is the case, we should observe the gaps in patient mortality between treated and control hospitals to appear prior to 2008. We check pre-trends using the following dynamic effects model for the sample of patients in nonprofit and for-profit hospitals separately:

$$Death_{i,j,t} = \sum_{t=2005}^{2010} \beta_t Treated_j \times 1_t + \phi_{j,d} + \alpha_{c,t} + \epsilon_{i,j,t}, \tag{3}$$

where β_t captures the difference in mortality between treated and control hospitals in year t. 1_t equals one for observations in year t, and zero otherwise. All other variables and parameters are the same as in Equation 1. Standard errors are clustered by hospital-year.

Figure 4 depicts our estimates of β_t. Panel A (B) reports the estimates for patients of nonprofit (for-profit) hospitals. In each panel, the dots represent point estimates of the coefficients, while the solid lines represent 90-percent confidence intervals. In both samples, we find no statistically significant differences in patient mortality between treated and control hospitals leading up to the GFC, suggesting that slow-moving hospital characteristics are unlikely to explain the responses of patient mortality to hospitals' external financing constraints. Starting 2008, patients in treated for-profit hospitals exhibit a large and significant jump in mortality rates relative to those in control hospitals, while those in nonprofit hospitals continue to show no increase in mortality rates. These estimates are consistent with the results reported in Table 3. Panel C plots the dynamic coefficients on the triple interaction term, *Treated* $\times$ *Nonprofit* $\times 1_t$, where $t = 2005, ..., 2010$, which estimate the difference in treatment effects by nonprofit status over time. Again, we observe no differential treatment effects in the pre-crisis period, but significant, negative coefficients following the onset of the Crisis. This suggests that nonprofits exhibit smaller increases in patient mortality rates than for-profit hospitals. These patterns confirm our results in Table 3 and support the notion that nonprofit hospitals are better able to shield patients from the effects of adverse external financing shocks.

Figure 4 About Here

4.3 Robustness Checks

We examine the robustness of our findings to alternative matching specifications. First, we repeat the baseline analysis on a sample of treated and control hospitals without matching. Results are reported in Panel A of Table 4. Our findings obtain in this unmatched sample of treated and control hospitals. Second, we augment our matching procedure using the for-profit status of a hospital as an additional matching variable. Each nonprofit hospital is additionally matched to a for-profit hospital on size and leverage, the same matching variables used to match treated and control firms. Results are reported in Panel B. Again, our results persist in the new sample with the additional matching variable, even though the augmented matching leaves us with a smaller sample. Third, we impose additional fixed effects to sharpen the comparison between patients with similar health risk and between hospitals in similar areas. This includes interacting patient comorbidity with patient demographic characteristics and year fixed effects as well as hospitals referral region fixed effects with patient demographics and year fixed effects. Results in Panel C indicate that our findings are robust to these finer controls. Finally, we consider an alternative measure of healthcare quality, 30-day readmission rates after discharge (see also Aghamolla et al. 2023 and Gao et al. 2023). Consistent with our baseline findings, we confirm in Panel D that readmission rates increase in for-profit hospitals facing external financing constraints, but not in nonprofit hospitals.

Table 4 About Here

In Table B.3 of the Appendix, we further demonstrate that our results are not predominantly driven by a specific type of nonprofit hospitals, such as church-owned hospitals or government-owned nonprofit hospitals.

Taken together, our findings in this section suggest that negative shocks to hospitals' access to debt markets affect patient mortality at nonprofit hospitals to a lesser extent than do patients at for-profit hospitals. This result is not explained by differences in patient health risk in nonprofit and for-profit hospitals, or driven by specific choices of our matching procedures. Instead, they suggest that nonprofit hospitals are more insulated from shocks originating from the external financing markets. We dig into these mechanisms further in the next section.

5 Economic Mechanisms

In this section, we investigate potential mechanisms underlying our effects. We start by analyzing whether the differential patient outcomes between for-profit and nonprofit hospitals are driven by hospitals' procedure choices or different quality hospital procedures. Next, we analyze the sources of care quality by looking into the changes in hospitals' wages and capital expenditures in response to external financing shocks. Third, we examine whether hospitals' cash holdings could explain their operational decisions and care quality.

5.1 Within-Procedure Analysis

Our baseline result suggests that patients with identical demographic characteristics and diagnoses have different mortality rates in nonprofit and for-profit hospitals under financial strain. Is this because patients receive different procedures at nonprofit and for-profit hospitals, or because they receive the same treatment with different quality? We evaluate this explanation by imposing procedure fixed effects, interacting procedure with both hospital-by-diagnosis fixed effects and diagnosis-by-demographics fixed effects (i.e., *Hospital* × *Diagnosis* × *Procedure* and *Year* × *Diagnosis* × *Age Category* × *Gender* × *Procedure* fixed effects). These fixed effects allow us to compare the mortality rates between patients who receive the same diagnosis and same treatment procedure at the same time, but are treated in different types of hospitals.

Results are presented in Table 5. Our results are largely unaffected by the addition of procedure fixed effects, with coefficients displaying similar economic magnitudes and statistical significance as those from the baseline results. Thus, our findings are unlikely to be driven by nonprofit and for-profit hospitals administrating different procedures for patients of identical diagnosis. Instead, it may be attributed to the difference in the quality of treatment given the procedures.

TABLE 5 ABOUT HERE

5.2 Investment in Human Capital and Physical Capital

Why do nonprofit hospitals deliver higher-quality treatment than for-profit hospitals under financial constraints? The answer may lie in their investment in medical staff and equipment (e.g., Propper and Van Reenen, 2010).

We thus examine how nonprofit and for-profit hospitals adjust their labor and capital expenditures in response to external financing shocks. We look into multiple metrics of hospital operations.

First, we examine hospitals' total wage expenses and scale it by total assets to make it comparable across hospitals (*Wages/AT*). Next, we focus on the wage expenses for patient-care employees (e.g., doctors and nurses) and also scale it by total assets (*Medical Staff Wages/AT*). For comparison, we look at wages for non-patient-care employees (*Other Wages/AT*), and the fraction of total wage expenses devoted to patient care employees (*%Medical Staff Wages*). Finally, we measure hospitals' investment in physical assets that are crucial to patient care using the ratio of their capital expenditures on durable medical equipment divided by total assets (*Investment in Medical Equipment*).

We construct a hospital-year panel and estimate the following equation:

$$Y_{j,t} = \beta Treated_j \times Post_t + \gamma Treated_j \times Post_t \times Nonprofit_j + \psi Post_t \times Nonprofit_j + \phi_{j,d} + \alpha_{c,t} + \nu_{j,t}, \quad (4)$$

where Y includes the above-mentioned hospital operation variables. The coefficient of interest is γ, which captures the differential changes in expenditures by treated nonprofit hospitals compared to their control group, relative to the changes by for-profit hospitals relative to their control group. The effect of financial shocks on for-profit hospitals is captured by the double-interaction coefficient, β.

Results are presented in Table 6. In column (1), *Treated* × *Post* generates a negative and significant coefficient, suggesting that for-profit hospitals significantly cut spending in human capital when facing financial constraints. The coefficient on the triple interaction term *Treated* × *Post* × *Nonprofit* has the opposite sign and a similar magnitude as the coefficient of *Treated* × *Post*. This means that nonprofit hospitals' wage expenditures are unaffected by financial stress.

<u>TABLE 6 ABOUT HERE</u>

We next separately examine the effect of financing shocks on patient-care and non-patient-care workers. We find that under financial stress, nonprofit hospitals maintained expenditures in nurses and physicians (column (2)), but not other, non-patient-care workers (column (3)). Consistent with this interpretation, we find in column (4) that patient care wage expense represents a larger share of total wages at nonprofits following financial stress. To interpret the coefficient magnitudes, estimates from column (4) suggest that medical staff share of wages at treated nonprofits 1.9% higher than treated for-profit hospitals.[14] Furthermore, results in column (5) suggest that nonprofit hospitals invest more in medical-specific capital goods in face of negative financing shocks compared to for-profit hospitals.

5.3 The Role of Cash Holdings

How do nonprofit hospitals manage to sustain their medical staff when the external debt market dries up? We conjecture that one reason could lie in the higher level of cash holdings due to regulatory restrictions. Given that nonprofit hospitals do not pay taxes on their operating income, and that they are forbidden from distributing earnings, they hold residual earnings inside the firm in the form of cash (Cadman and Patel, 2023). Figure 5 depicts the average cash holdings of nonprofit and for-profit hospitals during our sample period. The pattern shows that nonprofit hospitals have substantially higher cash reserves compared to for-profit hospitals in every year of our sample. During 2005–2007, nonprofit hospitals have 2.2 percentage points higher cash holdings than for-profits, or 37.9% higher relative to the sample average. This difference is economically and statistically significant (p-value = 0.001). This gap narrows during 2008, but widens in 2009 and 2010. The narrowing of the gap in 2008 is likely driven by nonprofit hospitals incurring higher expenditures on maintaining larger medical staffs and medical equipment.

Figure 5 About Here

[14] In Table B.4, we further show that nonprofit hospitals do not suppress salaries to medical workers during financial stress. This evidence is consistent with the notion that nonprofit hospitals do not compromise the interest of their stakeholders.

Does the excess cash holdings help nonprofit hospitals deliver better care to patients than for-profit ones? We seek to answer this question by separating hospitals into two groups, based on their cash holdings in 2007. We then compare the changes in their mortality rates, for both nonprofit and for-profit hospitals. Specifically, we estimate the following equation:

$$Death_{i,j,t} = \theta_1 Treated_j \times Post_t \times Nonprofit_j \times HighCash_j + \theta_2 Treated_j \times Post_t \times For\text{-}Profit_j \times HighCash_j + \delta_1 Treated_j \times Post_t \times Nonprofit_j \times LowCash_j + \delta_2 Treated_j \times Post_t \times For\text{-}Profit_j \times Low\,Cash_j + \beta Treated_j \times Post_t + \delta Treated_j \times Post_t \times High\,Cash_j + \phi_{j,d} + \alpha_{c,t} + \epsilon_{i,j,t}, \quad (5)$$

where *High Cash* and *Low Cash* are indicator variables taking the value one if a hospital's cash holdings in 2007 is above and below the sample median, respectively. Parameter θ_1 (δ_1) captures the differential mortality of high-cash (low-cash) nonprofit hospitals relative to the average untreated hospital, while parameter θ_2 (δ_2) captures the differential mortality of high-cash (low-cash) for-profit hospitals relative to the average untreated hospital. Column (1) of Table 7 reports the results from this estimation. The results suggest that regardless of the for-profit status, the effect of negative financing constraints on hospital patient mortality is concentrated among cash-poor hospitals, but is absent among cash-rich hospitals. In column (2), we restrict the sample to only patients at nonprofit hospitals and find the same effect. This finding highlights the role of cash reserves as an important mechanism that allows hospitals to survive financial shocks.

TABLE 7 ABOUT HERE

5.4 Hospital Cash Flows, Donations, and Endowment Flows

The majority of nonprofit hospitals receive funding support from governments, foundations, endowments and individual donors. Could nonprofit hospitals rely more on these sources to bridge funding gaps during financially challenging times? We explicitly test this idea by estimating Equation 4, while switching the dependent variable to hospitals' financing cash flows, as well as the income from donations and endowments. If constrained nonprofit hospitals receive more funds from their stakeholders during the Financial Crisis than for-profit hospitals, we should observe an increase in their financing cash flows, especially income from donations and endowment. Table 8 presents the results from this analysis. We do not find significant differences in the financing cash flows of treated nonprofit hospitals and treated for-profit hospitals. Among nonprofit hospitals, the ones facing external credit market shocks do not receive more income from donations and endowments either.

Table 8 About Here

Taken together, our results in this section shed light on the mechanisms underlying the resilience of nonprofit hospitals to external financing shocks. Specifically, our evidence suggests that nonprofit hospitals conserve more liquidity inside the organization, likely due to their tax exemption and non-distribution rules. The excess cash holdings help them maintain expenditures on core medical staff and medical equipment, which in turn allow them to "save lives" during financial strain.

6 Heterogeneity Across Patients

In this section, we examine which patient populations are better served by nonprofit hospitals during periods of financial stress. In particular, we ask whether the differences in patient mortality between nonprofit and for-profit hospitals are more pronounced for patients with worse financial and health conditions.

We begin by examining the heterogeneity of our baseline results across three patient characteristics. The first characteristic is whether a patient has public or private insurance plans. Public insurance plans include MediCal, Medicare, and government indigent plans. Insurance types are an indicator of a patient's income and socioeconomic status. According to the U.S. Census Bureau, only 22.8% of privately insured patients are below the federal poverty line, compared to 58.6% of publicly insured patients. On the flip side, 82.3% of privately insured patients have incomes greater than 250% of the federal poverty line, compared to 23.0% of publicly insured patients.[15] Furthermore, privately insured patients have greater access to healthcare providers. According to the State Health Access Data Assistance Center (SHADAC), 95% of physicians accept new privately insured patients, while only 74% of physicians accept new medicaid patients.[16] The above statistics suggest that publicly insured patients are more vulnerable both in terms of personal financial conditions and from a healthcare-access standpoint.

We consider two metrics of patient health risk. The first metric is the riskiness of patients' diagnoses. Under the first measure, we consider a patient to be "high-risk" if their primary diagnoses have a mortality rate in the top quartile (greater than 2.0%) of the sample. Treating high-risk patients likely requires more resources from hospitals, and the quality of treatment may decline when hospitals face binding resource constraints.

The second metric of health risk is the presence of comorbidities. Comorbidities lead to complications in the treatment process and could aggravate mortality risk. We consider a patient to have a comorbidity if they have at least one of 17 conditions that comprise the Charlson Comorbidity Index, which is widely used in the medical sciences to predict mortality within one year of hospitalization (Charlson et al., 1987; Deyo et al., 1992). The conditions that comprise the Charlson Comorbidity Index are myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, connective tissue disease-rheumatic disease, mild liver disease, diabetes without chronic complications, diabetese with chronic complica-

[15] Data comes from "Health Insurance Coverage in the United States: 2013." The year 2013 is the first year when data on health insurance type by poverty levels are reported (Smith and Medalia, 2014).

[16] SHADAC data from 2014-2017 (https://www.shadac.org/news/14-17-physician-Mcaid-SHC)

tions, paraplegia and hemiplegia, renal disease, cancer, moderate or severe liver disease, metastitic carcinoma, HIV/AIDS.

In examining the heterogeneity of our effects across the above patient types, we repeat the dynamic Equation (3) separately for patients with public and private insurance, with high- or low-risk diagnoses, and with and without comorbidities. Figure 6 depicts the results. Panel A shows the estimates for private-insured patients, and Panel B shows the results for public-insured patients. For privately-insured patients, we observe no differential trend in patient mortality between nonprofit and for-profit hospitals around their external financing shocks. However, for publicly-insured patients, we see a significantly lower increase in mortality rates of nonprofit hospitals than those in for-profit hospitals facing the same external financing constraints.

FIGURE 6 ABOUT HERE

Panels C and D show that for both high-risk and low-risk patients, mortality rates do not differ across treated and control hospitals prior to 2008, regardless of their for-profit status. Starting 2008, the mortality rates of high-risk patients decline at non-profit hospitals relative to for-profit ones. On the other hand, low-risk patients experienced no differential mortality at nonprofits versus for-profits following the Crisis. Consistent with this evidence, Panels E and F of Figure 6 show that nonprofit hospitals see a reduction in mortality rates relative to for-profit hospitals following negative financing shocks only for patients with comorbidities. The effect does not exist for patients without comorbidities.

To better understand the effects of hospital financing constraints for each patient population, we separate the sample into four groups: (1) patients with public insurance in nonprofit hospitals, (2) patients with private insurance in nonprofit hospitals, (3) patients with public insurance in for-profit hospitals, and (4) patients with private insurance in for-profit hospitals. We then estimate the effect of hospital external financing constraints on patient mortality in each subsample.

Panel A of Table 9 reports the results. We find that hospitals' external financing constraints significantly increase the mortality of publicly-insured patients by 0.6 percentage points in for-profit hospitals, but not those in nonprofit hospitals. Such a difference in the effects across hospital status is statistically significant. By contrast, hospitals' financing constraints only generate a weak effect on privately insured patients, by about 0.1 percentage points, in both for-profit and nonprofit hospitals. This result indicates that when facing financial pressure, for-profit hospitals seem to cut back on the delivery of quality healthcare towards publicly insured patients, who are less likely to be "profit centers" to those hospitals.

TABLE 9 ABOUT HERE

Similarly, we separate the sample by the intersection of patient health risk (*High-Risk Diagnosis* and *Has Comorbidities*) and hospitals' for-profit status. Panels B and C report the results. Again, we find hospitals' financing constraints to only increase the mortality rate of high-risk patients inside for-profit hospitals. Our estimates suggest that constrained for-profit hospitals exhibit a 1.5 percentage points increase in the mortality of patients with high-risk diagnosis, and 0.9 percentage points increase in the mortality of patients with comorbidities. The effect is virtually non-existent among high-risk patients in nonprofit hospitals. Among patients without comorbidities, while mortality rates also increase with hospital financing constraints, the increase is minimal (0.1 percentage points) and does not differ between for-profit and nonprofit hospitals.

Overall, our findings suggest that the adverse effects of hospitals' external financing constraints disproportionately impact vulnerable patients in for-profit hospitals, including patients with public insurance and patients with higher health risk. While publicly insured, high-risk patients generally suffer a greater increase in mortality rates than other patients when their hospitals face financial stress, the difference narrows when they are treated by nonprofit hospitals. These results indicate that nonprofit hospitals can play an important role in improving the welfare for more vulnerable patient populations, especially during financially challenging times.

7 External Validity: Alternative Settings

To assess the external validity of our empirical approach, we design two additional experiments that utilize plausibly exogenous variation in hospitals' access to the debt markets. The first analysis focuses on fluctuations in the values of real estate assets held by hospitals, and the second takes advantage of a S&P ratings revision that expanded the debt capacity of affected hospitals.

7.1 Real Estate Value Fluctuations

We follow the methodology used in Glaeser et al. (2008), Chaney et al. (2012), and Carvalho (2018), which utilizes plausibly exogenous variation in the values of firms' real estate asset holdings. The rationale behind this analysis is that real estate assets are commonly pledged as collateral to support debt financing. Thus, fluctuations in real estate prices can affect hospitals' debt capacity. To isolate the effect of real estate price fluctuations from endogenous changes in local conditions, we use the interaction of land availability and national real estate price shocks as an instrument to predict the variation in the local real estate prices. The idea is that national housing price growth, which arguably is unlikely to be driven by patient outcomes at a specific hospital, is more likely to affect local real estate price growth if local real estate supply cannot increase flexibly. In particular, high national real estate price growth is more likely to lead to increases in high local real estate prices when there is less developable land in the local area.

We adopt a two-stage-least-square approach. In the first stage, we regress hospital real estate value (*Real Estate Value/Assets*) on the product of the share of undevelopable land in the hospital's MSA and the growth of national housing price index (HPI). Data on the share of undevelopable land in an MSA comes from Saiz (2010) and is measured from satellite data based on the existence of bodies of water and steep gradients, which are considered unsuitable for real estate development. In the second stage, we regress hospital mortality rates on the projected real estate values held by the hospital. We estimate the following regression model for patient discharges from nonprofit and for-profit hospitals separately.

$$Real\ Estate_{j,t} = \beta Undevelopable\ Land_j \times \Delta National\ HPI_{t-1} + \phi_{j,d} + \alpha_{c,t} + \epsilon_{j,t}$$

$$Death_{i,j,t} = \beta \widehat{Real\ Estate}_{j,t} + \phi_{j,d} + \alpha_{c,t} + \epsilon_{i,j,t}. \tag{6}$$

Once again, i, j, and t, denote patient, hospital, and year, respectively. Furthermore, c represents the combination of age categories, sex, and diagnosis. *Real Estate* is measured as the value of a hospital's real estate normalized by total assets. *Undevelopable Land* is the share of undevelopable land in a hospital's MSA (Saiz, 2010). *National HPI*$_{t-1}$ measures the average change in the housing price index at the national level during the previous year. We expect $\beta > 0$, since local real estate values should be more sensitive to national real estate shocks when local housing supply is inelastic due to land constraints.

We conduct this analysis using the full sample of patient discharges from 2005–2014 at hospitals that have available data on real estate values and undevelopable land in its MSAs, dropping observations from hospitals that switched nonprofit status. We label this sample the "Real Estate Sample." It contains 10.9 million patient discharges across 143 unique hospitals, wherein 9.1 million patient discharges come from 103 unique nonprofit hospitals, and 1.8 million patient discharges come from 40 for-profit hospitals.

Panel A of Table 10 describes summary statistics used in the real estate sample by hospital nonprofit status. Similar to the Crisis Sample, nonprofit and for-profit hospitals have similar mortality rates and patient demographics. Also similar to the Crisis Sample, in the Real Estate Sample, nonprofit hospitals are larger and have lower leverage than for-profit hospitals. However, different from the Crisis Sample, nonprofits in the Real Estate Sample are less profitable and treat a lower share of privately insured patients than their for-profit counterparts.

Table 10 About Here

With this sample, we estimate the two-stage regression described in Equation (6). Table B.5 displays the results from the first stage. Consistent with our expectation, *Undevelopable Land* $\times$ Δ *National HPI* generates a positive and statistically significant coefficient with an F-statistic of 118.0.

Panel B of Table 10 reports the results from the second stage. In columns (1) and (2), we estimate the effect of instrumented real estate collateral value on health outcomes separately for nonprofit and for-profit hospitals, respectively. We find a negative and significant effect of real estate value on patient mortality in the sample of for-profit hospitals only. The estimates suggest that a 10 percentage point decline in real estate values corresponds to a 0.12 percentage point increase in patient mortality, representing an 5.2% increase relative to the sample mean. In column (3), we pool together both hospital types in the same sample and find that the coefficient on *Real Estate* is negative and significant, while the coefficient on the interaction term *Real Estate* $\times$ *Nonprofit* is positive and significant. Similar effects emerge in column (4) when we restrict the sample to patients admitted directly from the hospital's emergency rooms. Again, using this sample helps mitigate the concern that patients' choice of hospitals drives our results.

These results suggest that, as declining real estate values create challenges for hospitals to access external debt markets, patient mortality increases significantly, but only at for-profit hospitals. This sensitivity is attenuated and become statistically insignificantly different from zero at nonprofit hospitals. Consistent with the baseline results (Table B.2), our findings indicate that patient outcomes at for-profit hospitals are sensitive to external financing conditions, while patients at nonprofit hospitals are relatively insulated from such fluctuations.

7.2 S&P Rating Revisions

Our second approach exploits the *expansion* of hospitals' debt capacity arising from S&P's revision of its accounting methodology used to rate firms in 2013. Leverage is a crucial metric in determining credit ratings. While all credit rating agencies adjust GAAP-debt for a host of debt-like obligations such as underfunded pensions, securitizations, and operating lease commitments, they vary in the decision to net cash against debt.[17] Prior to 2013, S&P rated firms using gross debt. In July 2013, S&P announced that they would change their accounting methodology and compute leverage by netting 75% of a firm's cash balance against its outstanding debt (Standard and Poor's, 2013). This change effectively lowered leverage ratios in the eyes of S&P even though the underlying financial health of their rated firms remained unaffected. Despite the change in its overall ratings methodology, S&P did not revise its firm-specific downgrade criteria (Liu and Shivdasani, 2022). S&P outlines firm-specific downgrade criteria in its credit reports for individual firms, for example, disclosing that a firm would be downgrade if adjusted debt-to-EBITDA ratios exceed 3.0x. Thus, the methodology revision allows firms to raise more debt without triggering a downgrade, tantamount to a relaxation of financial constraints.[18] We study the impact of this relaxation of constraints on patient outcomes by comparing cash-rich to cash-poor S&P rated hospitals around the methodology revision.

[17] In 2013, Fitch rated firms using net debt, while Moody's rated firms using gross debt (Fitch Ratings, 2010; Moody's, 2006). S&P rated firms using gross debt prior to 2013, but switched to net debt in 2013.

[18] Consistent with this notion, Liu and Shivdasani (2022) document that cash-rich S&P rated firms increased borrowing and investment following the 2013 methodology revision. Several other papers have shown how changes in rating agency policies can relax or tighten financial constraints, including Adelino et al. (2015) and Fracassi and Weitzner (2023).

Specifically, we estimate the following equation:

$$Death_{i,j,t} = \beta Post\ Revision_t \times Cash_{pre2013,j} + \phi_{j,d} + \alpha_{c,t} + \epsilon_{i,j,t}, \quad (7)$$

where *Post Revision* is an indicator variable that equals one for 2013 and years after, and zero otherwise. $Cash_{pre2013,j}$ measures hospital j's cash-to-asset ratio in 2012, the year prior to the methodology revision, normalized to have mean zero and standard deviation 1. The coefficient of interest is β, which captures the effect of cash holdings, which now counts as negative debt in the eyes of S&P, on patient mortality for S&P-rated hospitals.

For this analysis, we restrict our event window to two years before the ratings change (2011 and 2012) and two years after the ratings change (2013 and 2014) to keep a balanced event panel, since our dataset provided by the California HCAI ends in 2014. We further restrict the sample to S&P-rated hospitals and compare patient mortality rates around the methodology revision by hospital cash holdings. In addition, we drop all pre-switch observations for hospitals that switched nonprofit status. Furthermore, we drop all observations from hospitals that switched nonprofit status after S&P's methodology revision. We label this sample the "S&P Sample." This sample consists of 2.3 million patient discharges across 81 unique hospitals. 1.4 million patient discharges come from 47 unique nonprofit hospitals, while 0.9 million patient discharges come from 34 for-profit hospitals.

Panel A of Table 11 reports the summary statistics from the S&P sample by hospital nonprofit status. Patient mortality, gender composition, age, and patient risk-factors are economically comparable across nonprofit and for-profit hospitals in this sample. However, nonprofits hospitals treat privately insured patients at a higher rate than for-profit hospitals. Nonprofits in this sample tend to be larger, as measured by both beds and asset value, have more leverage, but are less profitable than their for-profit counterparts.

Table 11 About Here

Panel B displays the results of our estimation of Equation 7 for the sample of nonprofit (column (1)) and for-profit (column (2)) hospitals. Following a relaxation of financial constraints, we find no change in patient mortality at nonprofit hospitals but a decrease in patient mortality at for-profit hospitals. A one-standard-deviation increase in hospitals' pre-event cash holdings corresponds to a 0.1 percentage point decrease in patient mortality at for-profit hospitals. This is a meaningful magnitude, as it represents a 4.3% decline in mortality relative to the unconditional mean. These results are consistent with prior findings that nonprofit institutions are less sensitive to changes in financial constraints. The difference in sensitivity to financial constraint changes is statistically significant, as indicated by the statistically significant coefficient on $Post\ (S\&P)_t \times Nonprofit \times Cash\ (Pre\ S\&P)_j$ in column (3). Our findings also persist in the sample of patients administered from hospitals' emergency room in column (4), mitigating concerns that these results are driven by time-varying patient choice of hospitals.

We note that the S&P methodology revision represents a "reverse experiment" relative to our baseline approach, looking at the effect of the expansion of hospitals' debt capacity, instead of the reduction in debt capacity. It is reassuring that our results obtain from this experiment. Our results from this analysis corroborate our baseline findings: patient outcomes are sensitive to shocks to external financing at for-profit hospitals, both positive and negative shocks. In contrast, nonprofit hospitals seem to shield their patients from such fluctuations from the capital markets.

8 Conclusion

This paper investigates the role of hospitals' ownership structure (nonprofit vs. for-profit) in shaping their ability to weather financial stress and how such stress affects patient mortality. Leveraging exogenous shocks to hospitals' ability to access debt markets, we find that the patient mortality of for-profit hospitals significantly increase in response to hospital financial stress, while the patient mortality of nonprofit hospitals does not. This effect is not driven by the sorting of patients to hospitals, and intensifies for vulnerable patient populations.

Importantly, our evidence highlights cash holdings as a mechanism through which nonprofit hospitals are able to maintain healthcare quality when they face difficulty raising funds externally. In particular, we show that nonprofit hospitals preserve higher cash holdings than for-profit hospitals, likely due to their tax exemption status and restrictions to earnings distribution. With more cash at hand, nonprofit hospitals can overcome external financing frictions and maintain their spending on core medical staff and medical equipment, while for-profit hospitals have to cut such expenditures substantially.

Our findings potentially provide a novel justification for the distribution restrictions and tax exemption of nonprofit hospitals. To the extent that nonprofit hospitals are incentivized to preserve more liquidity, they are able to provide healthcare to vulnerable patients when external financing becomes costlier. Hence, while the lack of profit incentives may be financially inefficient, it may help save lives of key stakeholders during turbulent economic times.

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Figure 1. Nonprofit Hospital Share over Time
This figure displays the share of nonprofit hospitals alongside the growth in for-profit hospitals in the US over time. Nonprofit shares and for-profit counts come from KFF and the American Hospital Association (AHA).

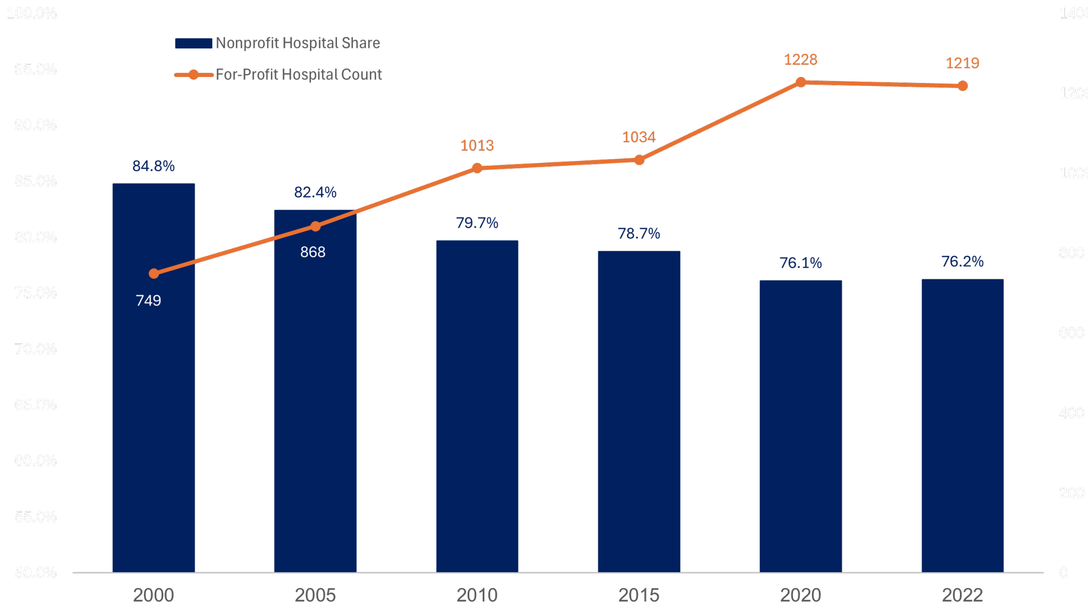


Figure 2. Patient Mortality over Time by For-Profit Status
This figure displays the average patient mortality for nonprofit and for-profit hospitals during our sample period. The light blue (orange) series plots the patient mortality rate for nonprofit (for-profit) hospitals. The solid blue bar series plots the difference in the time trend in patient mortality rates across nonprofits and for-profits. The sample reflects patient discharge-level observations from the PDD with available diagnostic and procedure data.

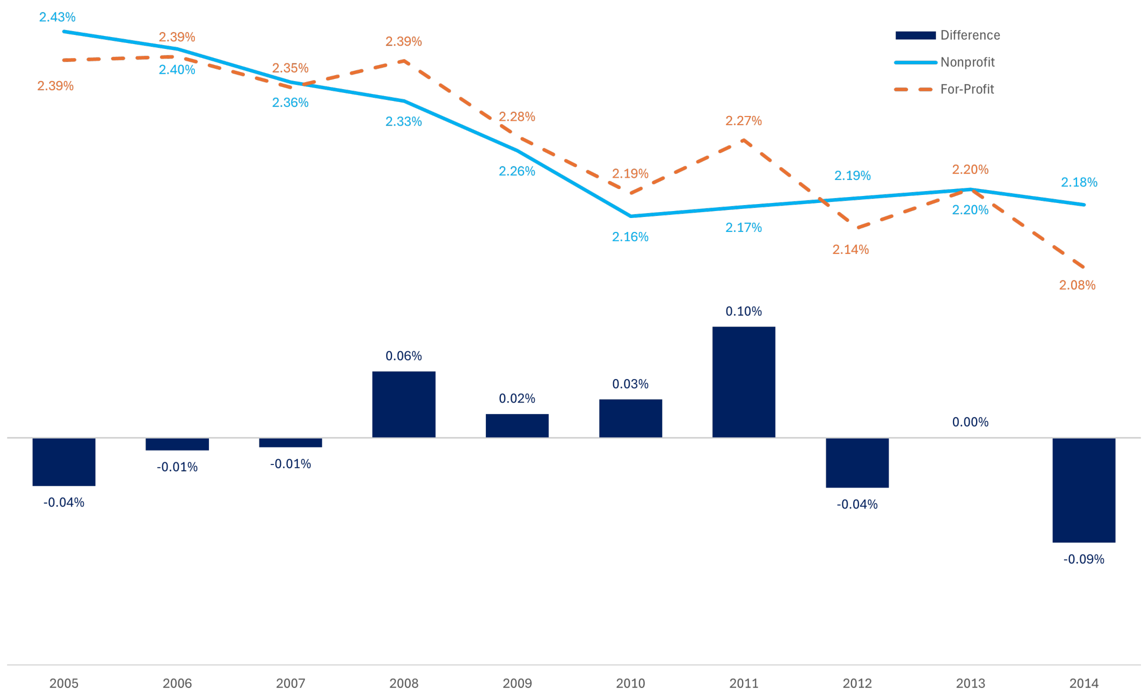


Figure 3. Patient Mortality by Diagnosis and For-Profit Status
The figure plots patient mortality rates across broad diagnosis sections for nonprofit and for-profit hospitals separately. The blue bars indicate the mortality rates at nonprofit hospitals and the shaded red bars indicate patient mortality rates at for-profit hospitals. Diagnosis sections are ranked from highest to lowest risk (mortality rates) from the top to the bottom. Appendix Table B.1 contains a mapping from ICD-9 codes to broad diagnosis sections.

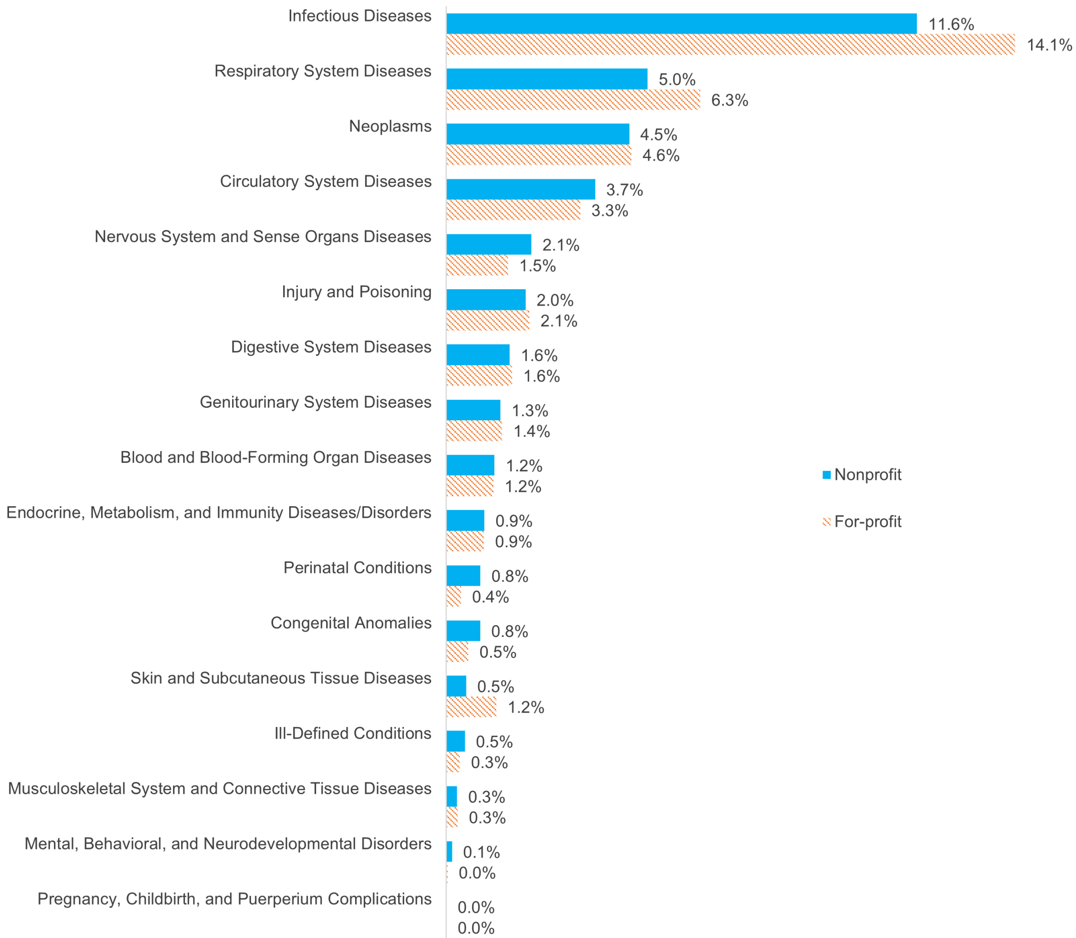
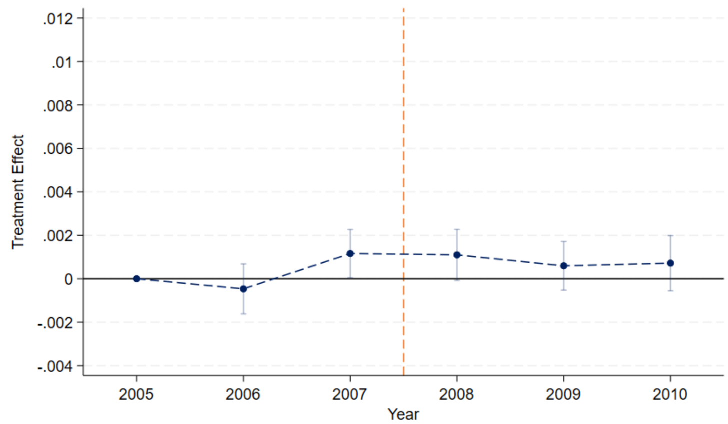
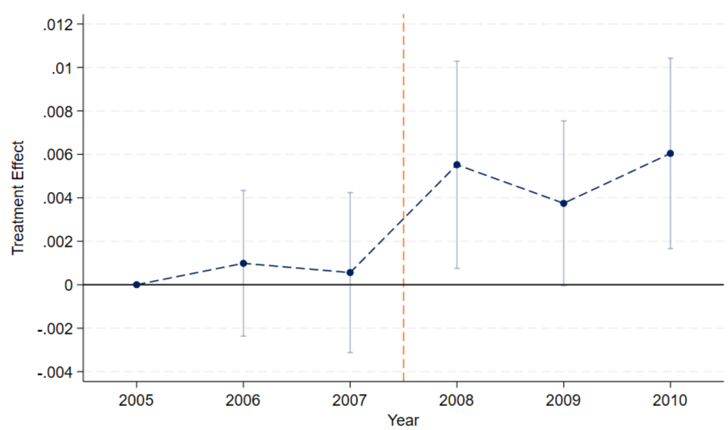


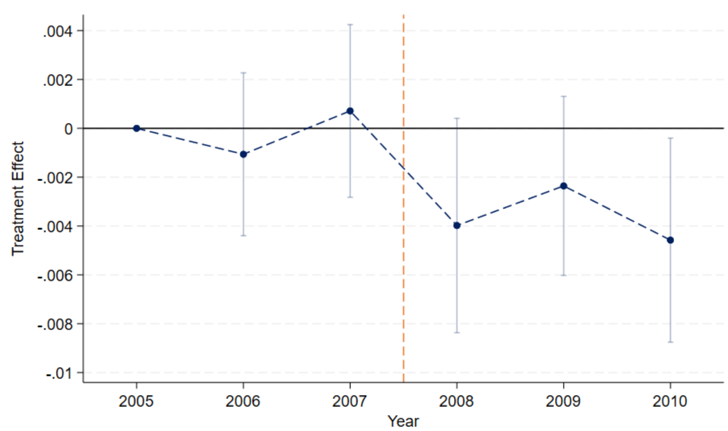
Figure 4. Dynamic Treatment Effects by Nonprofit Status
This figure reports the dynamic effect of external financing shocks during the 2008 Financial Crisis for nonprofit and for-profit hospitals. The estimates come from Equation 3. Panel A (B) plots the estimates for nonprofit (for-profit) hospitals. Panel C presents the triple-difference estimates for the pooled sample with both nonprofit and for-profit hospitals. In each panel, the dots represent the point estimates of the β_t, while the bars represent 90% confidence intervals. Standard errors are clustered at the Hospital×Year level.



Panel A. Dynamic Effects, Nonprofit



Panel B. Dynamic Effects, For-profit



Panel C. Dynamic Effects, Triple Difference Coefficients

Figure 5. Hospital Cash Holdings by Nonprofit Status
This figure displays cash-to-total asset ratios by nonprofit status of hospitals. The sample reflects hospital-year observations from the California HCAI with available financial data.

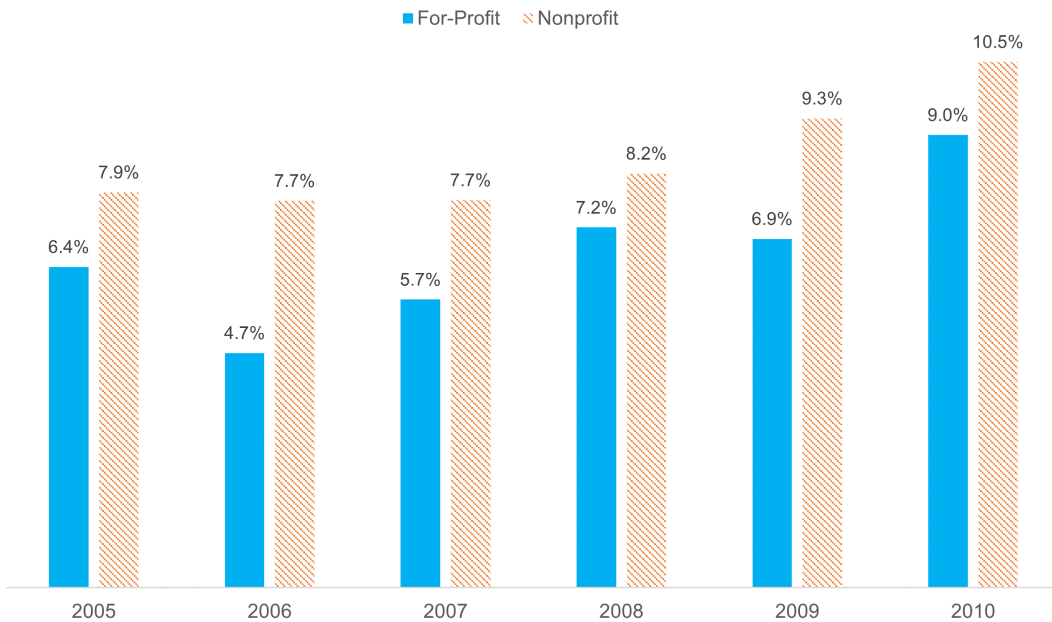
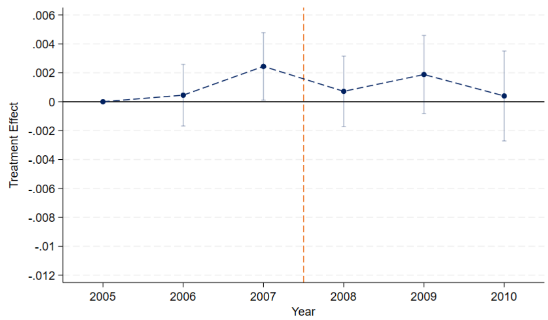
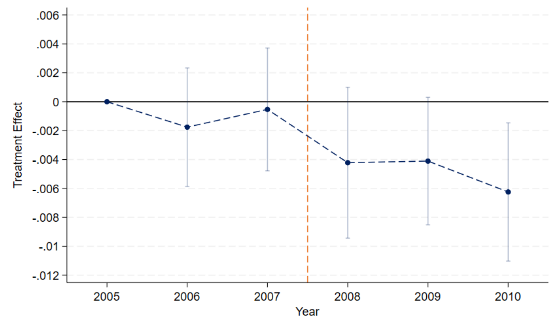


Figure 6. Dynamic Treatment Effects by Insurance Status and Patient Risk

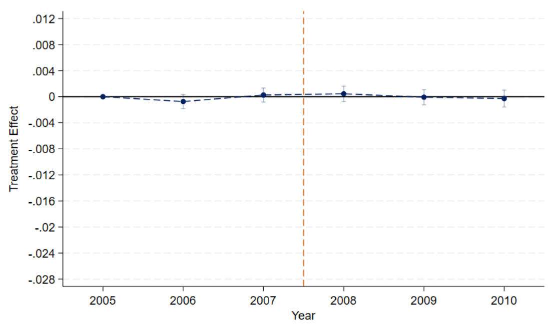
This figure displays dynamic treatment effect of the 2008 financial crisis on patient mortality by patient insurance status (Panels A and B), diagnosis risk (Panels C and D), and presence of comorbidities (Panels E and F). Within each panel, the dots reflect point estimates of coefficients on *Treated* $\times$ *Nonprofit* $\times 1_t$, where 1_t are indicator variables taking the value one in year t, and the bars represent 90% confidence intervals. The sample reflects patients from hospitals with available financial data that remain after matching, as described in Section 2. Panel A (B) estimates β_t in the sample of patient discharges with private (public) insurance and available diagnostic and procedure data. Panel C (D) estimates β_t in the sample of patient discharges with low-risk (high-risk) diagnoses, where high-risk patients are identified as having primary diagnoses with mortality rates greater than 5%. Panel E (F) estimates β_t in the sample of patient discharges without (with) a comorbidity, where the presence of a comorbidity is defined as having a condition that comprises the Charlson Comorbidity Index. Standard errors are clustered at the Hospital$\times$Year level.



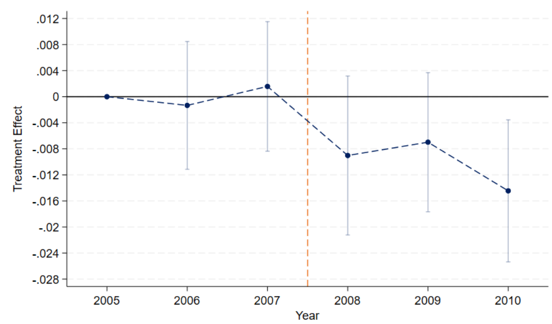
Panel A. Private Insurance



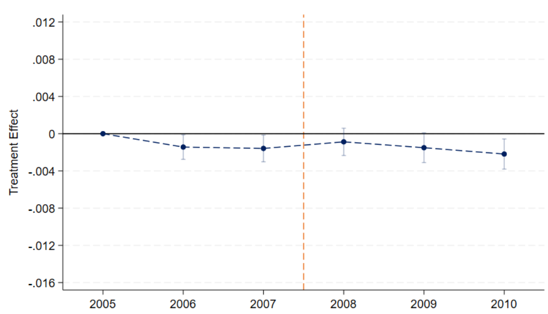
Panel B. Public Insurance



Panel C. Low-Risk Diagnosis



Panel D. High-Risk Diagnosis



Panel E. No Comorbidity

Panel F. Has Comorbidity

Table 1. Summary Statistics

This table displays summary statistics of the key variables used in our study. The unit of observation is a patient discharge. The sample in Panel A reflects patient discharge-level observations from the PDD from hospitals with available financial data from 2005–2014 and consists of 34.2 million observations. The sample in Panel B is restricted to patients from nonprofit hospitals and consists of 27.6 million observations. The sample in Panel C is restricted to for-profit hospitals and consists of 6.6 million observations. *Death* is an indicator variable taking the value one if a patient-hospital interaction ended in patient death, and zero otherwise. *Nonprofit* is an Indicator variable taking the value of one if a hospital is owned by a government or other nonprofit entity (e.g., church, university), and zero otherwise. Detailed variable descriptions can be found in Appendix A.

Panel A. Full Sample

	Mean	Median	Std. Dev.	25^{th} Pctl.	75^{th} Pctl.
Death	0.023	0	0.149	0	0
Female	0.596	1	0.491	0	1
Age Category	11.852	12	4.808	8	16
Private Insurance	0.312	0	0.463	0	1
High-Risk Diagnosis	0.265	0	0.441	0	1
Has Comorbidity	0.449	0	0.497	0	1
Size (Beds)	330.871	321	182.801	192	420
Leverage	0.347	0.326	0.243	0.184	0.457
Profitability	0.053	0.052	0.157	0.009	0.104

Panel B. Nonprofit

	Mean	Median	Std. Dev.	25^{th} Pctl.	75^{th} Pctl.
Death	0.023	0	0.149	0	0
Female	0.597	1	0.490	0	1
Age Category	11.820	12	4.846	8	16
Private Insurance	0.322	0	0.467	0	1
High-Risk Diagnosis	0.269	0	0.443	0	1
Has Comorbidity	0.449	0	0.497	0	1
Size (Beds)	354.687	336	184.092	228.000	445
Leverage	0.347	0.329	0.220	0.195	0.452
Profitability	0.047	0.049	0.135	0.011	0.094

Panel C. For-profit

	Mean	Median	Std. Dev.	25^{th} Pctl.	75^{th} Pctl.
Death	0.023	0	0.150	0	0
Female	0.589	1	0.492	0	1
Age Category	11.998	12	4.627	8	16
Private Insurance	0.267	0	0.442	0	1
High-Risk Diagnosis	0.246	0	0.430	0	0
Has Comorbidity	0.452	0	0.498	0	1
Size (Beds)	205.985	178.000	111.175	117	282
Leverage	0.351	0.265	0.378	0.013	0.544
Profitability	0.077	0.090	0.232	-0.001	0.173

Table 2. Covariate Balancing for the Crisis Sample

This table displays covariate balance for the crisis sample. The unit of observation is a hospital-year. The sample spans 2007 and is restricted to hospitals with available financial data that remain after matching, as described in Section 2. Panel A represents all hospitals in the Crisis sample, while Panel B splits hospitals by nonprofit status. Nonprofit hospitals include hospitals that are owned by a government or other nonprofit entities (e.g., church, university). Treated hospitals are those with greater than 20% of long-term debt maturing at the onset of the 2008 Financial Crisis. Detailed variable descriptions can be found in Appendix A. *** p<0.01, ** p<0.05, * p<0.10.

Panel A. Covariate Balancing

Sample:	(1) Treated	(2) Control	(3) Difference	(4) p-val
Size (ln(Beds))	4.749	4.888	-0.139	0.252
Leverage	0.307	0.371	-0.064	0.146
Profitability	0.022	-0.015	0.037	0.548
Cash/Assets	0.083	0.078	0.005	0.762

Panel B. Covariate Balancing by Nonprofit Status

Sample:	Nonprofit				For-profit			
	(1) Treated	(2) Control	(3) Diff.	(4) p-val	(5) Treated	(6) Control	(7) Diff.	(8) p-val
Size (ln(Beds))	4.871	4.920	-0.049	0.752	4.586	4.721	-0.135	0.559
Leverage	0.293	0.365	-0.072	0.154	0.325	0.404	-0.078	0.428
Profitability	0.037	0.000	0.037	0.576	0.001	-0.095	0.096	0.261
Cash/Assets	0.091	0.077	0.014	0.529	0.071	0.083	-0.012	0.737

Table 3. Hospital Mortality Around the 2008 Financial Crisis by Nonprofit Status
This table reports results from the effect of debt maturing during the 2008 Financial Crisis on patient mortality by hospital nonprofit status. The unit of observation is a patient discharge. The sample spans 2005–2010 and is restricted to hospitals with available financial data that remain after matching, as described in Section 2. The dependent variable is *Death*, which equals one if an inpatient visit to a hospital results in patient death, and zero otherwise. *Treated* hospitals are those with greater than 20% of long-term debt maturing at the onset of the Financial Crisis in 2008. *Post* is an indicator variable taking the value one for observations in 2008 or later. *Nonprofit* is an indicator variable taking the value one for patients discharged from nonprofit hospitals, and zero otherwise. Column (1) restricts the sample to patient discharges of nonprofit hospitals, and Column (2) focuses on for-profit hospitals. Column (3) reports results from the pooled sample that includes both nonprofit and for-profit hospitals. Column (4) further restricts the sample to patients admitted from the hospital's emergency room. Detailed variable descriptions can be found in Appendix A. Standard errors are clustered at the Hospital×Year level. *** p<0.01, ** p<0.05, * p<0.10.

Dep. Var.: *Death*	(1)	(2)	(3)	(4)
Sample:	Nonprofit	For-Profit	Pooled	Pooled (ER Adm.)
Treated × *Post*	.001	.005***	.004***	.007***
	[.000]	[.001]	[.001]	[.002]
Treated × *Post* × *Nonprofit*			-.004***	-.008***
			[.001]	[.002]
Post × *Nonprofit*			.003**	.006***
			[.001]	[.002]
Hospital×Diagnosis FE	Yes	Yes	Yes	Yes
Year×Diag.×Age×Female FE	Yes	Yes	Yes	Yes
Observations	5542343	1220611	6833818	3269164
R^2	.20	.22	.20	.20

Table 4. Robustness

This table examines robustness of our main findings to alternative empirical specifications. Panel A reports results from a unmatched sample of treated and control hospitals, Panel B reports results from a matched sample where treated and control hospitals are matched based on size, leverage, profitability as well as nonprofit status, Panel C presents results from augmenting Equations 1 and 2 with comorbidity fixed effects and hospital referral region (HRR) fixed effects, and Panel D reports the effect of financing constraints on readmission rates. In Panels A-C, the dependent variable is *Death*, which equals one if an inpatient visit to a hospital results in patient death, and zero otherwise. In Panel D, the dependent variable is *30-Day Readmission*, which equals one if a patient was admitted 30-days after a prior admission. *Treated* hospitals are those with greater than 20% of long-term debt maturing at the onset of the Financial Crisis in 2008. *Post* is an indicator variable taking the value one for observations in 2008 or later. *Nonprofit* is an indicator variable for patients discharged from nonprofit hospitals. The unit of observation is a patient discharge. The unit of observation is a patient discharge. The sample spans 2005–2007 and is restricted to hospital with available financial data that remain after matching, except for in Panel B. Detailed variable descriptions can be found in Appendix A. Standard errors are clustered at the Hospital×Year level. *** p<0.01, ** p<0.05, * p<0.10.

Panel A. Unmatched Sample

Dep. Var.: *Death*	(1)	(2)	(3)
Sample:	Nonprofit	For-profit	Pooled
Treated × *Post*	.000	.002***	.002***
	[.000]	[.001]	[.001]
Treated × *Post* × *Nonprofit*			-.001*
			[.001]
Post × *Nonprofit*			.000
			[.001]
Hospital×Diagnosis FE	Yes	Yes	Yes
Year×Diag.×Age×Female FE	Yes	Yes	Yes
Observations	15928434	3197948	19230352
R^2	.18	.21	.18

Panel B. Matching on Nonprofit Status

Dep. Var.: *Death*	(1)	(2)	(3)
Sample:	Nonprofit	For-profit	Pooled
Treated × *Post*	-.000	.004***	.004***
	[.000]	[.001]	[.001]
Treated × *Post* × *Nonprofit*			-.004***
			[.001]
Post × *Nonprofit*			.003***
			[.001]
Hospital×Diagnosis FE	Yes	Yes	Yes
Year×Diag.×Age×Female FE	Yes	Yes	Yes
Observations	3957445	1063257	5087549
R^2	.21	.22	.20

Panel C. Additional Fixed Effects

Dep. Var.: *Death*	(1)	(2)
Treated × *Post* × *Nonprofit*	-.004***	-.004**
	[.001]	[.002]
Treated × *Post*	.004***	.005***
	[.001]	[.001]
Post × *Nonprofit*	.003**	.003**
	[.001]	[.001]
Hospital×Diagnosis FE	Yes	Yes
Year×Diagnosis×Age×Female×Comorb FE	Yes	No
Year×Diagnosis×Age×Female×HRR FE	No	Yes
Observations	6742184	5988319
R^2	.21	.26

Panel D. Readmissions

Dep. Var.: *30-Day Readmission*	(1)	(2)	(3)
Sample:	Nonprofit	For-profit	Pooled
Treated × *Post*	.002	.010**	.011**
	[.002]	[.004]	[.005]
Treated × *Post* × *Nonprofit*			-.010*
			[.005]
Post × *Nonprofit*			.002
			[.005]
Hospital×Diagnosis FE	Yes	Yes	Yes
Year×Diag.×Age×Female FE	Yes	Yes	Yes
Observations	5542343	1220611	6833818
R^2	.26	.34	.26

Table 5. Within-Procedure Effects

This table examines robustness of our main findings to alternative empirical specifications. We present results from augmenting Equations 1 and 2 with procedure interactive fixed effects. In all panels, the dependent variable is *Death*, which equals one if an inpatient visit to a hospital results in patient death, and zero otherwise. *Treated* hospitals are those with greater than 20% of long-term debt maturing at the onset of the Financial Crisis in 2008. *Post* is an indicator variable taking the value one for observations in 2008 or later. *Nonprofit* is an indicator variable for patients discharged from nonprofit hospitals. The unit of observation is a patient discharge. The sample spans 2005–2007 and is restricted to hospital with available financial data that remain after matching. Detailed variable descriptions can be found in Appendix A. Standard errors are clustered at the Hospital×Year level. *** p<0.01, ** p<0.05, * p<0.10.

Dep. Var.: *Death* Sample:	(1) Nonprofit	(2) For-profit	(3) Pooled
Treated × *Post*	.000	.003**	.003***
	[.000]	[.001]	[.001]
Treated × *Post* × *Nonprofit*			-.003***
			[.001]
Post × *Nonprofit*			.002**
			[.001]
Hospital×Diagnosis×Procedure FE	Yes	Yes	Yes
Year×Diagnosis×Age×Female×Procedure FE	Yes	Yes	Yes
Observations	2917332	453181	3475672
R^2	.46	.49	.46

Table 6. Changes in Hospital Operations Following External Financing Shocks

This table examines the effect of external financing shocks on labor and equipment expense of nonprofit and for-profit hospitals. The dependent variable in Column (1) is *Wages/AT*, the expenses allocated to total wages, divided by total assets; *Medical Staff Wages/AT*, the expenses allocated to wages for medical staff (doctors, nurses, physicians assistants, and other providers who see patients), divided by total assets, in Column (2); *Other Wages/AT*, the expenses allocated to wages for all non-medical staff workers, divided by total assets in Column (3); *%Medical Staff Wages*, medical staff wage expenses divided by total wage expenditures, in Column (4); *Investment in Medical Equipment*, the expenses allocated to the purchase of durable medical equipment divided by total assets, in Column (5). The unit of observation is a hospital-year. *Treated* hospitals are those with greater than 20% of long-term debt maturing at the onset of the 2008 Financial Crisis. *Post* is an indicator variable taking the value one for observations in 2008 or later. *Nonprofit* is an indicator variable taking the value one for patients discharged from nonprofit hospitals, and zero otherwise. Hospital level controls include size (ln(Beds) and leverage (debt/total assets). Detailed variable descriptions can be found in Appendix A. Standard errors are clustered at the hospital level. *** p<0.01, ** p<0.05, * p<0.10.

Dep. Var.:	(1) *Wages/AT*	(2) *Medical Staff Wages/AT*	(3) *Other Wages/AT*	(4) *%Medical Staff Wages*	(5) *Investment in Medical Equipment*
Treated × Post × Nonprofit	.211**	.170***	.041	.019**	.031*
	[.096]	[.064]	[.036]	[.009]	[.019]
Treated × Post	-.240***	-.179***	-.061*	-.002	.000
	[.093]	[.062]	[.034]	[.008]	[.002]
Post × Nonprofit	-.077*	-.066*	-.011	-.013**	-.015***
	[.044]	[.035]	[.011]	[.006]	[.006]
Hospital Controls	Yes	Yes	Yes	Yes	Yes
Hospital FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	947	947	947	947	947
R^2	.83	.84	.83	.95	.68

Table 7. The Role of Cash Holdings

This table examines the effect of external financing shocks on patient mortality for nonprofit hospitals with higher and lower cash holdings prior to the 2008 Financial Crisis. The dependent variable is *Death*, which equals one if an inpatient visit to a hospital results in patient death, and zero otherwise. The unit of observation is an inpatient discharge. The sample spans from 2005 to 2010 and includes hospitals with available financial data that remain after matching, as described in Section 2. In Column (2), the sample only includes patient discharges from nonprofit hospitals. *Treated* hospitals are those with greater than 20% of long-term debt maturing at the onset of the 2008 Financial Crisis. *Post* is an indicator variable for observations in 2008 or later. *Nonprofit* is an indicator variable for patients discharged from nonprofit hospitals, and zero otherwise. *High Cash* (*Low Cash*) is an indicator variable taking the value one for hospitals with above (below) median cash in 2007. Detailed variable descriptions can be found in Appendix A. Standard errors are clustered at the Hospital×Year level. *** p<0.01, ** p<0.05, * p<0.10.

Dep. Var.: *Death*	(1)	(2)
Sample:	Pooled	Nonprofits
Treated × *Post* × *Nonprofit* × *High Cash*	-.001	
	[.001]	
Treated × *Post* × *For-Profit* × *High Cash*	.000	
	[.001]	
Treated × *Post* × *Nonprofit* × *Low Cash*	.001**	
	[.001]	
Treated × *Post* × *For-Profit* × *Low Cash*	.002**	
	[.001]	
Treated × *Post* × *High Cash*		-.002***
		[.001]
Treated × *Post*		.001**
		[.001]
Post × *High Cash*		.001
		[.001]
Hospital×Diagnosis FE	Yes	Yes
Year×Diagnosis×Age×Female FE	Yes	Yes
Observations	5972898	4990959
R^2	.20	.21

Table 8. Cash Flow and Donations

This table examines the effect of external financing shocks on cash flow of nonprofit and for-profit hospitals. The dependent variable is *Financing Cash Flow*, cash flow from financing divided by total assets, in Column (1); *Income from Donations and Endowments*, donations plus income drawn from endowments divided by total/assets, in Column (2). The unit of observation is a hospital-year. The sample in Column (1) includes all California hospitals with available financial data, while Column (2) restricts the sample to nonprofit hospitals only. *Treated* hospitals are those with greater than 20% of long-term debt maturing at the onset of the 2008 Financial Crisis. *Post* is an indicator variable taking the value one for observations in 2008 or later. *Nonprofit* is an indicator variable taking the value one for patients discharged from nonprofit hospitals, and zero otherwise. Hospital level controls include size (ln(Beds) and leverage (debt/total assets). Detailed variable descriptions can be found in Appendix A. Standard errors are clustered at the Hospital level. *** p<0.01, ** p<0.05, * p<0.10.

	(1)	(2)
Dep. Var.:	*Financing Cash Flow*	*Income from Donations and Endowments*
Treated × *Post* × *Nonprofit*	.001	
	[.063]	
Treated × *Post*	-.010	.002
	[.060]	[.002]
Post × *Nonprofit*	.006	
	[.038]	
Hospital Controls	Yes	Yes
Hospital FE	Yes	Yes
Year FE	Yes	Yes
Observations	949	354
R^2	.29	.70

Table 9. Heterogeneity Across Patient Characteristics
This table examines the heterogeneous effects of external financing shocks on nonprofit and for-profit hospitals across patient characteristics. The dependent variable is *Death*, which equals one if an inpatient visit to a hospital results in patient death, and zero otherwise. The unit of observation is an inpatient discharge. The sample spans from 2005 to 2010 and includes hospitals with available financial data that remain after matching, as described in Section 2. Odd and even columns restrict the sample to patient discharges of nonprofit and for-profit hospitals, respectively. Panel A restricts the sample to patients with private (column (1) and (2)) and public insurance (column (3) and (4)). Panel B restricts the sample to patients with low-risk (column (1) and (2)) and high-risk (column (3) and (4)) diagnoses. Panel C restricts the sample to patients without (column (1) and (2)) and with (column (3) and 4) comorbidities. *Difference* displays the difference in estimated coefficients between patient mortality nonprofit and for-profit hospitals for a given patient type (i.e., between column (1) and column (2) and between column (3) and column (4). Detailed variable descriptions can be found in Appendix A. Standard errors are clustered at the Hospital×Year level. *** p<0.01, ** p<0.05, * p<0.10.

Panel A. Insurance Type

Sample:	Private Insurance		Public Insurance	
	Nonprofit	For-Profit	Nonprofit	For-Profit
Dep. Var.: *Death*	(1)	(2)	(3)	(4)
Treated × Post	.001**	.001	.000	.006***
	[.000]	[.001]	[.001]	[.002]
Difference	-.000		-.005***	
	[.001]		[.002]	
Hospital×Diagnosis FE	Yes	Yes	Yes	Yes
Year×Diag.×Age×Female FE	Yes	Yes	Yes	Yes
Observations	1592636	306661	3585974	837119
R^2	.32	.34	.20	.22

Panel B. Diagnosis Risk

Sample:	Low-Risk		High-Risk	
	Nonprofit	For-Profit	Nonprofit	For-Profit
Dep. Var.: *Death*	(1)	(2)	(3)	(4)
Treated × Post	.000	.000	.001	.015***
	[.000]	[.000]	[.001]	[.004]
Difference	-.000		-.014***	
	[.000]		[.004]	
Hospital×Diagnosis FE	Yes	Yes	Yes	Yes
Year×Diag.×Age×Female FE	Yes	Yes	Yes	Yes
Observations	4110686	913836	1431657	306775
R^2	.12	.17	.17	.18

Panel C. Presence of Comorbidity

Sample:	No Comorbidity		Has Comorbidity	
	Nonprofit	For-Profit	Nonprofit	For-Profit
Dep. Var.: *Death*	(1)	(2)	(3)	(4)
Treated × Post	.001**	.001**	.000	.009***
	[.000]	[.001]	[.001]	[.003]
Difference	-.001		-.009***	
	[.001]		[.003]	
Hospital×Diagnosis FE	Yes	Yes	Yes	Yes
Year×Diag.×Age×Female FE	Yes	Yes	Yes	Yes
Observations	3173163	647775	2235105	527380
R^2	.29	.29	.20	.21

Table 10. Alternative Empirical Setting: Real Estate Values

This table reports results of the effect of real estate value fluctuations on patient mortality in nonprofit and for-profit hospitals. The dependent variable is *Death*, which equals one if a patient-hospital interaction results in a patient fatality, and zero otherwise. *Nonprofit* is an indicator variable taking the value one for patients discharged from nonprofit hospitals, and zero otherwise. Panel A displays summary statistics for the real estate sample, which reflects patient discharge-level observations from 2005–2014 from hospitals with available data on real estate values and undevelopable land shares in their MSA, as described in Section 2. Panel B isolates changes in hospital real estate collateral value as a source of variation in financial constraints. *Real Estate* is the value of a hospital's real estate divided by total assets. *Real Estate* is instrumented using the interaction of *National HPI*, which measures the average change in the HPI at the national level in a given year, and *Undevelopable Land*, which measures the share of land in a hospital's MSA that is undevelopable. The analysis in Panel B is conducted on the Real Estate Sample. Column (1) and (2) further restricts the sample to patient discharges of nonprofit and for-profit hospitals, respectively. Column (3) includes observations from both types of hospitals. Column (4) further restricts the sample to patients admitted from the hospital's emergency room. Detailed variable descriptions can be found in Appendix A. Standard errors are clustered at the Hospital×Year level (*** p<0.01, ** p<0.05, * p<0.10).

Panel A. Real Estate Sample Summary Statistics

	All Hospitals		Nonprofit		For-Profit	
	(1) Mean	(2) σ	(3) Mean	(4) σ	(5) Mean	(6) σ
Death	0.022	0.148	0.022	0.148	0.024	0.152
Female	0.595	0.491	0.597	0.490	0.583	0.493
Age Category	12.072	4.730	11.982	4.776	12.485	4.490
Private Insurance	0.257	0.437	0.261	0.439	0.238	0.426
High-Risk Diagnosis	0.267	0.442	0.269	0.443	0.259	0.438
Has Comorbidity	0.468	0.499	0.464	0.499	0.486	0.500
Size (Beds)	262.519	120.970	274.075	122.200	212.726	101.441
Leverage	0.352	0.254	0.351	0.232	0.355	0.368
Profitability	0.055	0.146	0.040	0.129	0.124	0.194

Panel B. Real Estate IV

Dep. Var.: *Death*	(1)	(2)	(3)	(4)
Sample:	Nonprofit	For-Profit	Pooled	Pooled (ER Adm.)
Real Estate	-.008	-.012***	-.032***	-.045***
	[.007]	[.004]	[.006]	[.010]
Real Estate × *Nonprofit*			.027***	.033***
			[.005]	[.009]
Hospital×Diagnosis FEs	Yes	Yes	Yes	Yes
Year×Diag.×Age×Female FEs	Yes	Yes	Yes	Yes
Observations	8784940	1648300	10560860	5535800

Table 11. Alternative Empirical Setting: S&P Rating Revisions

This table reports the effects of S&P rating revisions on patient mortality for nonprofit and for-profit hospitals. The dependent variable is *Death*, which equals one if a patient-hospital interaction results in a patient fatality, and zero otherwise. *Nonprofit* is an indicator variable taking the value one for patients discharged from nonprofit hospitals, and zero otherwise. Panel A reports the summary statistics for the S&P sample, which reflects patient discharge-level observations from 2010–2014 from S&P-rated hospitals with available financial data that remain after matching, as described in Section 2. Panel B exploits a 2013 accounting methodology revision at S&P, whereby S&P's leverage assessments are calculated on a net debt basis instead of a gross debt basis. Specifically, 75% of a firm's cash balance is subtracted from debt in S&P's subjective leverage assessments. *Post Revision* is an indicator variable taking the value one for observations in 2013 and 2014, and zero in 2011 and 2012. *Cash (Pre-Revision)* is calculated as Cash/Assets in 2012, the year prior to the methodology revision, normalized to have mean zero and standard deviation one. The analysis in Panel D is conducted on the S&P Sample. Column (1) and (2) further restricts the sample to patient discharges of nonprofit and for-profit hospitals, respectively. Column (3) pools the sample of columns 1 and 2 together, while Column (4) further restrict the sample of column (3) to patients admitted from the hospital's emergency room. Detailed variable descriptions can be found in Appendix A. Standard errors are clustered at the Hospital×Year level. *** p<0.01, ** p<0.05, * p<0.10.

Panel A. S&P Sample Summary Statistics

	All Hospitals		Nonprofit		For-Profit	
	(1) Mean	(2) σ	(3) Mean	(4) σ	(5) Mean	(6) σ
Died	0.022	0.148	0.022	0.147	0.023	0.149
Female	0.596	0.491	0.599	0.490	0.584	0.493
Age Category	12.089	4.702	12.084	4.732	12.111	4.575
Private Insurance	0.288	0.453	0.301	0.459	0.233	0.423
High-Risk Diagnosis	0.271	0.444	0.276	0.447	0.249	0.432
Common Comorbidity Present	0.626	0.484	0.624	0.484	0.631	0.483
Size(Beds)	304.932	159.217	326.459	161.332	216.236	113.049
Leverage	0.348	0.263	0.356	0.243	0.305	0.353
Profitability	0.056	0.152	0.037	0.128	0.120	0.203

Panel B. S&P 2013 Rating Methodology Revision

Dep. Var.: *Death* Sample:	(1) Nonprofit	(2) For-Profit	(3) Pooled	(4) Pooled (ER Adm.)
Post Revision × $Cash_{pre2013}$	.000	-.001*	-.001**	-.001*
	[.000]	[.000]	[.000]	[.001]
Post Revision × *Nonprofit* × $Cash_{pre2013}$			.001**	.001*
			[.000]	[.001]
Hospital×Diagnosis FE	Yes	Yes	Yes	Yes
Year×Diag.×Age×Female FE	Yes	Yes	Yes	Yes
Observations	1319084	821518	2185195	1263393
R^2	.18	.20	.18	.17

Appendix A Variable Definitions

Patient-Level Variables	
Admission Type	Categorical variable that denotes whether a patient's admission was scheduled, unscheduled, newborn, or unknown/other. Source: HCAI
Age Category	Categorical variable that takes the following values based on patient age: 1 = under 1, 2 = 1-4 years, 3 = 5-9 years, 4 = 10-14 years, 5 = 15-19 years, 6 = 20-24 years, 7 = 25-29 years, 8 = 30-34 years, 9 = 35-39 years, 10 = 40-44 years, 11 = 45-49 years, 12 = 50-54 years, 13 = 55-59 years, 14 = 60-64 years, 15 = 65-69 years, 16 = 70-74 years, 17 = 75-79 years, 18 = 80-84 years, 19 = 85+ years. Source: HCAI
Has Comorbidity	Indicator variable taking the value one if a patient has at least one of 17 conditions that comprise the Charlson Comorbidity Index, and zero otherwise. These comorbities are myocardial infarction, congestive heart failure, peripheral vascular disease, cerebrovascular disease, dementia, chronic pulmonary disease, connective tissue disease-rheumatic disease, mild liver disease, diabetes without chronic complications, diabetese with chronic complications, paraplegia and hemiplegia, renal disease, cancer, moderate or severe liver disease, metastitic carcinoma, HIV/AIDS (Charlson et al., 1987; Deyo et al., 1992). Source: HCAI
Diagnosis	A patient's primary diagnosis as denoted by their primary ICD-9 diagnosis code. Source: HCAI
Death	Indicator variable taking the value one if a patient-hospital interaction ended in patient death, and zero otherwise. Source: HCAI
Female	Indicator variable taking the value one if a patient is female, and zero if a patient is male. Source: HCAI
High-Risk Diagnosis	Indicator variable taking the value one if a patient's primary diagnosis has a mortality rate greater than 2%, and zero otherwise. Source: HCAI
Public Insurance	Indicator variable taking the value one for a patient has public insurance, defined as one of Medicare, Medi-Cal, County Indigent Programs, Workers' Compensation, and Other Government or Indigent Programs, and zero if a patient has private insurance. Source: HCAI

Hospital-Level Variables	
Beds	Total number of beds that are licensed and available for use. Source: HCAI
Cash (Pre-Revision)	Cash/Total Assets measured in 2012. Source: HCAI
Financing Cash Flows	Cash flow from financing divided by total assets. Source: HCAI
High Cash	Indicator variable taking the value one if a hospital's Cash/Total Assets in 2007 is above median, and zero otherwise. Source: HCAI
Income from Donations and Endowments	Income from donations and endowment funds divided by total assets. Source: HCAI
Investment in Medical Equipment	Total expense allocated to the purchase of durable medical equipment, divided by total assets. This variable is further multiplied by 100 to rescale for ease of exposition. Source: HCAI
Leverage	Total long-term debt divided by total assets. Source: HCAI
Low Cash	Indicator variable taking the value one if a hospital's Cash/Total Assets in 2007 is below median, and zero otherwise. Source: HCAI
Medical Staff Wages/AT	Expense allocated wages for medical staff (doctors, nurses, physicians assistants, and other providers who see patients), divided by total assets. Source: HCAI
%Medical Staff Wages	Expense allocated to wages for medical staff, divided by total wage expense. Source: HCAI
Δ *National HPI*	Change in the Housing Price Index (HPI) at the national level. Source: FHFA
Nonprofit	Indicator variable taking the value on if a hospital is owned by a government or other nonprofit entity (e.g., church, university), and zero otherwise. Source: HCAI
Other Wages/AT	Expense allocated to wages for non-medical staff workers, divided by total assets. Source: HCAI
Profitability	Return on Assets (ROA), calculated as net income divided by total assets. Source: HCAI
Real Estate	Hospital real estate value divided by total assets. Source: HCAI
Size (Beds)	Total number of beds that are licensed and available for use. Source: HCAI
Size (ln(Beds))	Logged total number of beds that are licensed and available for use. Source: HCAI
Treated	Indicator variable taking the value one if the amount of long-term debt maturing in 2008 is greater than 20%, and zero otherwise. Source: HCAI
Undevelopable Land	Share of land in an MSA that is unsuitable for development. Data on undevelopable land comes Saiz (2010) and is measured from satellite image data analyzing the presence of large bodies of water and steep gradients. Source: Saiz (2010)

Time-Level Variables	
Post	Indicator variable taking the value one for observations the three years after the onset of the Financial Crisis (2008-2010), and zero for observations in the three years prior (2005-2007). Source: NBER
Post Revision	Indicator variable taking the value one for observations the two years after the S&P methodology revision (2013-2014), and zero for observations in the two years prior (2011-2012). Source: S&P
Year	Patient discharge year. Source: HCAI

Appendix B Robustness Checks

Table B.1. ICD-9-CM Diagnosis Sections
This table displays the ICD-9-CM diagnostic codes that correspond to each broad ICD-9-CM diagnosis section.

ICD-9-CM Code Range	ICD-9-CM Section
001-139	Infectious Diseases
140-239	Neoplasms
240-279	Endocrine, Metabolism, and Immunity Diseases/Disorders
280-289	Blood and Blood-Forming Organ Diseases
290-319	Mental, Behavioral, and Neurodevelopmental Disorders
320-389	Nervous System and Sense Organs Diseases
390-459	Circulatory System Diseases
460-519	Respiratory System Diseases
520-579	Digestive System Diseases
580-629	Genitourinary System Diseases
630-679	Pregnancy, Childbirth, and Puerperium Complications
680-709	Skin and Subcutaneous Tissue Diseases
710-739	Musculoskeletal System and Connective Tissue Diseases
740-759	Congenital Anomalies
760-779	Perinatal Conditions
780-799	Ill-Defined Conditions
800-999	Injury and Poisoning

Table B.2. Financial Constraints and Hospital Mortality Rates

This table reports results from the effect of debt maturing during the 2008 Financial Crisis on patient mortality. The unit of observation is a patient discharge. The unit of observation is a patient discharge. The sample spans 2005–2010 and is restricted to hospital with available financial data that remain after matching, as described in Section 2. The dependent variable is *Death*, which equals one if an inpatient visit to a hospital results in patient death, and zero otherwise. *Treated* hospitals are those with greater than 20% of long-term debt maturing at the onset of the Financial Crisis in 2008. *Post* is an indicator variable taking the value one for observations in 2008 or later. Detailed variable descriptions can be found in Appendix A. Standard errors are clustered at the Hospital×Year level. *** p<0.01, ** p<0.05, * p<0.10.

Dep. Var.: *Death*	(1)	(2)	(3)
Treated × *Post*	.001**	.001**	.001***
	[.000]	[.000]	[.000]
Hospital FE	Yes	No	No
Year FE	Yes	Yes	No
Hospital×Diagnosis FE	No	Yes	Yes
Year×Diag.×Age×Female FE	No	No	Yes
Observations	7101314	6990942	6833818
R^2	.01	.15	.20

Table B.3. Robustness – Nonprofit Definition

This table examines robustness of our main findings to various definitions of nonprofit hospitals. The unit of observation is a patient discharge. The sample spans 2005–2010 and is restricted to hospitals with available financial data that remain after matching, as described in Section 2. The dependent variable is *Death*, which equals one if an inpatient visit to a hospital results in patient death, and zero otherwise. *Treated* hospitals are those with greater than 20% of long-term debt maturing at the onset of the Financial Crisis in 2008. *Post* is an indicator variable taking the value one for observations in 2008 or later. *Nonprofit* is an indicator variable taking the value one for patients discharged from nonprofit hospitals, and zero otherwise. Columns (1), (2), and (3) further drop from the sample patient discharges from church-affiliated, government, and non-church non-government nonprofit hospitals, respectively. Detailed variable descriptions can be found in the Appendix. Standard errors are clustered at the Hospital×Year level. *** p<0.01, ** p<0.05, * p<0.10.

Dep. Var.: *Death* Sample:	(1) Drop Church	(2) Drop Government	(3) Drop Other Nonprofits
Treated × Post × Nonprofit	-.004***	-.003**	-.003**
	[.001]	[.001]	[.001]
Treated × Post	.004***	.004***	.004***
	[.001]	[.001]	[.001]
Hospital×Diagnosis FE	Yes	Yes	Yes
Year×Diagnosis×Age×Female FE	Yes	Yes	Yes
Observations	5800822	5748628	3293770
R^2	.20	.19	.21

Table B.4. Hospital Salaries

This table examines differences in average salaries (Panel A) and the effect of external financing shocks on average salaries (Panel B) by nonprofit and for-profit hospitals. In Panel A, Columns (1) and (2) display average salaries for nonprofit and for-profits, respectively, and Columns (3) and (4) displays the difference and p-value. In Panel B, the dependent variable is *ln(Average Salary)*, the logarithm of average salary. The unit of observation is a hospital-year. *Treated* hospitals are those with greater than 20% of long-term debt maturing at the onset of the 2008 Financial Crisis. *Post* is an indicator variable taking the value one for observations in 2008 or later. *Nonprofit* is an indicator variable taking the value one for patients discharged from nonprofit hospitals, and zero otherwise. Hospital level controls include size (ln(Beds) and leverage (debt/total assets). Detailed variable descriptions can be found in Appendix A. Standard errors are clustered at the Hospital level. *** $p<0.01$, ** $p<0.05$, * $p<0.10$.

Panel A. Average Salaries by Nonprofit Status

Sample:	(1) Nonprofit	(2) For-Profit	(3) Difference	(4) p-val
Average Salary	236586	235910	677	0.758

Panel B. Salaries around External Financing Constraints

Dep. Var: *ln(Average Salary)*	
Treated × *Post* × *Nonprofit*	-.021
	[.048]
Treated × *Post*	.029
	[.040]
Post × *Nonprofit*	.044
	[.035]
Hospital Controls	Yes
Hospital FE	Yes
Year FE	Yes
Observations	947
R^2	.88

Table B.5. Real Estate IV - First Stage

This table displays the first stage regression of the instrumental variables analysis in Table 10. The unit of observation is a patient discharge. The sample spans 2005–2014 and is restricted to hospitals with available data on real estate values and undevelopable land shares in their MSA, as described in Section 2. The dependent variable is *Real Estate*, which measures the value of a hospital's real estate divided by total assets. *National HPI* measures the average change in the HPI at the national level in a given year, and *Undevelopable Land* measures the share of land in a hospital's MSA that is undevelopable. Detailed variable descriptions can be found in the Appendix. Standard errors are clustered at the Hospital×Year level. *** p<0.01, ** p<0.05, * p<0.10.

Dep. Var.: *Real Estate*	(1)
Undevelopable Land × Δ *National HPI*	.863***
	[.003]
Hospital×Diagnosis FE	Yes
Year×Diag.×Age×Female FE	Yes
Observations	10560860
R^2	.75