Private Equity in the Hospital Industry*

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Abstract

We examine the survival prospects, employment profiles, and patient outcomes at private equity (PE)-acquired hospitals. Target hospitals maintain their survival rates while significantly reducing employment and wage expenditures. The number of core medical workers drops temporarily, but returns to its pre-acquisition level in the long run. However, administrative job and wage cuts persist over the long term, particularly at previously nonprofit hospitals. Using proprietary insurance claims data, we find no significant changes in patient demographics or inpatient prices at PE-acquired hospitals. While patient satisfaction declines, there is no evidence of increased patient mortality or readmission rates at PE-acquired hospitals.

Keywords: Private Equity, Hospital Acquisitions, Employment, Operational Efficiency, Real Patient Outcomes, Hospital Prices

1. Introduction

It is estimated that private equity (PE) firms invested around $200 billion into the U.S. healthcare industry over the past decade, a large fraction of which is invested in hospitals.[1] There are opposing views regarding the growing presence of PE firms in the hospital industry. Proponents claim that they provide hospitals with much-needed managerial expertise and operational reforms, which help turn around struggling hospitals. Opponents voice concerns that PE firms load hospitals with debt, sell assets, lay off workers, and, in some cases, even close hospitals. This debate is particularly important given the economic significance of the healthcare industry. This industry contributes to nearly 20% of total U.S. GDP, provides critical healthcare to local communities, and ranks among the top ten job providers in the U.S. In this paper, we seek to shed light on

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[1] Source: A city's only hospital cut services. How locals fought back. *Wall Street Journal*, Aug. 2020.

this important debate by examining outcomes for key stakeholders including investors, employees and patients at hospitals acquired by PE firms.

We study the survival prospects, employee profiles, and patient outcomes at PE-acquired hospitals. Our findings show that PE-acquired hospitals do not exhibit higher closure rates, but experience substantial cost-cutting. Cost-cutting is focused on administrative expenditures instead of core medical functions, reflecting the operational expertise of PE (Jensen, 2019; Kaplan and Stromberg, 2009). Our analysis reveals no changes in inpatient prices, patient composition, or patient mortality and readmission rates. At the same time, patient satisfaction declines, possibly due to the reduction in administrative staff.

We compile a sample of 1,218 M&A deals in the hospital industry over the period from 2001 to 2018. Our focus is on 281 deals where the acquirer is a for-profit organization, either a PE firm, a PE-owned hospital or a hospital with no PE ownership. These deals involve 610 unique target hospitals. We analyze PE-acquired hospitals relative to a control group of non-acquired hospitals that are closely matched by location, time, and pre-event characteristics. We also benchmark the effects of PE buyers against non-PE, for-profit buyers by comparing the outcomes of the hospitals they acquire. This comparison helps address concerns that our results may capture simply the treatment effects or target selection by for-profit acquirers that is not specific to PE.

We track target and control hospitals over two horizons around the events: a short-run horizon where we compare outcomes during the four-year pre-event window ([-4, -1]) with those in the four-year post-event window ([0, 4]), and a long-run horizon where we contrast the pre-event window with a second post-event window spanning years [5, 8] after the event. This choice is motivated by the consideration that restructuring events often involve large-scale transformation and take a long time to implement. Looking only at the short-term effects could mask important implications of reforms conducted in acquired hospitals.[2]

We start our analysis with the survival and profitability of acquired hospitals. Contrary to the concerns raised in the popular press that PE firms tend to close hospitals, we find no evidence of excessive closure of PE-acquired hospitals. PE-acquired hospitals significantly improve their operating profitability, although this effect becomes statistically insignificant in the long-run. These results do not imply, however, that all jobs are preserved at PE-acquired hospitals. We find that employment at PE-acquired hospitals declines by 6% over the first four-year event window and stays at a similar level over the long-term horizon. As a natural consequence, the total wage bill goes down by 7% over the first four years and becomes 9% lower than its pre-acquisition level at the end of the eight-year window following the deal. Together, our findings suggest that PE substantially cuts costs at acquired hospitals, and target hospitals do not experience a greater likelihood of closure compared to the control group.

Although employment cuts can reduce operating costs and improve profitability, they can compromise the quality of healthcare and the long-term viability of acquired hospitals if they involve essential medical workers. Therefore, we examine the employment

[2]Prior studies on the roles of PE examine both the short-run effects following PE buyouts (e.g., Kaplan 1989; Davis et al. 2014; Lerner et al. 2011; Bernstein 2022) and long-term outcomes (e.g., Kaplan and Stromberg 2009). Kaplan and Stromberg (2009) report that the holding periods of PE firms have increased substantially since the 1990s, with only 12% of deals being exited within 24 months and around half of the deals having PE ownership for over 6 years.

outcomes separately for administrative workers and core workers. We define core workers as nurses, pharmacists and physicians—those critical for healthcare delivery. We find that the number of core workers at PE-acquired hospitals temporarily drops over the first event window but bounces back over the second event window. In other words, at the end of our eight-year horizon, the number of core workers does not differ from its pre-acquisition level. The short-term reduction of core workers may arise from the temporary disruption of operations due to corporate restructuring, the re-sorting of workers based on their preferences for the work environment in a PE-owned hospital, or a need to restructure hospitals' skilled labor force following PE acquisitions. These factors, combined with labor market frictions related to searching and hiring skilled workers, can result in the temporary decline of medical workers. Our examination of administrative workers reveals different dynamics from those of core workers. We observe a large decline in administrative workers, by 17% over the first event window. Unlike core workers, the drop in administrative workers does not revert back, but stays at 20% below the pre-acquisition level by the end of the second event window.

Next, we compare the estimated effects across the samples of PE and non-PE, for-profit acquirers. Non-PE, for-profit acquirers serve as a basis for comparison because they also have profit motives, but may not possess the same level of operational expertise, financial engineering capability, or governance discipline as do PE firms. Thus, we expect the targets of non-PE, for-profit acquirers to exhibit a lower degree of efficiency improvement. We find that target hospitals of non-PE acquirers exhibit a 16% closure likelihood during the eight years after their acquisitions. Subsequent to being acquired, these hospitals also reduce their total employment, but such a reduction is relatively small and statistically insignificant. In terms of worker composition, we observe a significant reduction in core workers, but no decline in administrative workers at hospitals acquired by non-PE acquirers, during either the short-run or the long-run event window. Our results from this set of analyses suggest that the operational changes documented above are unique to PE acquirers, but not present for other for-profit acquirers in general.

One concern is that our findings may be driven by PE firms selecting targets that show signs of improved operational performance prior to being acquired. We address this concern in two ways. First, we examine the pre-acquisition changes in profitability, employment, and core and administrative workers at target hospitals. If PE acquirers select hospitals already in the process of cutting employment, we should observe changes in profitability and employee profiles in the pre-acquisition period. However, we do not find this to be the case. In particular, the changes in profitability and workers do not occur prior to PE acquisitions, but start only after the acquisitions.

Second, we follow the methodology in Liu (2021) and exploit the staggered changes in the Corporate Practice of Medicine (CPOM) doctrine across states. CPOM prohibits people or business corporations without medical licenses, such as PE firms, from practicing medicine or employing physicians to perform medical services. The stringency of CPOM enforcement varies widely across states and changes over time. We compile a list of state-level changes in CPOM stringency by manually searching and filtering through state legislation changes, case laws, and informal comment letters from state attorney generals that indicate changes in a state government's strictness towards implementing CPOM. Our identification assumption is that the changes in CPOM doctrines in a state are not driven by the performance and the operational characteristics of hospitals in that state. To verify this assumption, we show that many state-level characteristics, such as healthcare spending, income, and mortality do not predict changes in the CPOM doctrine. Importantly, we document that following a relaxation of CPOM doctrines in a state, hospitals in that state are more likely to be acquired by PE firms.[3] Target hospitals also experience improved profitability and declines in employment and wages. Moreover, hospitals in states with relaxed CPOM enforcement experience a significant reduction in administration workers, by over 9%, subsequent to the changes in CPOM statute, while having virtually no change in their core workers. While these results do not fully eliminate endogeneity concerns, they lend further support for the argument that PE acquirers affect the employment profiles and profitability of target hospitals.

We design two additional analyses to strengthen the inferences from our employment results. To start, we examine wage rates offered to core and administrative workers, which help separate the effects of hospital labor demand from the effects of labor supply. We do not observe a meaningful change in the wage rate paid to core workers, but a substantial decline in the wage rate of administrative workers, by around 7% over the long run. This result supports our interpretation that PE acquirers trim spending related to administrative functions. In addition, we consider an alternative definition of core workers that consists only of nurses and pharmacists, excluding physicians. This helps address the concern that cost reports may not track physician hours correctly, since physicians may be hired through part-time contracts, employed by multiple hospitals, or work under flexible contracts like independent contractor agreements.

We subject our results to several robustness analyses. For example, we control for commuting zone-year interactive fixed effects to remove the confounding effects of changing local conditions. We examine alternative employment variables, measured by the ratio of employee counts by the number of patients treated. We also test the sensitivity of our results to the sampling procedure in two ways. In one test, we change the hospital characteristics used in the matching process. In the other, we exclude cases where the target hospital and its matched control are located nearby, so as to mitigate the spillover effects from local acquisitions. Our results remain largely unchanged in these alternative measurements or samples.

Next, we compare target hospitals with nonprofit status to those with for-profit status prior to being acquired. We expect that nonprofit targets may experience a greater reduction in administrative workers after PE takeover, for at least two reasons. First, nonprofit hospitals face no investor scrutiny and may operate less efficiently by employing excessive amount of administrative workers prior to being acquired. Second, nonprofit hospitals may prioritize patient satisfaction over profitability and thus maintain substantial administrative functions. Our evidence is consistent with this conjecture. Over the short-term horizon, total employment declines more substantially at formerly nonprofit hospitals than for-profit ones after PE acquisitions. Over the long-term, administrative workers experience a 33% decline while core workers revert back to their pre-acquisition level at previously non-profit targets. In contrast, target hospitals with previous for-profit status experience significantly smaller reductions in administrative workers.

What are the implications of PE acquisitions of hospitals for patients? On the one hand, the reduction in overall employment may result in worse patient experiences and outcomes. On the other hand, patient outcomes may not deteriorate, given that employ-

[3] We do not find a tightening of CPOM doctrines in a state to reduce PE acquisitions of hospitals in that state. This may be due to the fact that the pre-existing CPOM doctrine was already restrictive, creating a significant hurdle for PE acquisitions. Hence, further restrictions may have not generated further effect.

ment cuts largely consists of administrative workers and not core workers, especially in the long run. To answer this question, we examine multiple dimensions of patient characteristics and outcomes, including patient composition, hospital pricing, patient satisfaction, and patient health outcomes, including mortality and readmission rates.

To start, we look at how PE acquisitions affect patient composition in terms of the case mix index (CMI) (i.e., the measure of resource intensive patients treated at a hospital), the outpatient ratio (i.e., the ratio of patients treated in outside clinics relative to those treated inside the hospital), the percentage of patients with Medicare and Medicaid insurance, and patient demographics such as gender, age, and income. We find that the CMI remains unchanged and the outpatient ratio decreases significantly in hospitals acquired by PE, suggesting that acquired hospitals do not move away from complex procedures or focus more on outpatient services to generate greater profit (Baugh and Schuur, 2013). Although the fraction of Medicare patients at target hospital declines in the initial four-year window, this effect disappears in the long run.

We further investigate the changes in patient demographics at PE-acquired hospitals using information from a large, proprietary database on insurance claims from the Health Care Cost Institute (HCCI). The HCCI database includes health insurance claims for individuals with coverage from four large private insurance companies in the U.S.: Aetna, Humana, Kaiser Permanente, and Blue Health Intelligence. The data cover healthcare services paid for by these insurers from 2012 to 2018 (the end of our acquisition sample). Analyzing these data, we do not find that PE-acquired hospitals shift to serving younger and wealthier patients.

We next ask whether PE acquirers are associated with higher prices at target hospitals. Our analysis focuses on inpatient prices, which account for the most expensive procedures, and a major source of hospital income. We focus on a sample consisting of all inpatient procedure prices as well as seven procedure-specific samples, each focusing on one relatively homogeneous procedure (C-section, vaginal delivery, hip replacement, knee replacement, PTCA, MRI, and colonoscopy). Compared to matched control hospitals, we do not find evidence that PE-acquired hospitals increase inpatient prices significantly. Among the seven procedures that we examine, prices do not increase for six of them, with the exception of colonoscopy, where the price increases by around 29%, after PE takeovers.[4]

Overall, our results on patient composition and pricing suggest that PE-acquired hospitals do not appear to attract or focus more on wealthier and younger patients who potentially have lower health risks. They do not significantly raise inpatient prices either. In additional analyses, we do not detect any evidence that PE-acquired hospitals shift towards more profitable operations (such as C-section over vaginal birth for child delivery, or catheterization over intensive drug treatment for heart attack patients).

We next examine the changes in patient satisfaction. Although PE-acquired hospitals manage to restore their core medical employees over the long-term window, the decline in administrative employees may lead to poor outcomes in serving patients. We utilize data on patient satisfaction from the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey. Our finding suggests that patient satisfaction indeed declines across many dimensions at PE-acquired hospitals compared to control hospitals.

[4] Liu (2021) examine how PE acquisitions affect outpatient prices. Our results add to the literature by looking at inpatient prices, which account for on average 58 percent of total charges in our matched sample.

At the same time, hospitals acquired by non-PE firms also experience similar declines in patient satisfaction. Thus, our findings likely capture the interruption in services following any takeover by for-profit acquirers.

Finally, we analyze patient mortality rates and readmission rates related to heart attack, heart failure, and pneumonia at acquired hospitals. We do not find that patients at PE-acquired hospitals experience significant increases in mortality rates. Readmission rates do not increase for PE-acquired hospitals across any of the health conditions we examine either. The lack of deterioration in patient outcomes, combined with the evidence that patient characteristics do not change, suggests that healthcare quality does not deteriorate at PE-acquired hospitals. This finding is in line with the evidence presented by contemporaneous research such as Liu (2021), Craig et al. (2021), Cerullo et al. (2022b), and Bruch et al. (2022).

2. Relation to Existing Literature

A number of studies in financial economics, health economics and medical research examine the effects of PE in the hospital industry.[5] Our study differs from the existing literature in several ways. First, our paper is the first study to provide a comprehensive examination of the effects of PE on patients, prices, and employees together, using a uniform sampling process and empirical methodology. Second, we provide the first piece of evidence regarding the survival prospects of PE-acquired hospitals, addressing an important policy concern that PE may excessively close acquired hospitals. Third, our analysis provides unique insights on how PE selectively reduces labor costs, which reflects their operational expertise. Our finding that PE substantially and persistently reduces administrative workers is particularly noteworthy, given that over-sized administrative functions are a major source of operating inefficiency in the hospital industry.[6] Finally, our evidence suggests that a channel through which PE improves hospital efficiency is by converting nonprofit hospitals into for-profit ones, thus providing hospitals with investor accountability.

Different from most studies in this area, Liu (2021) and our study provide a causal interpretation of how PE affects hospitals beyond a selection effect. We further differentiate from Liu (2021) by looking into how PE acquisitions affect core and administrative workers, and by examining the changes in inpatient prices instead of outpatient prices. In our sample of hospitals, inpatient charges account for around 58% of total patient charges. Inpatient care also tends to be significantly more costly than outpatient care. Thus, examining if PE acquisitions lead to changes in inpatient prices is crucial in understanding their impact on patients.

[5] Borsa et al. (2023) identify 9 recent papers studying various effects of PE in the hospital industry, among which only Liu (2021) is in the area of financial economics and the remaining 8 are in the field of health economics and medicine. Out of the 8 papers outside financial economics, La France et al. (2021) and La Forgia et al. (2022) do not represent direct comparisons to our paper as the former provides a qualitative case comparison and the latter provides an analysis of outpatient anesthesia facilities acquired by PE.

[6] Shrank et al. (2019) review estimates from 54 unique academic articles and government-based reports and estimate that administrative complexity contributes to $265.6 billion of annual wasteful expenditure, the largest across all estimated categories. Consistent with our findings, both Cerullo et al. (2022a) and Offodile II et al. (2021) document a reduction in total employment at PE-acquired hospitals, but do not separate core workers from administrative workers or distinguish short-term from long-term effects.

Our paper is also related to the contemporaneous studies on the role of PE in the nursing home industry. Gandhi et al. (2020b) document positive effects of PE on nursing homes in highly competitive markets. Gupta et al. (2021), on the other hand, find that PE reduces the quality of care at nursing homes. Gandhi et al. (2020a) document worse patient outcomes at PE-acquired nursing homes during COVID-19. Our analysis complements these studies by examining PE acquirers in the hospital industry, an industry accounting for a large fraction of employment in many labor markets.

The difference in our findings and those in Gandhi et al. (2020a) and Gupta et al. (2021) can be attributed to the fundamental differences between the nursing home industry and the hospital industry. To start, nursing homes serve older patients, with an average patient age above 80. These patients face relatively fewer options in selecting nursing homes and often choose ones close to home. They are often uninformed of nursing home quality and have lower ability to advocate for themselves. This means that PE investors in the nursing home industry may be able to cut cost at the expense of patient welfare without damaging nursing homes' revenue or long-term reputation. In contrast, the average hospital patient is younger and more mobile. Hence, PE investors in the hospital industry may be constrained in the extent to which they can cut expenditures on healthcare services, as drastic cost-cutting may push away patients and reduce revenue. Another unique feature of PE investors in the hospital industry is that they transition nonprofit hospitals to for-profit hospitals in some deals. We document that providing hospitals with investor accountability is potentially an important mechanism through which PE can institute changes in target hospitals. In contrast, the vast majority of nursing homes are already owned by for-profit firms, leaving little room for this mechanism.[7]

More broadly, our study adds to the literature examining the effect of financial and credit constraints on hospital outcomes (e.g., Adelino et al. 2015, Adelino et al. 2021, Aghamolla et al. 2021, and Cornaggia et al. 2021) and the literature on hospital mergers. Studies on hospital mergers typically do not separate acquirers into PE or non-PE, but mainly focus on the impact of mergers on hospital prices and costs (Dafny, 2009; Lewis and Pflum, 2017; Schmitt, 2017; Cooper et al., 2019; Dafny et al., 2019; Craig et al., 2021).[8] We extend this line of research by focusing on PE acquirers and examining their impact on prices, employees and patients.

More generally, we contribute to the broad literature examining the operational and employment effects of PE buyouts (see, among others, Kaplan 1989, Bernstein and Sheen 2016, Boucly et al. 2011, Davis et al. 2014, Olsson and Tåg 2017, and Antoni et al. 2019), as well as the burgeoning research documenting PE involvement in specific industries (Bernstein and Sheen, 2016; Spaenjers and Steiner, 2021; Fracassi et al., 2022; Ewens et al., 2022; Howell et al., 2022). The hospital industry provides us with unique advantages to investigate the role of PE firms in transforming acquired companies. First, we study the community impact of PE acquisitions by looking into their influence on hospital survival, healthcare quality, and hospital prices. Second, we have detailed information regarding the operational profile of hospitals, including operating performance, the number of beds,

[7]Griffin and Priest (2024) show that opportunistic over-billing is widespread among profit-oriented nursing homes and exists beyond those nursing homes acquired by PE. Morris et al. (2022) link aggressive cost-cutting efforts at nursing homes to high financial leverage and show that the link is not unique to PE ownership.

[8]Beaulieu et al. (2020) examine the quality of healthcare at acquired hospitals, but do not focus on PE acquirers. Prager and Schmitt (2021) investigate the implication of hospital mergers on the local labor market concentration for nurses and pharmacists.

patient composition, and clinical complexity. Such granular information allows us to investigate in-depth how PE reshapes the operations of acquired companies in ways that have not been feasible in earlier studies. Third, although the PE literature analyzed the labor profile of acquired firms extensively, our paper provides a more nuanced perspective as we are able to observe administrative and core workers separately—arguably the two most important occupations in the industry.

3. Data and Sample

3.1. Hospital M&As and the Classification of Acquirers

To compile a list of hospital M&As, we start from the merger roster during the period of 2001 through 2014 provided by Cooper et al. (2019), and then extend the sample to 2018 following their methodology.

First, we use the American Hospital Association (AHA)'s Annual Survey of Hospitals and identify the changes in system identifiers of individual hospitals, which likely suggest changes in hospital ownership. Next, we manually verify whether a change in system identifier is indeed associated with an acquisition by manually validating these events across several M&A databases, including SDC, Factset, and Becker's Hospital Review. In this process, we match the list of AHA system changes with acquisitions recorded in these databases based on the names and locations of target hospitals and acquirers, as well as the completion date of the deals. We also supplement the acquisition list based on information from these databases and record deals that are not correctly captured by changes in the AHA system IDs. When the matching between Becker's and the AHA is ambiguous, we search internet resources including local newspaper articles and the American Hospital Directory (AHD) to verify the accuracy of the matches.

The above process yields a sample of 1,218 M&A deals that occurred during the period of 2001 through 2018. The deals involve 478 unique acquirers and 1,686 unique target hospitals. Among these deals, we focus on 281 acquisitions where the acquirer is a for-profit organization. These deals involve 610 unique target hospitals.

There are two types of hospital acquisitions where the acquirer is associated with a PE firm. First, a PE firm directly acquires a hospital or a system of hospitals. Second, PE-acquired hospitals conduct acquisitions themselves, commonly referred to as "roll-up acquisitions." We label acquirers in both types of deals as "PE acquirers." To identify PE acquirers, we obtain information from Preqin, CapitalIQ, and descriptions in Becker's Hospital Review, and manually verify this information. In the manual verification process, we supplement our data regarding the identities of hospital acquirers from news articles. We identify 117 deals where the acquirer is either a PE firm or a PE-owned hospital, with 419 unique target hospitals. We refer to the rest of the for-profit acquirers, who are for-profit hospitals or hospital systems that have had no PE ownership, as *Non-PE Acquirers*. In our analysis, we distinguish PE acquirers from non-PE, for-profit acquirers to understand the unique roles of PE investors in selecting targets and in implementing changes at acquired hospitals. There are 164 deals by non-PE acquirers in our sample, involving 191 target hospitals.

3.2. Hospital Characteristics Data

We obtain hospital characteristics data from the Healthcare Cost Report Information System (HCRIS) maintained by the Centers for Medicare & Medicaid Services (CMS). Medicare-certified institutional providers are required to submit their annual cost report to a Medicare administrative contractor. Such information is then compiled into the HCRIS. From these reports, we gather data regarding hospital characteristics, employment, and workforce composition.

Hospital characteristics include financial performance metrics such as gross margin, operating income over total assets (*OI/TA*), and returns on assets (*ROA*). It also includes other operational characteristics such as hospital size as measured by the log number of beds (*Log(Beds)*), the log gross (net) patient sales (*Log(Gross (Net) Patient Sales)*), and the log number of patients (*Log(Patients)*), the complexity of operations measured by case mix index (*CMI*), the outpatient ratio given by the ratio of outpatient charges over total charges, as well as the percentage of patients that have Medicare (*%Medicare*) and Medicaid insurance (*%Medicaid*).[9]

We compile various measures of hospital employment, worker composition, and wages to study changes in the operational profile of target hospitals. To start, we construct a measure of total employment. The HCRIS provides data on paid work hours and wages for employees in various occupations. Paid work hours are then converted to full-time equivalent (FTE) employee counts based on the total number of work hours in a year. Specifically, annual employment is defined as the total paid work hours divided by 2,080 (40 hrs/week $\times$ 52 weeks), then converted to log terms (*Log(Employment)*).

For employee composition, we focus on core medical workers and administrative workers. Core medical workers include physicians, nurses, and pharmacists, who are essential in providing quality health care.[10] The list encompasses roles related to both Medicare Part A (inpatient services) and Medicare Part B (primarily outpatient services). It also includes contract physicians, who are not directly employed by hospitals but work as independent contractors or through physician group practices. Administrative employees are a subset of non-core workers, whose wages constitute an important component of hospital overhead costs (Shrank et al. 2019). Employees outside these categories include maintenance and repair staff, housekeeping, cafeteria employees, etc.

Based on HCRIS wage breakdown across employee categories, we construct various metrics of worker composition. First, we examine the log number of core workers (*Log(Core Workers)*) as well as the log number of administrative workers (*Log(Admin Workers)*). In robustness tests, we also scale the number of employees, core workers, and administrative workers by the number of patients treated at the hospital.

Finally, we measure the hourly wages paid to core workers and administrative workers, *Log(Core Wage Rate)* and *Log(Admin Wage Rate)*. Hourly wage rate is computed as the total wages paid divided by the total paid hours within each worker category.

3.3. Patient Information

Data on patient characteristics and hospital procedure prices come from the Health Care Cost Institute (HCCI). The HCCI data include insurance claims from patients who obtain employer-sponsored healthcare insurance from four large private insurance companies in the U.S.: Aetna, Humana, Kaiser Permanente, and Blue Health Intelligence.

[9] We follow Schmitt (2017) and impute the number of treated patients as the number of inpatient discharges multiplied by $(1 + \frac{outpatient\ charges}{inpatient\ charges})$. This adjustment is necessary because (1) information on outpatient discharges is not available in the CMS, and (2) it accounts for the fact that outpatient treatment generally takes up less hospital resources than inpatient treatment.

[10] See Appendix A for detailed job categories. In Table IA5 of the Internet Appendix, we show that our results are robust when we apply a more restrictive definition of core workers.

The data cover one-third of U.S. individuals with employer-sponsored health insurance population, representing over 50 million individuals in all 50 states and the District of Columbia. We utilize the information from 2012 to 2018, the beginning of the data coverage till the end of our acquisition sample.

We start with a sample of 407.1 million insurance claims, including patients receiving both inpatient and outpatient services. We require each claim observation to have information on the hospital delivering the service, leaving us with a sample of 386.8 million insurance claims.

We examine patient gender, age, and income and define the following variables: *Female*, an indicator for female patients; *Age*, an integer ranging from 1–7, indicating seven age bands;[11] and *Income*, the log of the average individual income in the zipcode of the patient. We infer patient income from their residential location because we do not directly observe patients' income levels. Zipcode-level income data come from IRS' adjusted gross income (AGI).[12] For each hospital-year, we compute the average patient characteristics by taking the simple or weighted average across all patients treated at the hospital-year, with weights being the total amount paid to the hospital for the services delivered to each patient during that year.

We follow Cooper et al. (2019) and create 8 samples, where the unit of observation is at the hospital-year level. The first is a full inpatient sample that includes all inpatient admissions. We focus on inpatient treatment prices because inpatient treatments are highly costly to households, and account for a major revenue source for hospitals. To create this sample, we first aggregate inpatient claims to the level of a single hospital admission characterized by a unique Diagnosis-Related Group (DRG) code. For each hospital-year, we compute a risk-adjusted inpatient price index following the procedure laid out in Cooper et al. (2019), using data from all inpatient admissions in that hospital-year. The adjustment accounts for patient characteristics such as gender and age, with more details provided in Section I.A of the Internet Appendix.

Each of the other seven samples includes one procedure, namely, Hip Replacement, Knee Replacement, C-Section, Vaginal Delivery, PTCA (Percutaneous Transluminal Coronary Angioplasty), MRI, and Colonoscopy. These seven procedures are relatively homogeneous, minimizing concerns about patient and case heterogeneity in our price analysis. For hip and knee replacements, we focus on procedures delivered to inpatients between 45 and 64 years old. For C-section and vaginal delivery, we limit our analysis to inpatient mothers between 25 and 34 years old.

Patient satisfaction scores come from the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey, a standardized survey of patients' perspective of hospital care conducted nationally at the annual frequency. The survey contains questions about patients' experience and satisfaction levels with each hospital. The questions relate to many aspects of patient experience, and we focus on the ones most representative of the quality of care provided by a hospital: quality of communication with nurses and doctors, whether patients get timely help, the overall rating that patients assign to a hospital, and whether patients would recommend the hospital to someone else. For each survey question, the database classifies the responses into three categories (top box,

[11] Age bands are defined as the following: 1: 0-17, 2: 18-24, 3: 25-34, 4: 35-44, 5: 45-54, 6:55-64, 7:65+

[12] IRS Individual Income Tax Zip Code Data comes from https://www.irs.gov/statistics/soi-tax-stats-individual-income-tax-statistics-zip-code-data-soi. We compute the average individual income in a zipcode using the total AGI over the number of filers.

middle box, and bottom box) and discloses the percentage of respondents in each category. We compute the average response by assigning scores of 1–3 to the categories, with 3 corresponding to top box and 1 to bottom box. We then take the weighted average of these scores for each question, hospital, and year, with the weight being the percentage of respondents in a given category. Appendix B provides more detailed explanation and examples for this classification scheme.

We obtain information on patient outcomes such as mortality and readmission rates from Hospital Compare Outcome Measures, which is publicly disclosed by the CMS and the Hospital Quality Alliance (HQA). These databases provide rich information including details of medical treatment provided, patient recovery, complications during treatment, readmission rates, and mortality rates. Hence, we follow the prior literature and focus primarily on mortality and readmission rates as proxies for the quality of health care provision (e.g., Ho and Hamilton, 2000; Propper et al., 2004; Cooper et al., 2011; Gaynor and Town, 2011; Aghamolla et al., 2021). Mortality rate is the most commonly used indicator for the quality of care in hospitals. Readmission rate is also used as a measure of the effectiveness of treatment.

Our main measures of healthcare quality include 30-day mortality rates from heart attack (AMI), heart failure (HF), and pneumonia (PN), as well as 30-day readmission rates following treatment for the same conditions. Those measures have been adjusted for patient risk using statistical models. Patient risk includes clinical (e.g., types of treatments, severity of conditions), demographic (e.g., age and sex), and socioeconomic (e.g., race, income, ethnicity) factors.[13]

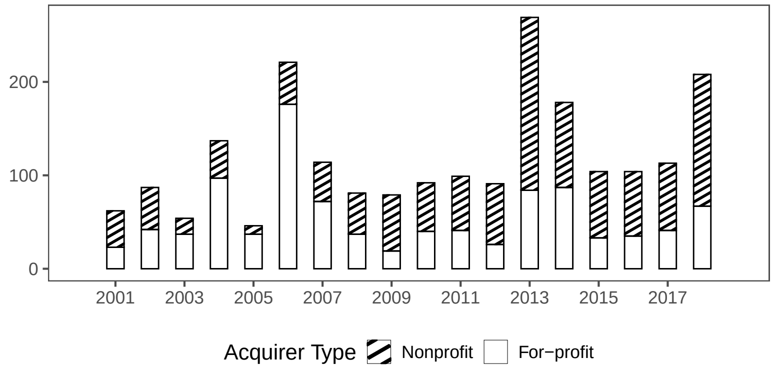
3.4. Initial Sample Construction

With data gathered from the above sources, we compile a hospital-year panel. Each standalone hospital and each hospital that belongs to a system has its own, separate observation. This allows us to follow and track an individual hospital after it is acquired. Following Cooper et al. (2019), we restrict our sample to general medical and surgical hospitals. Military and Veteran Health (VA) hospitals are excluded from the sample. For hospitals acquired more than once, we keep the first acquisition if those deals are over five years apart. We remove the hospitals that experience more than one acquisition within a five-year period. Target hospitals are required to have at least two years of observations before and after the acquisition year, so we can track the same hospital around the event.

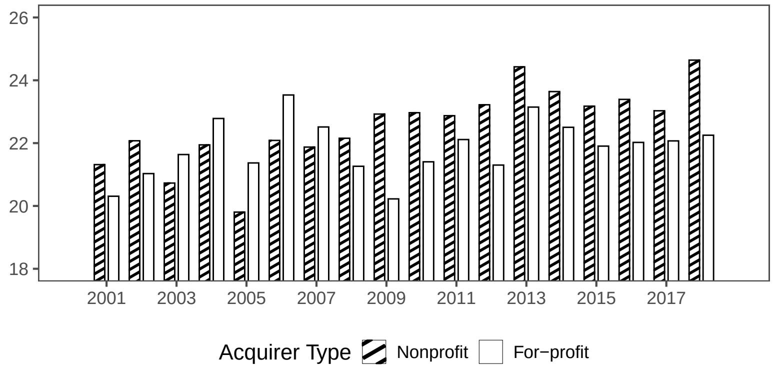
3.5. Univariate Analysis

The hospital industry has experienced growing M&A activity over the past two decades. Figure 1 illustrates this time trend. Panel A reports the total number of U.S. hospitals acquired each year and Panel B reports the natural logarithm of total asset values of hospitals acquired each year. In both panels, white (patterned) columns represent deals conducted by for-profit (nonprofit) acquirers. Over our sample period, 46.5% of the target hospitals were acquired by for-profit organizations. Deal volume peaked in 2013, when nearly 240 hospitals were acquired, and again in 2018, when the total asset value of acquired hospitals reached $175 billion. Overall, hospitals acquired by for-profit organizations have a combined asset value of $79 billion, a substantial fraction of the total value across all acquisitions. These statistics suggest that for-profit acquirers play an economically important role in the M&A landscape in the hospital industry.

[13]See more detailed explanation regarding risk adjustment in CMS MMS Blueprint.



(A) Number of Target Hospitals



(B) Total Asset Value of Target Hospitals (log)

Figure 1. Hospital M&A Activity By Acquirer Type. This figure shows the time series patterns of hospital M&A activity in our sample. We classify acquired hospitals into two groups based on whether the acquirer is a for-profit or a nonprofit institution. Panel A reports the number of hospitals acquired by each acquirer type in a given year. Panel B reports the log of total asset values (in $) of target hospitals associated with each acquirer type.

Figure 2 reports the composition of deals involving different types of target hospitals acquired by for-profit organizations. We separate deals based on whether the acquirer is a PE firm, and count the number of for-profit and nonprofit targets within each category. PE acquirers account for the majority of the deals made by for-profit entities (74%), and around 70% of target hospitals had for-profit status.

In Table 1, we report and compare the characteristics of all target hospitals during the four years prior to their acquisition and hospitals that are never acquired during our sample period. Target hospitals have a smaller employment size, with fewer core and administrative workers, compared to never-acquired hospitals. Target hospitals also have lower wage bills than never-acquired hospitals.

<u>TABLE 1 ABOUT HERE</u>

We also observe that target hospitals have more beds, lower CMI, and a lower outpatient ratio (the ratio of outpatient charges over total charges). While target hospitals treat a greater proportion of Medicaid patients (those with limited financial resources to pay for health care), but a smaller proportion of Medicare patients (65 years or older) than non-target hospitals.

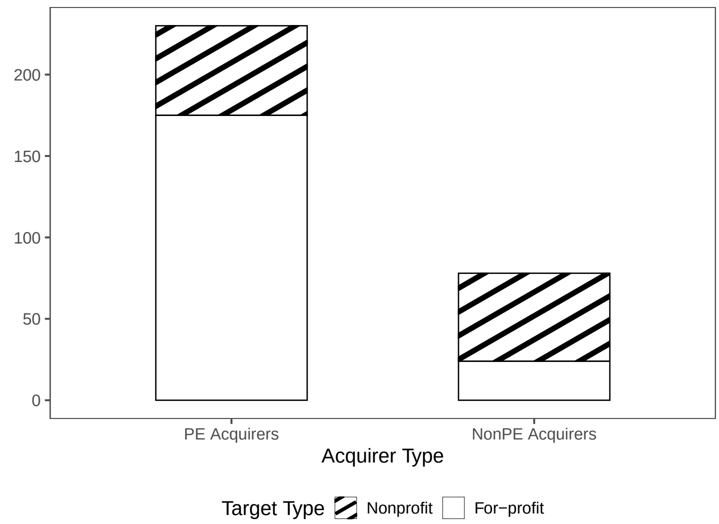


Figure 2. Composition of Target Hospitals. This figure reports the number of target hospitals in our sample taken over by PE acquirers and non-PE, for-profit acquirers. Within each acquirer type, we classify targets into two groups based on whether they operated as for-profit or nonprofit hospitals prior to being acquired. The height of the each column represents the number of target hospitals within each classification.

4. Empirical Methodology

Given that target and non-target hospitals differ significantly in many dimensions, we follow the existing work on hospital mergers such as Schmitt (2017) and Prager and Schmitt (2021) and conduct a matched sample analysis. We match each target hospital to a control hospital in the following steps. We start with an initial pool of hospitals that have not been acquired in the corresponding event window, and have at least two years of data prior to the event year. Within this pool, we find one "nearest neighbor" hospital based on a Mahalanobis matching method with replacement. The matched control hospital needs to locate in the same Census Division and have the same Metropolitan area status as the target hospital. It also needs to have the closest Mahalanobis distance to the target hospital based on their average hospital characteristics (i.e., *Log(Beds)*, *CMI*, *%Medicare*, *%Medicaid*, outpatient ratio, and profitability) during the four-year period prior to the acquisition, as well as the log number of core workers and administrative workers and profitability during the year prior to the deal. There are multiple ways to measure profitability, including gross margin, operating income over total assets, and return on assets (*ROA*), and these measures are highly correlated. We match on the first principal component of the three measures. Matching based on core and administrative workers at $t-1$ helps us control for pre-existing trends in the hospitals' labor force conditions prior to the acquisition.[14]

Figure 3 summarizes the covariate balance before and after matching, measured by the standardized difference of each variable. The standardized difference is the average

[14]The idea of matching on an outcome variable is also found in other matching methodologies such as entropy balancing or synthetic control methods, whereby the researcher identifies the control group by minimizing the difference in the sample moments of the outcome variable between the treatment and control groups (Abadie et al., 2010; Hainmueller, 2012). In Section VI of the Internet Appendix, we verify the robustness of our results using alternative matching variables.

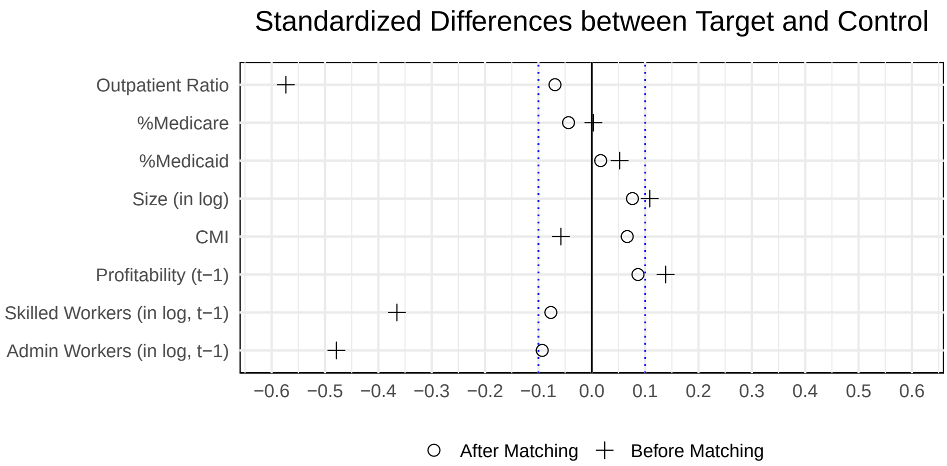


Figure 3. Covariate Balance. This figure shows the values of standardized differences between target and matched control hospitals. Standardized difference is computed as the average difference between the matched pairs (target − control) divided by the standard deviation computed over all observations. Profitability is the first principal component of three variables: gross margin, operating income over total assets, and return on assets (ROA). Detailed variable definitions are provided by Appendix A.

difference between the matched pairs (target − control) divided by the standard deviation computed over all observations. The literature suggests a threshold of 0.1 for the absolute standardized differences, under which the treated and control groups can be considered comparable (Austin 2009, 2011). After matching, we observe that the standardized differences between target and control hospitals fall below 0.1 across all dimensions.

We track each matched pair of hospitals over two event horizons, the short-run and the long-run horizon. The short-run horizon tracks changes in hospital characteristics from four years prior to the takeover ($[-4, -1]$) to four years after ($[0, +4]$). This horizon conforms to the literature on the short- to medium-term effects of PE firms (Kaplan 1989; Lerner et al. 2011). The long-run horizon compares hospital conditions during the pre-acquisition period ($[-4, -1]$) to the second four-year period after the acquisition (i.e., $[+5, +8]$), excluding the $[0, +4]$ period. This horizon is motivated by Kaplan and Stromberg (2009), which show that PE firms have increased their holding periods since the 1990s, exiting less than half of the deals within 72 months of their acquisitions. Examining the long-run effects helps uncover whether the changes we observe in the short run persist, amplify, or revert back in the longer term. Finally, we stack these observations associated with all matched pairs together. Our testing sample is thus an event-hospital-year panel, whereby an event refers to the acquisition of a hospital. We focus on private target hospitals by excluding observations related to hospitals that become publicly traded.

Table 2 reports the summary statistics related to key variables in our matched sample over the $[-4, +8]$ event window. Panel A summarizes employment variables and hospital characteristics. The average hospital in this sample has 866 employees, 181 beds, and an outpatient ratio of 0.42 on average. Among all job categories of which working hours are tractable in the HCRIS, 16% of aggregated working hours correspond to core workers and 22% to administrative workers in an average hospital. We note that these fractions rank among the highest across the 53 occupations provided by the HCRIS. Panel B summarizes patient mortality, readmission rates, and patient satisfaction scores in the matched sample. In Panel C, we present the summary statistics for hospital prices and patient characteristics (extracted from the HCCI data) in the matched sample. The price statistics suggest that there are significant variations in inpatient treatment and procedure prices across hospitals. In addition, we note that female patients account for nearly 60% of the overall patient population. The average adjusted gross income is approximately 60,000 USD per year.

Table 2 About Here

We examine post-acquisition outcomes at target hospitals relative to their matched control hospitals in a difference-in-difference framework. Specifically, we estimate the following regression, both for the short-run and the long-run windows:

$$Y_{e,i,t} = \beta_1 PE\ Target_{e,i,t} + \beta_2 NonPE\ Target_{e,i,t} + \gamma \cdot X_{i,t} + \alpha_i + \mu_e + \tau_t + \epsilon_{e,i,t}, \quad (1)$$

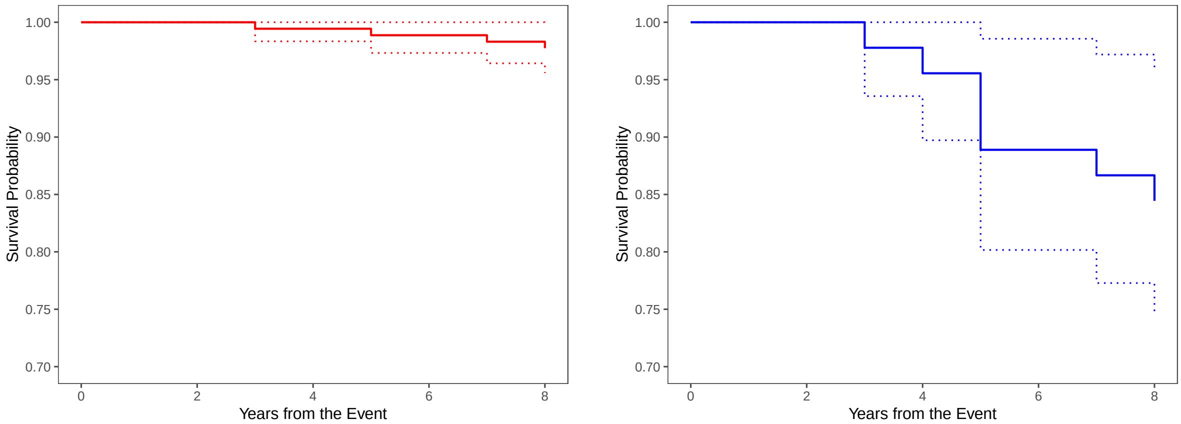
where e indicates an acquisition event, i indicates a hospital, and t indicates a year around the event. $Y_{e,i,t}$ represents a variety of hospital outcomes that we examine, including operating performance, the log of employment, core and administrative workers, the log of wage rates, hospital patient characteristics, patient satisfaction, and hospital inpatient prices. *PE Target* indicates whether hospital i has been acquired by a PE acquirer in event e as of year t, and zero otherwise. *NonPE Target* is an indicator for whether hospital i has been acquired by a non-PE acquirer in event e as of year t. Both indicators equal zero for years $[-4, -1]$ prior to the event.

We control for hospital fixed effects (α_i), matched pair fixed effects (μ_e), and event-time fixed effects (τ_t). Hospital fixed effects allow us to trace the same hospital over the event horizon. Matched pair fixed effects are separate indicators for each pair of matched target and control hospitals. Including these fixed effects helps us compare within a pair of treated and control hospitals. Event time fixed effects are a set of 9 indicators for each year in the event window. They absorb common time-series changes across the matched pair around the event. We also include a multitude of hospital and county controls (X_{it}). Hospital controls include all variables in the matching process. County controls include population size, one-bedroom rent, and population demographics (e.g., the percentage of residents that are Asian and Black) in the county that the target hospital is located. Similar to existing studies (e.g., Schmitt, 2017; Gupta et al., 2021; Liu, 2021), we cluster standard errors by hospital.[15]

The coefficients of interest are β_1 and β_2, which measure how a target hospital changes subsequent to being acquired, compared to the concurrent changes in the conditions of its matched control hospital. We also report p values from the Wald Chi-square test for $\beta_1 = \beta_2$, i.e., evaluating whether the changes associated with PE and non-PE acquisitions are statistically significantly different from each other.

Non-PE, for-profit acquirers are for-profit hospitals or hospital systems that do not have PE ownership. Similar to PE acquirers, they focus on profit generation and can enhance the operational efficiency of target hospitals if the targets previously operated as nonprofit entities or were managed inefficiently prior to the takeover. At the same time, we note that non-PE, for-profit acquirers may not have the same level of operating expertise, financial engineering capability, or governance discipline as PE acquirers. For example, non-PE acquirers may not have experience managing a large hospital system, or they may not impose high-powered incentives on hospital management. Such differences

[15] Our results are robust to several alternative clustering methods, including clustering by hospital-system, double clustering by hospital and system, and double clustering by hospital and acquirer.



(A) *Survival Analysis*, PE Targets (B) *Survival Analysis*, Non-PE Targets

Figure 4. Survival Analysis of PE and Non-PE Targets. This figure shows the survival rates of target hospitals in each year after the acquisition. Panel A (B) reports the survival likelihoods of target hospitals of PE (non-PE) acquirers. The solid lines represent the Kaplan-Meier estimates, while the dashed lines show their 95-percent confidence intervals.

may lead to differential target outcomes between PE and non-PE acquirers.

5. Main Results

5.1. Hospital Survival and Profitability

There are concerns in the popular press that PE firms acquire hospitals, close them, and subsequently sell assets owned by those hospitals. We investigate the validity of such concerns using large-scale data and tracing the survival likelihood of target hospitals in Figure 4. In Panel A (B), we plot the survival rates of PE (non-PE)-acquired hospitals. The solid lines indicate the survival rate of a hospital from the acquisition event to the eighth year after the event. Higher values indicate that the hospital is more likely to remain open. The dotted lines indicate the confidence intervals of the estimated survival rates.

The patterns suggest that the survival rate of PE-acquired hospitals does not drop statistically significantly from one, as the upper bound of the confidence interval overlaps with one. In contrast, the survival rate of non-PE-acquired hospitals is statistically significantly lower than one. This observation is at odds with the anecdotal claim that PE firms acquire hospitals with the purpose of closing them and profiting from the sale of their assets.

In Figure IA1 of the Internet Appendix, we compare the survival rates of acquired hospitals and their matched control group. For both PE and non-PE target hospitals, there is an overlap between the confidence intervals of their survival rates with those of their control group's survival rates. This is not surprising given the limited statistical power. Among our matched sample of 444 hospitals, there are only 20 hospitals that closed within 8 years after the acquisition events, including 4 PE target hospitals, 7 targets of non-PE acquirers, and 9 hospitals in the control group.

In Table 3, we examine the profitability of acquired hospitals, measured by gross margin, operating income over total assets, and return on assets (ROA). We find that PE-acquired hospitals become significantly more profitable than their matched control hospitals shortly after the acquisition. Our estimates suggest that PE-acquired hospitals increase their operating income and return on assets each by 4 percentage points in the first four years after the acquisition. This profitability boost seems to persist over the [5, 8]-year post-event window, although the effect becomes statistically insignificant. The profitability effects of non-PE, for-profit acquirers are somewhat mixed. The gross margin and operating income of the target hospitals exhibit some positive, yet statistically insignificant changes, potentially due to a smaller sample size. Their ROA declines slightly over the long-run window.

Table 3 About Here

5.2. Employment Outcomes

We next examine changes in the number and composition of employees at acquired hospitals, relative to those at matched control hospitals. To the extent that PE firms are efficiency-driven acquirers with expertise in shaving off excess costs, we expect employment and total wage costs to decline at acquired hospitals. Yet, the employment effects may not be uniform across worker types. On the one hand, PE firms may reduce core medical workers more than other workers, as core workers require higher wages. On the other hand, PE firms could retain core medical workers to sustain healthcare quality, but cut administrative workers given the documented evidence that hospitals suffer from administrative inefficiency.

5.2.1. Total Employees and Wage Expenditures

We examine the changes in the total number of employees as well as total wage expenditures at acquired hospitals following the specification in Equation (1). Table 4 reports the results. In columns (1) and (2), we examine the changes in the total number of employees, and in columns (5) and (6), we look into total wage expenditures. Both total employment and total wages are in log terms, so the coefficients inform us of the percentage changes in these outcomes after acquisitions. For each outcome variable, we first present results over the short-term window ($[-4, -1]$ to $[0, +4]$), and then we present effects from a longer horizon ($[-4, -1]$ to $[+5, +8]$).

Table 4 About Here

We find a large and significant decline in employment at PE-acquired hospitals. After being acquired, the average target hospital reduces its employment by over 6% over the next four years, and maintains the reduced employment level over the next four-year window. Consistently, the wage costs of PE-acquired hospitals decline by 7% over the four years following their acquisitions, and continue to drop over the next four years, to a level that is around 9% lower than their pre-acquisition level. In Table IA2 of the Internet Appendix, we show that the total employee-to-patient ratio of target hospitals also drops significantly after PE acquisitions, suggesting that the cost-cutting at PE-backed hospitals is not simply driven by a reduction in healthcare demand from patients.

We find that the employment of non-PE targets exhibit relatively small and statistically insignificant declines. While total wage bills of those hospitals decrease initially, such a decline becomes economically smaller and statistically insignificant in the long run. Constrained by the sample sizes, we are unable to detect statistical differences in the decline of employment and wages between PE and non-PE acquirers.

Overall, our results suggest that PE acquirers undertake substantial employment cuts and generate wage savings at target hospitals. These findings could explain the improved profitability and the sustained survival rates of target hospitals documented earlier.

5.2.2. Employee Composition

According to the HCRIS reporting convention, hospital employees are classified into 53 different occupations, reflecting the complexity and multidimensionality of the services hospitals provide. Among these occupations, we focus on two types of hospital employees: (1) core medical workers that include physicians, nurses, and pharmacists, and (2) administrative workers. Core medical workers are critical at providing quality health care. While administrative employees support key functions of hospitals such as finance and accounting, U.S. hospitals are often criticized for having a bloated overhead structure, employing too many administrative workers and spending excessively on overhead costs (e.g., Shrank et al. 2019; Kocher 2013).

We track the changes in worker composition in acquired and control hospitals after the year of acquisition. Table 5 reports the results. From columns (1) and (2), we find that PE-acquired hospitals experience a temporary drop in the number of core workers by around 16% over the first event window. This effect almost completely disappears over the second event window spanning from year 5 to year 8 following the acquisition. Comparing the core workers during this period to the pre-acquisition window, the difference is only 1% and is statistically insignificant from zero.

TABLE 5 ABOUT HERE

There can be multiple explanations for the temporary reduction of core workers. First, large corporate restructuring events can be chaotic and severely disruptive to operations, leading employees to become discontent and even leave the firm. Once the initial restructuring period is over, firms may regain their employment to a certain extent. Second, PE acquisitions of hospitals may lead to a re-sorting of medical workers based on their preference for the culture or work environment of PE-owned organizations. Third, following acquisitions, hospitals may shift and re-focus their operations, demanding different types of skilled labor from before. All three explanations are consistent with PE acquisitions leading to the departure of some existing employees and the hiring of new ones. These reasons, combined with substantial labor market frictions related to searching and hiring skilled workers, can result in an initial drop and later recovery of medical workers.

Columns (3) and (4) provide results for administrative workers. We find a significant and persistent decline in administrative workers at PE-acquired hospitals. Within the first four years after the acquisition, the number of administrative workers drops by around 17% at acquired hospitals. The reduction aggravates in the next four years, reaching over 20%.

In Table IA2 of the Internet Appendix, we scale the number of core and administrative workers by the number of patients, and find consistent effects as those from the log number of workers.

In Panel B, we directly compare the number of core workers in PE target hospitals during the short-run and long-run horizons following the takeover. To do so, we pool together the full sample period from [-4, 8]-year around the acquisition, and regress *Log(Core Workers)* and *Log(Admin Workers)* on the interaction of *PE Target* $\times$ *Long-run*, whereby *Long-run* turns to one for year [5, 8] following the acquisition event. In column (1), we find a positive, significant coefficient on this interaction term, in contrast to the negative coefficient on the standalone term *PE Target*. This result shows that the number of core workers in PE target hospitals recovers in the long run from the short-run decline in a statistically significant way. In column (2), we show that the number of administrative workers in PE targets becomes significantly lower in the long-run window than in the short-run post-acquisition window, confirming the continuing decline of administrative workers shown in columns (3) and (4) in Panel A.

Turning to target hospitals of non-PE, for-profit acquirers, we find that their core worker counts exhibit a substantial and persistent decline, with no reversal in the long run. Our estimates in columns (1) and (2) of Panel A suggest that non-PE targets see their core workers drop by 29% in the first four years after acquisitions, and by another 7% in the next four years ($= 0.3598 - 0.2868$). Such declines of core workers are statistically significantly stronger than those of PE targets. In contrast, we do not observe a decline in administrative workers at non-PE targets in either horizon we examine (columns (3) and (4) of Panel A).

We note that, while the coefficients for PE acquirers and non-PE acquirers differ substantially for the changes in administrative workers in the long-run (column (4) of both panels), they do not appear statistically significant from each other. This is because of the wide confidence intervals of the non-significant results from non-PE acquirers. In Table IA3 of the Internet Appendix, we compute the minimum detectable effect size (MDES) regarding the difference in coefficients between PE and non-PE acquirers. The MDES indicates the minimum size of the differential effects for there to be statistical significance, given our sample size and the standard error of the coefficients (Bloom, 1995). We find that the difference in the long-term reduction in the log of administrative workers between PE and non-PE targets needs to be at least 0.34 to 0.40 for us to detect statistical significant differences with 80% and 90% confidence using our sample. This is a large magnitude, which suggests that we may have limited statistical power to detect the statistical significance of such a differential effect.

We also evaluate the concern that our results may be driven by changes in local conditions concurrent with PE acquisitions, such as the changes in local resident demographics, health conditions, income, or other preferences. These changes may drive hospital performance, employment, and even survival. We address this concern by imposing commuting zone-year fixed effects in our baseline analysis. In Table IA4 of the Internet Appendix, we find our results to be robust to including this stringent fixed effect structure.

5.3. Dynamic Effects of PE Acquisitions

We track how the profitability and employment of PE-acquired hospitals evolve over each year during our event horizon, compared to their matched control group. This examination allows us to infer when changes start taking place around the involvement of PE acquirers, and more importantly, evaluate whether PE buyers select hospitals based on their pre-event characteristics. If they do, the changes in operating performance and worker composition we document should start prior to their acquisition.

We track PE targets and their matched control hospitals over the [-4, +8] event horizon. With this sample, we extend the baseline regression model (Equation (1)) by creating separate indicators of each year in the event horizon and interacting these indicators with *PE Target*. The estimation includes the same set of fixed effects and controls as in the baseline analysis, and further imposes commuting zone-by-year interactive fixed effects to help remove potential confounding effects from local conditions.

Figure 5 depicts the results. Panels A and B present results for hospital profitability, including *Operating Income/TA* and *ROA*.[16] Panels C through E present results regarding hospital employment profiles, including the log of total employees, the log of total core workers, and the log of total administrative workers. In each panel, the dots represent point estimates, surrounded by 95% confidence intervals. The year prior to the event (i.e., year -1) is omitted as the benchmark year. We do not observe any significant pre-event changes in most of the outcome variables for PE targets. The exception is that total employment exhibits an increase in year -2, but the effect is economically small (0.041). After PE acquisitions, target hospitals experience a temporary boost in profitability, but this effect diminishes in the long run.

Panel C shows that target hospitals experience a significant reduction in total workers. We then focus on core and administrative workers separately. Panel D suggests that PE acquisitions are followed by a significant dip in core workers at target hospitals, but this effect dissipates in the longer term. Starting Year 5, PE target hospitals no longer have significantly fewer core workers compared to the pre-event level of core workers or relative to the control hospitals. Panel E shows that target hospitals experience a sizable decline in the number of administrative employees, and this effect persists and deepens in the long run.

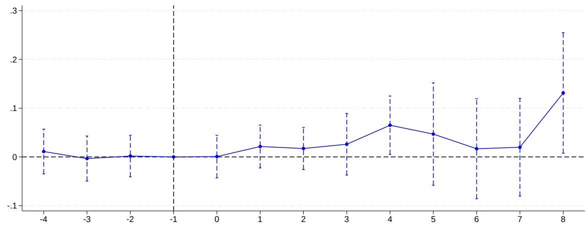
Results from our dynamic analyses indicate little pre-event trend in hospital characteristics prior to PE acquisitions, but significant post-event effects after the acquisitions. They are consistent with PE improving the operating efficiency of the acquired hospital without excessively cutting core workers in the long run. These results, together with evidence of covariate balance, help alleviate concerns regarding PE selecting targets based on observable characteristics such as profitability, size, employee composition, and patient composition. To further address this concern, we provide additional analyses in Section IV of the Internet Appendix that other hospital characteristics, including charity services and healthcare quality (Lewellen et al., 2023), are unlikely to drive our results. Still, we acknowledge that our approach does not entirely rule out the possibility that PE acquirers may select hospitals based on factors unobservable to researchers that predict future performance improvement of hospitals. We continue to address this possibility in the next section.

5.4. Addressing Endogeneity Concerns

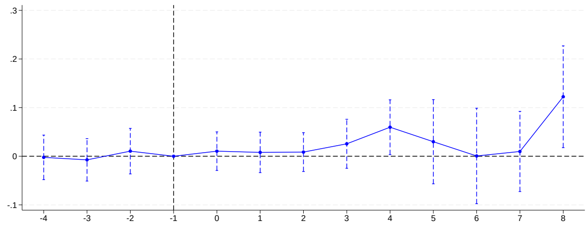
We further address the selection concern following the approach designed in Liu (2021). Specifically, we take advantage of the staggered changes in the Corporate Practice of Medicine (CPOM) doctrine across states and over time. The CPOM doctrine prohibits non-physician-owned corporations (including PE firms) from practicing medicine or employing a physician to provide professional medical services. It was adopted under the concern that corporations with no healthcare experience and for-profit motivations may influence medical judgment for physicians and compromise the fiduciary relationship between physicians and patients. The implementation of CPOM doctrine varies state-by-state, depending on numerous factors including anti-competition concerns,[17] shortage

[16] We do not present results for *Gross Margin* here because we do not find PE investors to significantly affect acquired hospitals' gross margin.

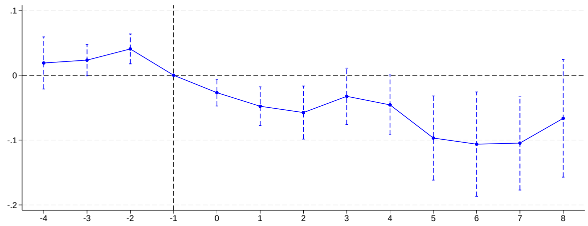
[17] In 1975, the Federal Trade Commission found the CPOM doctrine to be anti-competitive in nature and charged the AMA with violations of Section 5 of the Federal Trade Commission Act (FTC Act). The FTC's decisions were confirmed by the the United States Second Circuit Court of Appeals and the United States Supreme Court. For more details of *FTC v. AMA*, 1975, see Gustavson and Taylor (2010); Ameringer (2000).



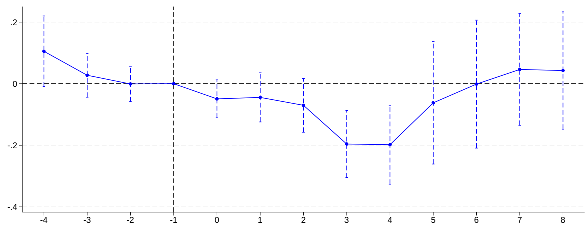
(A) *OI/TA*



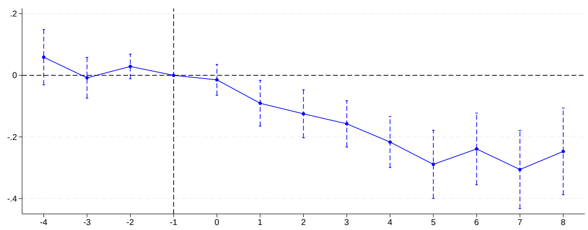
(B) *ROA*



(C) *Log(Employment)*



(D) *Log(Core Workers)*



(E) *Log(Admin Workers)*

Figure 5. Dynamic Effect of PE Acquirers. This figure shows the changes in profitability, total employment, and worker composition for PE-acquired hospitals relative to their matched control hospitals over the [-4, +8]-year event window. All regressions include the same set of fixed effects and controls as in the baseline analysis, and further include commuting zone-by-year interactive fixed effects to help remove potential confounding effects from local conditions. In each panel, the dots and intervals represent the coefficients and the associated 90-percentile confidence intervals, respectively. Year -1 is absorbed as the base year.

of healthcare provision, as well as technological innovation in care delivery.

Although CPOM enforcement in each state may be driven by underlying socioeconomic conditions, changes in its stringency are often driven by the lobbying efforts of interest groups, as well as judicial decisions. Key events that mark such changes include landmark cases, legislatures, and the issuance of opinions by key agents (including state medical boards and attorneys general) (Silverman, 2015; Gustavson and Taylor, 2010). The timing of these events are often difficult to predict precisely.[18]

We consider three types of events that can strengthen or relax CPOM in a given state: (i) state statutes or regulations, (ii) case law, and (iii) opinions issued by the state attorney general or medical board. Following the method described by Liu (2021), we identify a list of events whereby CPOM implementation becomes more lax or stricter during our sample period 2001–2018. Information regarding the changes to a state's CPOM status comes from several sources. The primary source is *Corporate Practice of Medicine: A Fifty State Survey*, a publication by the American Health Lawyers Association that details changes and the status of CPOM regulations across states. We also supplement this source with news articles from Nexis Uni and Permit Health's guidelines and carefully verify their contents and relevance through additional manual internet searches. We present the detailed manual search process and list the identified changes in CPOM doctrines in Section V.A of the Internet Appendix.

We define a CPOM event to be a state-year where the state experiences changes in legislation, case laws, or opinions that relax or tighten the implementation of the CPOM doctrine. We label states that experienced a CPOM event during our sample period as treated states. If a state experiences more than one CPOM event in the same direction, we only consider the first event. If a state experiences both tightening and relaxation of the CPOM doctrine during our sample period, we exclude it from the sample, because the post-event years of earlier changes may overlap with pre-event years for later changes. Control states are ones that did not experience any CPOM event during our sample period. In Internet Appendix V.B, we explicitly test whether state-level characteristics predict the changes in the stringency of CPOM doctrines, including hospital care and other healthcare spending, population, income per capita, unemployment rates, the number of hospitals, and age-adjusted mortality rates. All covariates are measured contemporaneously (t) and with a one-year lag ($t-1$). In Table IA8, we examine the determinants of CPOM relaxation and tightening events, but do not find a significant effect from any characteristics that we consider.

We examine how the CPOM events affect the likelihood that hospitals in treated states are acquired by PE, and the subsequent changes in their operating performance and employment profiles. To do so, we construct a matched sample, matching each hospital in treated states with a hospital in control states using the same matching procedure in the main analysis (see Section 4). We then compare each pair of matched treated and control hospitals throughout the event window $[-4, 8]$ around the CPOM event year. Note that we no longer separately examine the short-run and long-run effects, because in this analysis, the treatment comes from the changes in CPOM doctrines at the state level instead of PE acquisition. Thus, we do not track the precise timing when the

[18] For example, Texas enacted a legislation in 2011 that created new provisions that relaxed CPOM, to enable the employment of physicians by certain county hospital districts. The State Medical Board in Ohio in 2012 declared an end to the corporate practice ban after determining the doctrine being essentially obsolete in the state. Effective 2017, California Governor Jerry Brown relaxed CPOM as part of the amendment to California Business and Professions Code (Section 2401), which aims to help rural hospitals attract physicians. Prior to our sample period, an exception to the CPOM was established by the seminal case of *Berlin v. Sarah Bush Lincoln Health Center*.

effects of PE-acquisitions set in. We also drop hospitals acquired by non-PE, for-profit acquirers. This is because the non-PE acquirers in our sample are either hospital systems or standalone hospitals, whose acquisitions are unlikely to be directly restricted by the CPOM doctrine.[19] We estimate the following regression model:

$$Y_{e,i,t} = \beta_1 CPOM\ Relaxation_{e,i,t} \times Post_{e,t} + \beta_2 CPOM\ Tightening_{e,i,t} \times Post_{e,t} + \gamma \cdot X_{i,t} + \alpha_i + \mu_e + \tau_{e,t} + \nu_{e,i,t}, \quad (2)$$

where e indicates a matched pair that includes a hospital located in a treated state (i.e., a state that changes its CPOM doctrine) and a matched "similar" hospital in control states, i indexes a hospital, and t indicates a year around the event. *CPOM Relaxation* is an indicator that turns to one for hospitals in states that relaxed their CPOM doctrines during our sample period, and 0 otherwise. Analogously, *CPOM Tightening* is an indicator that turns to one for hospitals in states that tightened their CPOM doctrine during our sample period, and 0 otherwise. *Post* indicates years following the changes in CPOM doctrines. The dependent variable Y includes *PE Target*, an indicator for whether a hospital is acquired by a PE firm. It also includes operating income over total assets, return on assets, log of total employment, the log of core workers, and the log of administrative workers. We control for the same set of hospital and county characteristics as in our main analysis. In addition, we control for hospital fixed effects (α_i), matched pair fixed effects (μ_e), and event time fixed effects ($\tau_{e,t}$). Standard errors are clustered by state.

Results from this analysis are presented in Table 6. Panel A reports the results regarding the effect of CPOM implementation on the likelihood of local hospitals being acquired by PE investors. Panel B examines the effects of CPOM implementation on the performance and employment profiles of hospitals in treated states.

TABLE 6 ABOUT HERE

In Panel A, we find that CPOM relaxation leads to a significant increase in PE takeover likelihood of hospitals, but CPOM tightening does not significantly reduce PE takeover likelihood. This asymmetric effect may be due to the fact that in tightening states, existing enforcement of the CPOM doctrine already present significant obstacles to PE investors, and hence, additional restrictions likely had limited effects. It is also worth mentioning that some states created exemptions to the CPOM doctrine, or choose not to enforce it without explicitly rejecting them (Gustavson and Taylor, 2010). These factors could add substantial noise in our estimation, preventing us from finding a significant effect from changes in CPOM enforcement.

Results in Panel B suggest that hospitals in states that relax their CPOM doctrines exhibit improved profitability measured by *ROA*. In contrast, there is little effect from the tightening of the CPOM doctrine. Hospitals in CPOM-relaxation states also significantly reduce their total employment by 4.3%. Importantly, we show that a relaxation in CPOM doctrines leads to no change in core workers in local hospitals, but a significant and large reduction of administrative workers, by over 9%. These results, while not definitively eradicating all endogeneity concerns, help bolster our causal inferences.

[19] We show in Table IA9 of the Internet Appendix that changes in CPOM doctrines do not affect the takeover likelihood of non-PE acquirers.

We note that the above results can also be generated through a two-stage-least-square framework, whereby the first stage examines the effect of CPOM doctrines on PE acquisitions, and the second stage examines how the predicted changes in PE acquisition likelihood affect target hospitals. We provide the results in Table IA10. The two-stage framework generates similar results in terms of statistical significance, but the coefficients generally have much larger magnitudes. This is because in the first stage, changes in CPOM doctrines only lead to small changes in PE acquisition likelihood, while in the data, such changes correspond to binary realizations of *PE Target*, i.e., the difference in acquired and non-acquired hospitals. Thus, the magnitudes from the second stage are artificially inflated.

5.5. Nonprofit and For-Profit Targets

We compare post-acquisition outcomes between targets that operated as for-profit and nonprofit organizations prior to being acquired. We expect that nonprofit targets will experience a greater reduction in administrative workers following PE acquisitions for at least two reasons. First, nonprofit hospitals are not subject to investor scrutiny and may operate less efficiently by employing a larger administrative workforce. PE firms can enhance the operational efficiency of nonprofit hospitals by introducing investor accountability. Second, nonprofit hospitals may prioritize patient satisfaction over profitability, leading them to maintain extensive administrative functions. A PE takeover may shift this priority, resulting in more significant cuts to administrative services at nonprofit targets compared to for-profit ones.

We focus on five outcomes, operating income over total assets, return on assets, the log of total employment, the log of core medical workers, and the log of administrative workers. We regress each outcome on the interaction terms *PE Target* × *For-profit Target* and *PE Target* × *Nonprofit Target*, whereby *For-profit Target* and *Nonprofit Target* represent target hospitals' for-profit status prior to the deal. The differences between these interaction terms as well as the statistical significance of the differences are calculated. Our regressions also include the indicator of non-PE acquisition, but we suppress the coefficient for brevity.

Table 7 reports the results from this analysis. Both previously for-profit and nonprofit target hospitals see a temporary improvement in profitability, but the effect becomes insignificant in the long run, consistent with our baseline results (Table 3). Both types of targets also experience significant declines in employment counts after being acquired, but the magnitudes of the declines are larger for nonprofit targets than for-profit ones over the first four-year window. Both nonprofit and for-profit targets exhibit a drop in core worker counts, which rebound over the longer term.

TABLE 7 ABOUT HERE

Importantly, nonprofit and for-profit targets exhibit different changes in the number of administrative workers. Estimates in column (10) suggest that administrative workers decline by 33% at previously nonprofit targets over the [5, 8]-year window after PE acquisitions. This sizable reduction likely reflects the substantial restructuring efforts at nonprofit hospitals, which did not have investor accountability prior to being acquired. This magnitude stands in contrast to the 10%, statistically insignificant reduction at for-profit targets over the same horizon. This finding reveals a novel role for PE firms in transforming non-profit organizations into for-profit ones, and improving their efficiency by trimming the administrative burden of acquired hospitals.

5.6. Additional Robustness Checks

In this section, we perform multiple analyses to test whether our inferences are robust to empirical choices regarding measurement and sampling procedures.

First, we vary the definition of core medical workers, which in our main analysis are defined as physicians, nurses and pharmacists. As physicians may be hired through part-time contracts and be affiliated with multiple hospitals simultaneously, their hours may not be tracked in the cost reports in the same way as other full-time employees. To mitigate potential measurement errors, we restrict our definition of core workers to only nurses and pharmacists and examine changes in the log number of nurses and pharmacists. In Table IA5 of the Internet Appendix, we show that our results are robust to this alternative definition of core workers. As before, we observe that the number of nurses and pharmacists at PE-acquired hospitals temporarily drops in the short run, but reverts back in the longer horizon. In contrast, at non-PE targets, the number of nurses and pharmacists experiences a persistent and statistically significant decline subsequent to the acquisition. The initial decline does not reverse, but aggravates in the long run.

Our second test explores several alternative matching approaches. To start, we use the total number of workers during the year prior to acquisitions, rather than core and administrative workers separately, as our employment matching variable. Next, we match acquired hospitals and control hospitals based on a smaller set of variables, in two different analyses. In one, we match them based on the pre-event average of outpatient ratio, the CMI, and the log of total employment during the year prior to the acquisition. We also require acquired and control hospitals to be in the same Census division and to have the same metropolitan area status. In the other, hospitals are matched based on the pre-event average of outpatient ratio and the CMI. We then require them to be in the same census division, have the same metropolitan area status, and to be in the same decile of the number of beds. Results in Table IA11 of the Internet Appendix show that our results remain qualitatively unchanged across all the alternative matching methods.

Third, we address the concern that control hospitals may be influenced by the spillover effects from the acquisition of local, peer hospitals by PE firms. For example, as PE firms cut employment at target hospitals, those employees losing their jobs may switch to other hospitals in the same region, leading to an increase in employment in the control units. In Table IA12 of the Internet Appendix, we address this concern using two alternative samples, based on the assumption that switching is less likely across hospitals that are far away. First, we delete all matched target-control pairs where the control hospital is located in the same hospital referral regions (HRR) as the target (Panel A). Next, we remove from our sample matched pairs where the control hospital is located in an HRR where over 25 percent of hospitals in that region are acquired by PE over the $[-4, +8]$-year event period (Panel B). Our inferences remain unchanged in these samples.

6. Other Changes in Hospital Operations

In this section, we continue to examine other types of operational changes at PE-acquired hospitals. In particular, we investigate the changes in wage rates paid, hospital beds, revenues, the complexity of hospital operations, and the composition of treated patients.

6.1. Wage Rates

We examine whether core and administrative workers are paid lower wages at PE-acquired hospitals. This examination helps us address possibilities such as whether PE acquirers may lay off some administrative workers but offer higher wages to remaining ones, or that they may suppress the wages of core medical workers.

We compute the hourly wage rates for core and administrative workers separately. Wage rates are transformed to log terms, i.e., *Log(Core Wage Rate)* and *Log(Admin Wage Rate)*. From Table 8, we find no change in core workers' wage rate at PE-acquired hospitals. In contrast, administrative workers' wage rate drops significantly to 7% lower than its pre-acquisition level in the long-run window. These results are consistent with PE acquirers reducing the costs associated with administrative functions. For hospitals acquired by non-PE, for-profit acquirers, wage rates drop in the short-run but reverts in the long run. In the [5, 8]-year window, the wage rates of administrative workers in non-PE target hospitals are significantly higher than those in PE target hospitals.

Table 8 About Here

6.2. Hospital Size, Procedures, and Patient Insurance Types

We follow Schmitt (2017) and examine several aspects of operational changes in target hospitals around acquisitions. To start, we examine changes in hospitals' operating scale, including the number of beds, patients, and revenues. Hospital revenue is measured by the log of gross sales as well as net sales, which is gross sales after deducting rebate and discounts offered to patients. Panel A of Table 9 reports the results. We do not find target hospitals to exhibit changes in the number of beds after PE acquisitions, although the number of patients declines by around 10% in the long run. Importantly, we note that PE target hospitals do not generate significantly higher revenue, which suggests that the increased profitability documented in Table 3 likely arises from reduced costs.

Table 9 About Here

We next investigate the changes in the type of hospital treatments by looking at changes in the CMI and the outpatient ratio. The CMI is a weighted average across diagnosis codes of hospital discharges, with the weights corresponding to the associated costs of the treatment. It seeks to capture the diversity, clinical complexity, and resource needs of all the patients treated in a hospital. One concern with PE's involvement in the hospital industry is that PE acquirers might engage in "upcoding" practice, i.e., healthcare providers submitting codes for more severe conditions than the actual diagnoses in order to receive higher reimbursement. Such behaviors can push up CMI. Counter to this concern, we do not find significant changes in CMI at PE-acquired hospitals in columns (1) and (2). Our findings are consistent with those in Offodile II et al. (2021), which also documents no upcoding behavior at PE-owned hospitals.

Results in columns (3) and (4) suggest significant declines in outpatient ratio at PE-acquired hospitals. Because outpatient procedures are a more cost-efficient source of revenue for hospitals, a declining ratio suggests that PE-acquired hospitals do not shift their operations to outpatient services to generate revenue at lower costs compared to other hospitals.

Finally, we examine whether hospitals treat a greater or smaller fraction of patients enrolled in Medicare or Medicaid programs following PE acquisitions. We find that PE-acquired hospitals experience a small decline (by 1 percentage point) in the proportion of Medicaid patients as well as Medicare patients, although the latter effect dissipates over the longer horizon. In the next section, we provide a more detailed analysis on patient demographics using insurance claim data.

7. Implications of PE Acquisitions for Patients

How do PE acquisitions of hospitals affect patients? To explore this question, we look into changes in patient demographics, hospital prices, patient satisfaction, and mortality and readmission rates at target hospitals.

7.1. Changes in Patient Demographics

We leverage the HCCI data to investigate whether after PE acquisitions patient demographics at target hospitals change. We merge our sample of matched target and control pairs outlined in Section 4 with hospitals covered in the HCCI database, and estimate Equation (1) using the matched sample, regressing the patient characteristics of a hospital on the indicators *PE Target* and *NonPE Target*. Our estimation controls for hospital fixed effects, match-pair fixed effects and event-time fixed effects. We do not distinguish short-run and long-run outcomes in analyses with the HCCI data, since the data is only available from 2012, leaving at most seven years of observations for each hospital. Instead, we estimate the average differences between pre- and post-event periods during the $[-4, +8]$-year window, and compare changes between acquired hospitals and their matched control units.

Results are presented in Table 10. We do not find patient demographics to change at PE-acquired hospitals around the acquisition events compared to their matched control hospitals. All coefficients are statistically insignificant and economically negligible.

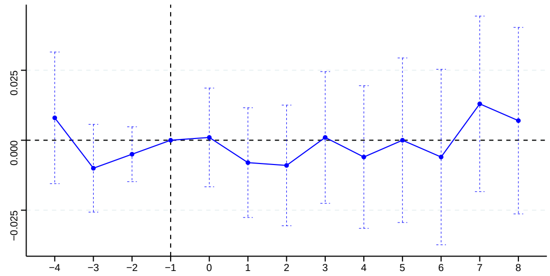
Table 10 About Here

Figure 6 presents the evolution of patient characteristics at target hospitals relative to those at control hospitals over time. We control for hospital-level and county-level factors as defined in Table 3, and include hospital fixed effects, matched-pair fixed effects, and event time fixed effects. We do not see significant shifts in any dimension of patient demographics at target hospitals prior to PE takeovers. Following the acquisitions, we observe a slight, statistically insignificant decline in the fraction of female patients, which reverses in the long run. There is also a mild drop in patient age in the first few years after the takeover, although the effects are rarely significant and reverse in the long run. We do not observe any significant changes in the income levels of patients' residential areas. If anything, patients served after the PE acquisitions tend to come from lower-income areas.

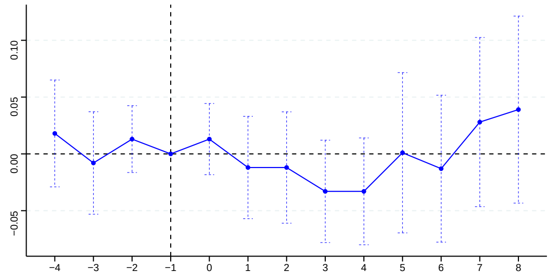
7.2. Changes in Hospital Prices

We next analyze the changes in hospital inpatient prices following PE takeovers. As explained in Section 3.3, we compute a price index for each hospital over time, forming a hospital-year panel. We then estimate Equation (1), switching the dependent variables to the price index. We continue to use the Mahalanobis matched sample for this analysis and focus on the price index for the average inpatient treatment as well as each of the seven procedures.

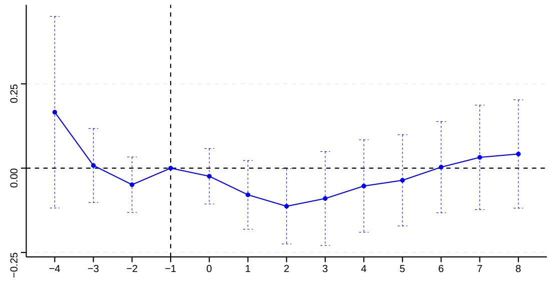
Panel A of Table 11 reports the results for prices on all inpatient procedures. We add controls in stages. In column (1), we control for hospital, event, and event time fixed effects. In column (2), we add hospital characteristics as controls, including the log of total beds, CMI, the percentage of patients with Medicare and Medicaid insurance, and the fraction of outpatient charges relative to total charges. In column (3), we further control for county characteristics, including the fraction of Black and Asian residents,



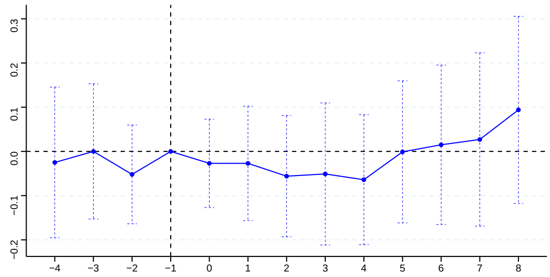
(A) *Female*, Simple Average



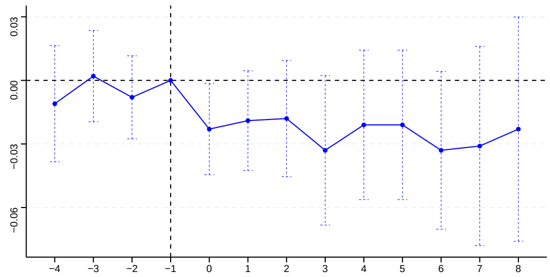
(B) *Female*, Weighted Average



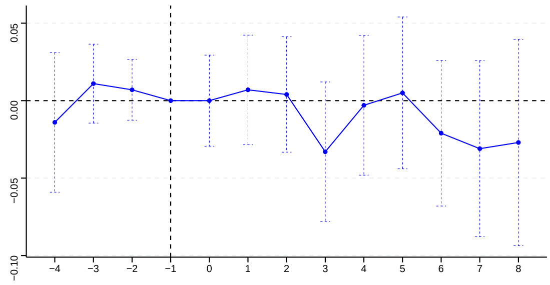
(C) *Age*, Simple Average



(D) *Age*, Weighted Average



(E) *Income (in log)*, Simple Average



(F) *Income (in log)*, Weighted Average

Figure 6. Dynamic Changes in Patient Demographics around PE Acquisition. This figure shows the changes in patient demographics for PE-acquired hospitals relative to their matched control hospitals over the [-4, +8]-year event window. The left (right) column presents the changes in the simple (weighted) average of patient characteristics at PE-acquired hospitals relative to the control hospitals. We control for hospital-level and county-level factors as defined in Table 3, and include hospital fixed effects, matched-pair fixed effects, and event time fixed effects. In each panel, the dots and intervals represent the coefficients and the associated 95-percentile confidence intervals, respectively. Year -1 is absorbed as the base year.

the log of population and the log of one-bedroom rent. Across all specifications, we do not find prices of inpatient services at target hospital to deviate from those at control hospitals in a meaningful way following PE acquisitions. If anything, inpatient prices drop slightly by around 5%.

<u>TABLE 11 ABOUT HERE</u>

In Figure 7, we report the dynamic effects of PE acquisitions on hospital inpatient prices. We do not observe significant deviations between the prices charged by target and control hospitals prior to the year of PE acquisitions. After the acquisitions, the inpatient prices at target hospitals experience a mild decline, but remain statistically similar with the inpatient prices at control hospitals for all post-event years.

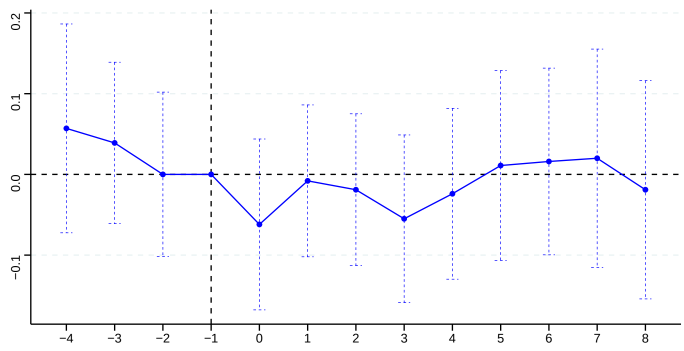


Figure 7. Dynamic Changes in Hospital Inpatient Prices around PE Acquisition. This figure shows the changes in the average inpatient prices at PE-acquired hospitals relative to their matched control hospitals over the [-4, +8]-year event window. We control for hospital-level and county-level factors as defined in Table 3, and include hospital fixed effects, matched-pair fixed effects, and event time fixed effects. The dots and intervals represent the coefficients and the associated 95-percentile confidence intervals, respectively. Year −1 is absorbed as the base year.

In Panel B of Table 11, we examine the changes in hospital prices for each of the seven procedures. We find that following acquisitions, PE target hospitals do not change prices differently relative to their matched control hospitals for six out of seven major procedures. The exception is colonoscopy, where prices increase by 29% after PE acquisitions, compared to control hospitals. Given that colonoscopy is often performed as an outpatient procedure, our finding is consistent with the evidence in Liu (2021) that PE acquirers increase outpatient prices.[20]

In Section I.B of the Internet Appendix, we follow Adelino et al. (2021) and examine whether PE-acquired hospitals are more likely to choose more intensive and profitable procedures, such as cesarean sections (C-section) in lieu of vaginal delivery for child delivery, and catheterization instead of intensive drug treatment for heart attacks (AMI). We do not find evidence that PE-acquired hospitals are more likely to opt for profitable procedures.

Recent studies have made important progress on understanding how PE influences healthcare prices (Liu, 2021; Cerullo et al., 2022b) and hospital charges (Offodile II et al., 2021; Bruch et al., 2020). We contribute to these studies in several ways. First, our findings are derived from private insurance claims data, which complement Cerullo et al. (2022b) that use medicare claims data. Both studies document no significant changes in average inpatient procedure prices. Second, our price analyses control for patient risk, representing an advancement from other studies that directly compare the charges across hospitals without controlling for patient heterogeneity (Offodile II et al., 2021; Bruch et al., 2020). It is also worth noting that hospital level charges could deviate substantially from the actual prices paid by patients, suggesting that investigating insurance claims rather than charges can more accurately uncover the effects of PE on hospital prices. Third, our analysis focuses on inpatient prices, a major component of hospital revenue. It complements Liu (2021), who finds that PE acquisitions of hospitals increase outpatient prices.

[20] Among the seven procedures that we examine, only colonoscopy and MRI are typically performed as outpatient procedures. Consistent with our evidence, Liu (2021) also finds that PE acquisition generates limited effects on MRI prices.

What explains the differential effect of PE on inpatient and outpatient prices? One potential explanation is that public attention and regulatory scrutiny may be particularly strong for inpatient prices, as inpatient services are more likely to involve expensive treatments such as intensive care and major surgeries. Such intense scrutiny can lead to relatively uniform prices and less room for PE to push up inpatient prices. Consistent with this conjecture, Wang et al. (2024) document that inpatient procedure prices are more uniform than outpatient service prices. We leave it to future research to further investigate the mechanisms through which hospital ownership differentially affects the pricing of inpatient and outpatient treatments.

7.3. Changes in Patient Satisfaction

In this section, we investigate patient satisfaction at acquired hospitals relative to the matched control group. We utilize data from the HCAHPS survey, which includes patients' evaluation of the quality of communication with doctors, the quality of communication with nurses, whether they receive help as soon as they need it, an overall rating of the hospital, and whether they would recommend the hospital to others.

Table 12 reports the results. We find that patient satisfaction scores across all dimensions decline significantly at hospitals acquired by PE acquirers, both in the short-run and long-run. These observations are potentially connected to our earlier results on the decline in the quantity and wages of administrative employees at PE-acquired hospitals. It is possible that the administrative job cuts lead target hospitals to operate less smoothly, with impaired non-medical services (scheduling, dining, etc.). It is also possible that the acquisitions lead to many operational changes, and could have disrupted services in the target hospitals.

TABLE 12 ABOUT HERE

7.4. Patient Mortality and Readmission Rates

We consider two measures of patient outcomes, mortality and readmission rates. Mortality rate is an ultimate measure of patient welfare, and has been used frequently in prior studies as a metric of the effectiveness of healthcare quality (see Gaynor and Town (2011) for a review). The most widely used mortality metric is 30-day acute myocardial infarction (AMI) mortality rate, that is, the death rate of heart-attack patients during the 30-day period following hospitalization. We construct two supplementary mortality measures related to heart failure and pneumonia, defined analogously. Each aspect of mortality rate is based on the 30-day risk standardized rates, in percentage points.

Readmission rates after discharge are also an important indicator of the effectiveness of medical treatment (Ho and Hamilton, 2000). Similar to mortality rates, we also evaluate readmission rates using a 30-day window after discharge, and we focus on the same illnesses as before — heart attack, heart failure, and pneumonia.

In the CMS Hospital Compare database, mortality and readmission rates are reported with 3-year rolling windows. In other words, for year 2007, we observe the cumulative mortality/readmission rates calculated based on data from 2005–2007. We collect mortality rates reported over several time intervals, including a pre-event window $[t-3, t-1]$ and four post-event windows reported in year 3 through 6: $[t+1, t+3]$, $[t+2, t+4]$, $[t+3, t+5]$, and $[t+4, t+6]$. We exclude the windows that straddle the year of the acquisition because patient outcomes in those windows reflect partly pre-event conditions and partly treatment effects.

Because the pre-event window does not overlap with post-event ones, we adopt a first-difference approach to examine the effect of an acquisition on patient mortality and readmission rates. For each post-event window, we compute the change in mortality rate for a given hospital from the pre-event window to each of the four post-event windows. This gives us up to four observations for each hospital-acquisition event. The first-difference approach allows us to directly measure the changes in mortality/readmission rates following hospitalization from pre-acquisition years to post-acquisition years.

We regress the changes in mortality and readmission rates for PE and non-PE acquirers, with all control variables transformed in a first-difference approach. We also remove hospital fixed effects, which are absorbed by the first-difference approach. Our specification is as follows:

$$\Delta Y_{e,i,\tau} = \beta_1 PE\ Target_{e,i,\tau} + \beta_2 NonPE\ Target_{e,i,\tau} + \gamma \cdot \Delta X_{i,t} + \mu_e + \nu_{e,i,\tau}, \qquad (3)$$

where $\Delta Y_{e,i,\tau}$ represents the changes in mortality and readmission rates from the pre-event to a post-event window, indexed by τ. $\Delta X_{i,t}$ represents the first-difference in control variables, and μ_e stands for matched pair fixed effects. In this specification, *PE Target* equals one for target hospitals of PE acquirers, and *NonPE Target* indicates target hospitals of non-PE acquirers.

Table 13 reports the results from estimating Equation (3). We present coefficients from regressions with and without matched pair fixed effects.

TABLE 13 ABOUT HERE

Panel A reports results regarding patient mortality. We do not find PE-acquired hospitals to exhibit significant increases in any of the three types of mortality rates we examine. There are mixed evidence regarding the effect of non-PE acquirers. While target hospitals of non-PE buyers have lower mortality rates regarding heart attacks compared to their control group, they exhibit higher mortality rates related to heart failures. Panel B presents results regarding readmission rates. We again do not find PE acquirers to be associated with significant changes in any type of readmission rates. Non-PE acquirers are associated with a 0.8 percentage point decrease in readmission rates following pneumonia, but no changes in other readmission rates.

In untabulated analyses, we also look into other patient outcomes, including stroke, complications and infection during hospitalization. We do not find evidence that PE-acquired hospitals differ from the control group, or from non-PE-acquired hospitals along these dimensions. Overall, our evidence does not support the argument that patients at PE-acquired hospitals exhibit worse treatment outcomes or higher readmission rates compared to those at targets of non-PE acquirers as well as those at control hospitals. This finding complements the results from Liu (2021) that there is no significant change in the service quality of PE target hospitals.

8. Conclusion

Hospitals are an important sector of the economy. They not only provide essential healthcare, but are also key job providers in the U.S. As PE firms are increasingly involved in the hospital industry, in-depth research is needed to understand how such activity affects jobs, efficiency and patient outcomes at acquired hospitals.

We find that PE-acquired hospitals exhibit significant employment cuts, reduced wage expenses, and improved operating profitability. Yet, the employment cuts largely involve administrative workers. In the longer term, the number of core medical workers (e.g., nurses and physicians) recovers to pre-acquisition levels, while the decline in administrative workers persists. Such reductions in administrative workers is unique to PE acquirers, and not observed for other for-profit acquirers in the hospital industry.

Perhaps as a result of preserving core workers in the long run, we do not observe a deterioration in real patient outcomes such as mortality or readmission rates at PE-acquired hospitals. Nor do we see significant shifts in patient demographics or hospital inpatient prices. These results alleviate the concerns that PE firms improve efficiency and profitability at the expense of patients. At the same time, we find that patients at PE target hospitals express lower satisfaction, suggesting that hospital services may be running less smoothly due to the reduction in supporting, non-medical staff.

Overall, our evidence suggests that PE acquirers improve the operating efficiency of target hospitals without significantly compromising healthcare quality. Targets of non-PE acquirers do not exhibit the same improvement in their operating efficiency. Thus, our analysis reveals a unique role of PE investors in shaping the hospital industry.

References

Abadie, A., Diamond, A., Hainmueller, J., 2010. Synthetic control methods for comparative case studies: Estimating the effect of california's tobacco control program. Journal of the American statistical Association 105, 493–505.

Adelino, M., Lewellen, K., McCartney, W.B., 2021. Hospital financial health and clinical choices: evidence from the financial crisis. Management Science .

Adelino, M., Lewellen, K., Sundaram, A., 2015. Investment decisions of nonprofit firms: Evidence from hospitals. The Journal of Finance 70, 1583–1628.

Aghamolla, C., Karaca-Mandic, P., Li, X., Thakor, R.T., 2021. Merchants of death: The effect of credit supply shocks on hospital outcomes. Working Paper .

Ameringer, C.F., 2000. Organized medicine on trial: The federal trade commission vs. the american medical association. Journal of Policy History 12, 445–472.

Antoni, M., Maug, E., Obernberger, S., 2019. Private equity and human capital risk. Journal of Financial Economics 133, 634–657.

Austin, P.C., 2009. Using the standardized difference to compare the prevalence of a binary variable between two groups in observational research. Communications in statistics-simulation and computation 38, 1228–1234.

Austin, P.C., 2011. An introduction to propensity score methods for reducing the effects of confounding in observational studies. Multivariate behavioral research 46, 399–424.

Baugh, C.W., Schuur, J.D., 2013. Observation care—high-value care or a cost-shifting loophole? New England Journal of Medicine 369, 302–305.

Beaulieu, N.D., Dafny, L.S., Landon, B.E., Dalton, J.B., Kuye, I., McWilliams, J.M., 2020. Changes in quality of care after hospital mergers and acquisitions. New England Journal of Medicine 382, 51–59.

Bernstein, S., 2022. The effects of public and private equity markets on firm behavior. Annual Review of Financial Economics 14, 295–318.

Bernstein, S., Sheen, A., 2016. The operational consequences of private equity buyouts: Evidence from the restaurant industry. The Review of Financial Studies 29, 2387–2418.

Bloom, H.S., 1995. Minimum detectable effects: A simple way to report the statistical power of experimental designs. Evaluation review 19, 547–556.

Borsa, A., Bejarano, G., Ellen, M., Bruch, J.D., 2023. Evaluating trends in private equity ownership and impacts on health outcomes, costs, and quality: systematic review. bmj 382.

Boucly, Q., Sraer, D., Thesmar, D., 2011. Growth LBOs. Journal of Financial Economics 102, 432–453.

Bruch, J.D., Gondi, S., Song, Z., 2020. Changes in hospital income, use, and quality associated with private equity acquisition. JAMA Internal Medicine 180, 1428–1435.

Bruch, J.D., Nair-Desai, S., Orav, E.J., Tsai, T.C., 2022. Private equity acquisitions of ambulatory surgical centers were not associated with quality, cost, or volume changes: Study examines private equity acquisitions of ambulatory surgical centers and potential impact on quality of care, cost, or volume. Health Affairs 41, 1291–1298.

Cerullo, M., Lin, Y.L., Rauh-Hain, J.A., Ho, V., Offodile II, A.C., 2022a. Financial impacts and operational implications of private equity acquisition of us hospitals: Study examines the impacts and operational implications of private equity acquisitions of us hospitals. Health Affairs 41, 523–530.

Cerullo, M., Yang, K., Maddox, K.E.J., McDevitt, R.C., Roberts, J.W., Offodile, A.C., 2022b. Association between hospital private equity acquisition and outcomes of acute medical conditions among medicare beneficiaries. JAMA network open 5, e229581–e229581.

Cooper, Z., Craig, S.V., Gaynor, M., Van Reenen, J., 2019. The price ain't right? hospital prices and health spending on the privately insured. The Quarterly Journal of Economics 134, 51–107.

Cooper, Z., Gibbons, S., Jones, S., McGuire, A., 2011. Does hospital competition save lives? evidence from the english nhs patient choice reforms. The Economic Journal 121, 228–260.

Cornaggia, K., Li, X., Ye, Z., 2021. Virtual competition and cost of capital: Evidence from telehealth. Available at SSRN 3833193 .

Craig, S.V., Grennan, M., Swanson, A., 2021. Mergers and marginal costs: New evidence on hospital buyer power. The RAND Journal of Economics 52, 151–178.

Dafny, L., 2009. Estimation and identification of merger effects: An application to hospital mergers. The Journal of Law and Economics 52, 523–550.

Dafny, L., Ho, K., Lee, R.S., 2019. The price effects of cross-market mergers: Theory and evidence from the hospital industry. The RAND Journal of Economics 50, 286–325.

Davis, S.J., Haltiwanger, J., Handley, K., Jarmin, R., Lerner, J., Miranda, J., 2014. Private equity, jobs, and productivity. American Economic Review 104, 3956–90.

Ewens, M., Gupta, A., Howell, S.T., 2022. Local journalism under private equity ownership .

Fracassi, C., Previtero, A., Sheen, A., 2022. Barbarians at the store? private equity, products, and consumers. The Journal of Finance 77, 1439–1488.

Gandhi, A., Song, Y., Upadrashta, P., 2020a. Have private equity owned nursing homes fared worse under covid-19? Available at SSRN 3682892 .

Gandhi, A., Song, Y., Upadrashta, P., 2020b. Private equity, consumers, and competition: Evidence from the nursing home industry. Working Paper .

Gaynor, M., Town, R.J., 2011. Competition in health care markets. Handbook of Health Economics 2, 499–637.

Griffin, J., Priest, A., 2024. Overbilling and killing? an examination of skilled nursing facilities. Working Paper .

Gupta, A., Howell, S.T., Yannelis, C., Gupta, A., 2021. Does private equity investment in healthcare benefit patients? evidence from nursing homes. Working Paper .

Gustavson, M., Taylor, N., 2010. At death's door-idaho's corporate practice of medicine doctrine. Idaho L. Rev. 47, 479.

Hainmueller, J., 2012. Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies. Political analysis 20, 25–46.

Ho, V., Hamilton, B.H., 2000. Hospital mergers and acquisitions: Does market consolidation harm patients? Journal of Health Economics 19, 767–791.

Howell, S.T., Jang, Y., Kim, H., Weisbach, M.S., 2022. All clear for takeoff: Evidence from airports on the effects of infrastructure privatization .

Jensen, M.C., 2019. Eclipse of the public corporation, in: Corporate Governance. Gower, pp. 239–252.

Kaplan, S., 1989. The effects of management buyouts on operating performance and value. Journal of Financial Economics 24, 217–254.

Kaplan, S.N., Stromberg, P., 2009. Leveraged buyouts and private equity. Journal of Economic Perspectives 23, 121–46.

Kocher, R., 2013. The downside of health care job growth. Harvard Business Review .

La Forgia, A., Bond, A.M., Braun, R.T., Yao, L.Z., Kjaer, K., Zhang, M., Casalino, L.P., 2022. Association of physician management companies and private equity investment with commercial health care prices paid to anesthesia practitioners. JAMA internal medicine 182, 396–404.

La France, A., Batt, R., Appelbaum, E., 2021. Hospital ownership and financial stability: a matched case comparison of a nonprofit health system and a private equity–owned health system, in: The Contributions of Health Care Management to Grand Health Care Challenges. Emerald Publishing Limited. volume 20, pp. 173–220.

Lerner, J., Sorensen, M., Strömberg, P., 2011. Private equity and long-run investment: The case of innovation. The Journal of Finance 66, 445–477.

Lewellen, K., Phillips, G., Sertsios, G., 2023. Control Without Ownership: Governance of Nonprofit Hospitals. Technical Report. Working Paper.(Cited on pages 5, 11, 27, and 28.).

Lewis, M.S., Pflum, K.E., 2017. Hospital systems and bargaining power: Evidence from out-of-market acquisitions. The RAND Journal of Economics 48, 579–610.

Liu, T., 2021. Bargaining with private equity: Implications for hospital prices and patient welfare. Working Paper .

Morris, P., Phalippou, L., Wu, B.H., 2022. How deadly is financial leverage? evidence from care homes during the covid-19 crisis. Evidence from Care Homes during the COVID-19 Crisis (January 25, 2022) .

Offodile II, A.C., Cerullo, M., Bindal, M., Rauh-Hain, J.A., Ho, V., 2021. Private equity investments in health care: an overview of hospital and health system leveraged buyouts, 2003–17. Health Affairs 40, 719–726.

Olsson, M., Tåg, J., 2017. Private equity, layoffs, and job polarization. Journal of Labor Economics 35, 697–754.

Prager, E., Schmitt, M., 2021. Employer consolidation and wages: Evidence from hospitals. American Economic Review 111, 397–427.

Propper, C., Burgess, S., Green, K., 2004. Does competition between hospitals improve the quality of care?: Hospital death rates and the nhs internal market. Journal of Public Economics 88, 1247–1272.

Schmitt, M., 2017. Do hospital mergers reduce costs? Journal of Health Economics 52, 74–94.

Shrank, W.H., Rogstad, T.L., Parekh, N., 2019. Waste in the US health care system: Estimated costs and potential for savings. JAMA 322, 1501–1509.

Silverman, S.I., 2015. In an era of healthcare delivery reforms, the corporate practice of medicine is a matter that requires vigilance. Health L. & Pol'y Brief 9.

Spaenjers, C., Steiner, E., 2021. The value of specialization in private equity: evidence from the hotel industry. HEC Paris Research Paper No. FIN-2020-1410 .

Wang, Y., Xu, J., Anderson, G., 2024. Within-hospital price gaps across national insurers. JAMA Network Open 7, e2451941–e2451941.

Table 1
Summary Statistics For the Initial (Unmatched) Sample
This table reports the summary statistics for the main variables used in our study. The sample includes target hospital observations during the four years prior to their acquisition and all observations from non-target hospitals. Target − Non Target represents the difference between the two groups. Detailed variable definitions are provided by Appendix A. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

	Non Target	Target	Target−Non Target
Log(Employment)	6.58	6.38	−0.20***
Log(Core Workers)	3.97	3.84	−0.12***
Log(Admin Workers)	4.39	4.11	−0.28***
Log(Total Wages)	17.36	17.10	−0.26***
Beds	142.24	168.18	25.94***
CMI	1.38	1.36	−0.02***
%Medicare	0.44	0.41	−0.03***
%Medicaid	0.13	0.14	0.02***
%Outpatient	0.55	0.41	−0.14***
Obs	49230	1140	

Table 2
Summary Statistics for the Matched Sample
This table reports the summary statistics for the matched sample of targets and controls. We track target and control hospitals during the [-4, +8] event period, where an event is defined by the acquisition of a hospital. Panel A reports hospital characteristics. Panel B presents summary statistics on patient satisfaction and outcomes. Panel C documents the summary statistics for risk-adjusted prices and patient demographics, obtained from the HCCI dataset. Detailed variable definitions are provided by Appendix A.

(A) Hospital Characteristics

	Obs	Mean	Std	Median	P25	P75
Employment	4,329	865.54	626.10	708.58	451.88	1083.62
Log(Employment)	4,329	6.52	0.72	6.56	6.12	6.99
Core Workers	4,328	67.14	62.70	47.86	25.32	89.51
Log(Core Workers)	4,328	3.86	0.88	3.89	3.27	4.51
Admin Workers	4,328	82.02	59.74	67.81	42.91	102.29
Log(Admin Workers)	4,328	4.21	0.66	4.23	3.78	4.64
Total Wages (mil.$)	4,344	48.21	37.89	38.60	21.76	62.13
Log(Total Wages)	4,344	17.39	0.83	17.47	16.90	17.94
Beds	4,399	181.09	121.64	148.00	101.00	235.00
CMI	4,309	1.38	0.21	1.38	1.25	1.54
%Medicare	4,399	0.38	0.13	0.38	0.29	0.47
%Medicaid	4,399	0.15	0.11	0.12	0.06	0.21
%Outpatient	4,398	0.42	0.15	0.40	0.30	0.53

(B) Patient Satisfaction and Patient Outcomes

	Obs	Mean	Std	Median	P25	P75
Mortality for Heart Attack (AMI)	1,659	15.36	1.70	15.30	14.10	16.40
Mortality for Heart Failure	1,852	11.20	1.49	11.00	10.00	12.00
Mortality for Pneumonia	1,864	12.22	2.44	11.80	10.40	13.60
Readmission for Heart Attack (AMI)	1,244	18.90	1.70	19.00	17.70	20.00
Readmission for Heart Failure	1,566	23.91	2.07	24.00	22.30	25.40
Readmission for Pneumonia	1,579	17.93	1.59	18.00	16.90	19.00
Nurse Comm.	2,427	2.67	0.10	2.68	2.61	2.74
Doctor Comm.	2,427	2.73	0.08	2.73	2.68	2.78
Receive Help	2,427	2.47	0.13	2.48	2.38	2.56
Hospital Rating	2,427	2.53	0.13	2.54	2.45	2.61
Recommendation	2,427	2.58	0.12	2.59	2.51	2.67

(C) Hospital Prices and Patient Characteristics (Source: HCCI)

	Obs	Mean	Std	Median	P25	P75
Price For:						
Inpatient	606	15580.81	4064.60	15162.60	13079.04	17361.56
Hip Replacement	425	24909.85	9417.38	23930.30	18749.61	29869.37
Knee Replacement	500	24261.13	9311.91	22598.13	17790.12	29782.37
C-Section	516	9510.26	3839.28	9145.81	6803.50	11432.77
Vaginal Delivery	532	6103.88	2418.38	5936.74	4313.72	7431.08
PTCA	276	26632.11	9555.16	24799.47	19545.93	32864.82
Colonoscopy	673	1902.95	996.96	1723.64	1147.37	2448.31
MRI	619	1121.82	568.70	1035.83	648.95	1501.72
Log(Price) For:						
Inpatient	606	9.62	0.24	9.63	9.48	9.76
Hip Replacement	424	10.05	0.43	10.09	9.84	10.31
Knee Replacement	500	10.02	0.42	10.03	9.79	10.30
C-Section	516	9.00	1.98	9.12	8.83	9.34
Vaginal Delivery	530	8.64	0.40	8.69	8.37	8.91
PTCA	276	10.12	0.37	10.12	9.88	10.40
Colonoscopy	671	7.41	0.57	7.45	7.05	7.81
MRI	618	6.89	0.54	6.95	6.48	7.31
Patient Characteristics:						
Female (Simple Average)	769	0.59	0.05	0.59	0.57	0.63
Female (Weighted Average)	769	0.57	0.07	0.57	0.54	0.60
Age (Simple Average)	769	4.06	0.40	4.11	3.91	4.29
Age (Weighted Average)	769	4.44	0.47	4.50	4.29	4.71
Income (Simple Average)	769	61514.45	19472.13	55949.80	48291.93	68470.64
Income (Weighted Average)	741	59871.64	18392.87	54685.72	47455.93	66483.43
Log(Income (Simple Average))	769	10.99	0.28	10.93	10.79	11.13
Log(Income (Weighted Average))	741	10.96	0.27	10.91	10.77	11.10

Table 3
Profitability at Target Hospitals
This table examines changes in profitability at target hospitals around acquisitions. The dependent variable for columns (1) and (2) is *Gross Margin*, which is net income from service to patients (as given in HCRIS) over net patient revenues (as given in HCRIS). The dependent variable for columns (3) and (4) is *OI/TA*, which is net income from service to patients (as given in HCRIS) over total assets. The dependent variable for column (5) and (6) is *ROA*, which is net income (total income−total other expenses, as given in HCRIS) over total assets. *PE Target* turns to one after a hospital is acquired by a PE acquirer. *Non-PE Target* turns to one after a hospital is acquired by a non-PE acquirer. Rows with H_0's provide p-values from Wald Chi-square tests indicating whether two coefficients are statistically significantly different from each other. Hospital Controls include the log of total beds (*Log(Beds)*), case mix index (*CMI*), percentage of patients with Medicare (*%Medicare*), percentage of patients with Medicaid (*%Medicaid*), and the percentage of patients that are outpatients (*%Outpatient*). County Controls include the percentage of Black residents (*%Black*), the percentage of Asian residents (*%Asian*), log of population (*Log(Pop)*), and the log of one bedroom rent in a county (*Log(FMR)*). See Appendix A for variable definitions. t-statistics are reported in parentheses and standard errors are heteroskedasticity robust and clustered by hospital. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

Dep. Var.:	*Gross Margin*		*OI/TA*		*ROA*	
	(1)	(2)	(3)	(4)	(5)	(6)
Post-Event Window	[0, 4]	[5, 8]	[0, 4]	[5, 8]	[0, 4]	[5, 8]
PE Target	0.0015	0.0214	0.0399**	0.0333	0.0399***	0.0343
	(0.14)	(0.86)	(2.36)	(0.88)	(2.65)	(1.09)
NonPE Target	0.0206	0.0321	0.0465	0.0021	0.0013	−0.0133
	(1.00)	(0.79)	(1.23)	(0.04)	(0.05)	(−0.35)
Hospital Controls	Yes	Yes	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes	Yes
Matched Pair FEs	Yes	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
H_0: PE=NonPE	0.36	0.81	0.87	0.61	0.15	0.30
Obs	3,685	2,230	3,677	2,225	3,677	2,225
Adj. R^2	0.58	0.56	0.56	0.55	0.54	0.50

Table 4
Employment and Wage Expenditures at Target Hospitals
This table examines the changes in employment and wages at target hospitals around acquisitions. The dependent variable in column (1) and (2) is the log of total employees (measured in full-time equivalent employees based on employed hours). The dependent variable in column (3) and (4) is the log of total wages. *PE Target* turns to one after a hospital is acquired by a PE acquirer. *NonPE Target* turns to one after a hospital is acquired by a non-PE acquirer. Rows with H_0's provide p-values from Wald Chi-square tests indicating whether two coefficients are statistically significantly different from each other. Hospital Controls and County Controls are defined in the same way as in Table 3. See Appendix A for variable definitions. t-statistics are reported in parentheses and standard errors are heteroskedasticity robust and clustered by hospital. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

Dep. Var.:	*Log(Employment)*		*Log(Total Wages)*	
	(1)	(2)	(3)	(4)
Post-Event Window	$[0, 4]$	$[5, 8]$	$[0, 4]$	$[5, 8]$
PE Target	-0.0612^{***}	-0.0630^{*}	-0.0721^{***}	-0.0855^{**}
	(-4.08)	(-1.80)	(-3.67)	(-2.01)
NonPE Target	-0.0259	-0.0282	-0.0604^{*}	-0.0489
	(-0.91)	(-0.54)	(-1.93)	(-0.83)
Hospital Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes
Matched Pair FEs	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes
H_0: PE=NonPE	0.23	0.52	0.71	0.54
Obs	3,691	2,231	3,691	2,231
Adj. R^2	0.98	0.98	0.98	0.98

Table 5
Core and Administrative Workers at Target Hospitals
This table examines the changes in core workers and administrative workers at target hospitals around acquisitions. Panel A reports the results for the number of core and administrative workers. The dependent variable for columns (1) and (2) is the log of total number of core workers, i.e., *Log(Core Workers)*. The dependent variable for columns (3) and (4) is the log of total number of administrative workers, i.e., *Log(Admin Workers)*. Panel B reports the results contrasting short-run and long-run changes in core workers and administrative workers at target hospitals. The dependent variable for column (1) is *Log(Core Workers)*, while that for column (2) is *Log(Admin Workers)*. *Long-run* turns to one for year [5, 8] following the acquisition event. *PE Target* turns to one after a hospital is acquired by a PE acquirer. *NonPE Target* turns to one after a hospital is acquired by a non-PE acquirer. Rows with H_0's provide p-values from Wald Chi-square tests indicating whether two coefficients are statistically significantly different from each other. Hospital Controls and County Controls are defined in the same way as in Table 3. See Appendix A for variable definitions. t-statistics are reported in parentheses and standard errors are heteroskedasticity robust and clustered by hospital. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

(A) Log Number of Core and Administrative Workers

Dep. Var.:	*Log(Core Workers)*		*Log(Admin Workers)*	
	(1)	(2)	(3)	(4)
Post-Event Window	[0, 4]	[5, 8]	[0, 4]	[5, 8]
PE Target	−0.1620***	−0.0120	−0.1656***	−0.2027***
	(−4.74)	(−0.16)	(−5.56)	(−3.31)
NonPE Target	−0.2868***	−0.3598**	−0.0310	−0.0314
	(−4.49)	(−2.20)	(−0.59)	(−0.23)
Hospital Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes
Matched Pair FEs	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes
H_0: PE=NonPE	0.05	0.05	0.01	0.21
Obs	3,691	2,231	3,691	2,231
Adj. R^2	0.91	0.90	0.90	0.90

(B) Long-run versus Short-run Changes

Dep. Var.:	*Log(Core Workers)*	*Log(Admin Workers)*
	(1)	(2)
Post-Event Window	[0, 8]	[0, 8]
PE Target	−0.1598***	−0.1663***
	(−4.75)	(−5.65)
PE Target×Long-run	0.0943*	−0.0649*
	(1.82)	(−1.82)
NonPE Target	−0.2938***	−0.0330
	(−4.69)	(−0.64)
NonPE Target×Long-run	−0.0666	−0.0355
	(−0.62)	(−0.48)
Hospital Controls	Yes	Yes
County Controls	Yes	Yes
Hospital FEs	Yes	Yes
Matched Pair FEs	Yes	Yes
Event Time FEs	Yes	Yes
Obs	4,281	4,281
Adj. R^2	0.90	0.90

Table 6
CPOM Analysis
This table examines the changes in profitability, employment, and core and administrative workers at hospitals around CPOM reforms at the state level. The analysis uses a matched sample of hospitals, where each hospital in treated states (i.e., states that changed their CPOM doctrines) is matched with a hospital in control states (i.e., states without any CPOM events during our sample period). We analyze changes at hospitals around the [−4,+8] CPOM event window. In Panel A, we examine how the relaxation and tightening of CPOM enforcement at the state level affect the likelihood that a hospital is acquired by PE investors. In Panel B, we examine changes in hospital profitability, employment, and core and administrative workers around CPOM events. *CPOM Relaxation* is an indicator for states that experienced a relaxation in CPOM doctrines. *CPOM Tightening* is an indicator that turns to one for states that experienced a tightening in CPOM doctrines. *Post* indicates years after the relaxation or tightening event. *PE Target* turns to one after a hospital is acquired by a PE acquirer. *Hospital Controls* and *County Controls* are defined in the same way as in Table 3. See Appendix A for variable definitions. t-statistics are reported in parentheses and standard errors are heteroskedasticity robust and clustered by state. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

(A) The Effects of CPOM Events on PE Acquisition

Dep. Var.: *PE Target*	(1)
CPOM Relaxation×*Post*	0.0914**
	(2.09)
CPOM Tightening×*Post*	0.0096
	(0.79)
Hospital Controls	Yes
County Controls	Yes
Hospital FEs	Yes
Matched Pair FEs	Yes
Event Time FEs	Yes
Obs	5,287
Adj. R^2	0.57

(B) The Effects of CPOM Events on Profitability and Employment

Dep. Var.:	*OI/AT* (1)	*ROA* (2)	*Log(Total Employment)* (3)	*Log(Core Workers)* (4)	*Log(Admin Workers)* (5)
CPOM Relaxation×*Post*	0.0108	0.0205*	−0.0431**	0.0267	−0.0916**
	(1.12)	(1.85)	(−2.28)	(0.91)	(−2.56)
CPOM Tightening×*Post*	0.0134	0.0069	0.0376	0.0571	0.0171
	(1.14)	(0.81)	(1.66)	(1.56)	(0.47)
Hospital Controls	Yes	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes
Matched Pair FEs	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes
Obs	5,278	5,278	5,287	5,286	5,282
Adj. R^2	0.45	0.36	0.99	0.95	0.92

Table 7

Nonprofit vs. For-Profit Targets

This table presents heterogeneity of our results across previously nonprofit and for-profit targets. We report the results for *OI/AT* (columns (1) and (2)), *ROA* (columns (3) and (4)), the log of total employment (columns (5) and (6)), the log of core medical workers (columns (7) and (8)), and the log of administrative workers (columns (9) and (10)) at target hospitals around acquisitions. Target hospitals' for-profit status is characterized based on its status prior to the acquisition. All regressions include the indicator of non-PE acquisition, but we suppress the coefficients for brevity. Rows with H_0's provide p-values from Wald Chi-square tests indicating whether two coefficients are statistically significantly different from each other. Hospital Controls and County Controls are defined in the same way as in Table 3. See Appendix A for variable definitions. t-statistics are reported in parentheses and standard errors are heteroskedasticity robust and clustered by hospital. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

Dep. Var.:	*OI/TA*		*ROA*		*Log(Employment)*		*Log(Core Workers)*		*Log(Admin Workers)*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Post-Event Window	[0, 4]	[5, 8]	[0, 4]	[5, 8]	[0, 4]	[5, 8]	[0, 4]	[5, 8]	[0, 4]	[5, 8]
PE Target × *Nonprofit Target*	0.0627**	0.0489	0.0320	0.0461	−0.1259***	−0.0902*	−0.1399**	−0.0080	−0.2214***	−0.3346***
	(2.35)	(0.86)	(1.17)	(0.95)	(−4.43)	(−1.77)	(−2.46)	(−0.07)	(−4.07)	(−4.67)
PE Target × *For-profit Target*	0.0336*	0.0213	0.0421***	0.0251	−0.0431***	−0.0420	−0.1681***	−0.0151	−0.1501***	−0.1004
	(1.82)	(0.48)	(2.61)	(0.71)	(−2.82)	(−1.04)	(−4.62)	(−0.17)	(−4.83)	(−1.33)
Hospital Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Matched Pair FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H_0: For-Profit=Nonprofit	0.30	0.68	0.73	0.70	0.00	0.41	0.63	0.96	0.19	0.01
Obs	3,677	2,225	3,677	2,225	3,691	2,231	3,691	2,231	3,691	2,231
Adj. R^2	0.56	0.55	0.54	0.50	0.98	0.98	0.91	0.90	0.90	0.90

Table 8
Wage Rates for Core and Administrative Workers at Target Hospitals
This table examines the changes in per hour salary paid to core workers and administrative workers at target hospitals around acquisitions. In columns (1) and (2), we present results related to *Log(Core Wage Rate)*, the log of hourly wage rate for core workers. In columns (3) and (4), we present results related to *Log(Admin Wage Rate)*, the log of hourly wage rate for administrative workers. *PE Target* turns to one after a hospital is acquired by a PE acquirer. *NonPE Target* turns to one after a hospital is acquired by a non-PE acquirer. Rows with H_0's provide p-values from Wald Chi-square tests indicating whether two coefficients are statistically significantly different from each other. Hospital Controls and County Controls are defined in the same way as in Table 3. See Appendix A for variable definitions. t-statistics are reported in parentheses and standard errors are heteroskedasticity robust and clustered by hospital. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

Dep. Var.:	*Log(Core Wage Rate)*		*Log(Admin Wage Rate)*	
	(1)	(2)	(3)	(4)
Post-Event Window	$[0,4]$	$[5,8]$	$[0,4]$	$[5,8]$
PE Target	−0.0049	−0.0455	−0.0196	−0.0708**
	(−0.33)	(−1.41)	(−1.29)	(−2.35)
NonPE Target	−0.0531*	0.0139	−0.0414*	0.0253
	(−1.83)	(0.29)	(−1.68)	(0.54)
Hospital Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes
Matched Pair FEs	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes
H_0: PE=NonPE	0.10	0.24	0.38	0.05
Obs	3,643	2,203	3,581	2,174
Adj. R^2	0.71	0.71	0.81	0.79

Table 9

Size and Operating Characteristics at Target Hospitals

This table examines changes in scale and operating characteristics at target hospitals around acquisitions. Panel A examines hospitals' operating scale, measured by the log number of beds, patients, and sales. Panel B examines the composition of hospitals patients or hospital operations, measured by CMI, outpatient ratio, and the percentage of Medicare and Medicaid patients. *PE Target* turns to one after a hospital is acquired by a PE acquirer. *NonPE Target* turns to one after a hospital is acquired by a non-PE acquirer. Rows with H_0's provide p-values from Wald Chi-square tests indicating whether the two coefficients are statistically significantly different from each other. Control variables are the same as in Table 3. See Appendix A for variable definitions. t-statistics are reported in parentheses and standard errors are heteroskedasticity robust and clustered by hospital. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

(A) Hospital Operating Scale

Dep. Var.:	*Log(Beds)*		*Log(Patients)*		*Log(Gross Patient Sales)*		*Log(Net Patient Sales)*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post-Event Window	[0, 4]	[5, 8]	[0, 4]	[5, 8]	[0, 4]	[5, 8]	[0, 4]	[5, 8]
PE Target	−0.0068	0.0225	−0.0215	−0.1008*	−0.0149	−0.0619	−0.0685***	−0.0173
	(−0.40)	(0.45)	(−1.06)	(−1.69)	(−0.61)	(−0.93)	(−3.00)	(−0.27)
NonPE Target	−0.0588**	−0.0011	−0.1033**	−0.1051	−0.0880**	−0.0617	−0.1100***	−0.0312
	(−2.33)	(−0.02)	(−2.53)	(−1.42)	(−2.26)	(−0.76)	(−2.95)	(−0.39)
Hospital Controls								
County Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Matched Pair FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H_0: PE=NonPE	0.04	0.68	0.04	0.96	0.07	1.00	0.27	0.88
Obs	3,771	2,270	3,766	2,269	3,765	2,269	3,765	2,269
Adj. R^2	0.97	0.96	0.96	0.96	0.98	0.97	0.97	0.97

(B) Hospital Operation and Patient Composition

Dep. Var.:	*CMI*		*Outpatient Ratio*		*%Medicare*		*%Medicaid*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post-Event Window	[0, 4]	[5, 8]	[0, 4]	[5, 8]	[0, 4]	[5, 8]	[0, 4]	[5, 8]
PE Target	−0.0026	0.0167	−0.0159***	−0.0344***	−0.0125**	0.0062	−0.0116*	−0.0134
	(−0.30)	(0.78)	(−3.41)	(−2.80)	(−2.18)	(0.43)	(−1.83)	(−0.73)
NonPE Target	−0.0244*	−0.0167	−0.0122	−0.0304**	0.0116	0.0305*	−0.0064	−0.0319
	(−1.82)	(−0.62)	(−1.51)	(−2.27)	(1.42)	(1.75)	(−0.72)	(−1.51)
Hospital Controls								
County Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Matched Pair FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H_0: PE=NonPE	0.10	0.27	0.64	0.77	0.00	0.18	0.58	0.42
Obs	3,705	2,240	3,770	2,269	3,771	2,270	3,771	2,270
Adj. R^2	0.91	0.89	0.95	0.94	0.89	0.88	0.79	0.75

Table 10
Patient Demographics at Target Hospitals
This table examines the changes in patient demographics at target hospitals around the [−4,+8] acquisition event window. Columns (1) and (2) examine changes in the proportion of female patients, while columns (3) and (4) examine the average age of patients. In columns (5) and (6), we investigate the average income of patients, as determined by the income level of their residential area. When aggregating patient information at the hospital level, we use either a simple average or a weighted average, with the weights being the total amount paid to the hospital for the service delivered to each patient during the year. *PE Target* turns to one after a hospital is acquired by a PE acquirer. *NonPE Target* turns to one after a hospital is acquired by a non-PE acquirer. Rows with H_0's provide p-values from Wald Chi-square tests indicating whether two coefficients are statistically significantly different from each other. Control variables are the same as in Table 3. See Appendix A for variable definitions. t-statistics are reported in parentheses and standard errors are heteroskedasticity robust and clustered by hospital. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

Dep. Var.:	*Female*		*Age*		*Income (IRS, in log)*	
	Simple	Weighted	Simple	Weighted	Simple	Weighted
	(1)	(2)	(3)	(4)	(5)	(6)
PE Target	−0.001	−0.010	−0.078	−0.013	−0.014	0.003
	(−0.12)	(−0.56)	(−1.56)	(−0.28)	(−1.40)	(0.21)
NonPE Target	−0.003	0.001	−0.055	−0.078	−0.006	−0.006
	(−0.30)	(0.06)	(−1.12)	(−1.28)	(−0.55)	(−0.40)
Hospital Controls	Yes	Yes	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes	Yes
Matched Pair FEs	Yes	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
H_0: PE=NonPE	0.81	0.59	0.67	0.67	0.37	0.50
Obs	752	752	752	752	752	724
Adj. R^2	0.81	0.23	0.91	0.88	0.98	0.97

Table 11

Inpatient and Procedure Prices at Target Hospitals

This table examines the changes in prices charged by target hospitals for overall inpatient procedures and seven specific procedures around the [−4,+8] acquisition event window. In Panel A, we analyze inpatient price changes. In Panel B, we analyze price changes for each of seven procedures, namely, hip replacement, knee replacement, C-section, vaginal delivery, PTCA, colonoscopy, and MRI. The dependent variable is the log of prices. *PE Target* turns to one after a hospital is acquired by a PE acquirer. *NonPE Target* turns to one after a hospital is acquired by a non-PE acquirer. Rows with H_0's provide p-values from Wald Chi-square tests indicating whether two coefficients are statistically significantly different from each other. Control variables are the same as in Table 3. See Appendix A for variable definitions. t-statistics are reported in parentheses and standard errors are heteroskedasticity robust and clustered by hospital. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

(A) Inpatient Prices (in log)

Dep. Var.: Inpatient	(1)	(2)	(3)
PE Target	−0.042	−0.049	−0.048
	(−1.05)	(−1.32)	(−1.20)
NonPE Target	0.012	0.013	0.022
	(0.18)	(0.21)	(0.34)
Hospital Controls		Yes	Yes
County Controls			Yes
Hospital FEs	Yes	Yes	Yes
Matched Pair FEs	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes
H_0: PE=NonPE	0.40	0.30	0.27
Obs	606	605	605
Adj. R^2	0.84	0.84	0.84

(B) Procedure Prices (in log)

Dep. Var.:	*Hip Repalcement* (1)	*Knee Replacement* (2)	*C-Section* (3)	*Vaginal Delivery* (4)	*PTCA* (5)	*Colonoscopy* (6)	*MRI* (7)
PE Target	0.128	0.014	−0.121	−0.010	0.029	0.294***	0.101
	(1.28)	(0.22)	(−1.03)	(−0.13)	(0.20)	(2.60)	(0.76)
NonPE Target	0.306	−0.064	−0.050	−0.143	0.351*	0.150	0.052
	(1.00)	(−0.41)	(−0.34)	(−1.62)	(1.70)	(1.07)	(0.45)
Hospital Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Matched Pair FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H_0: PE=NonPE	0.56	0.57	0.70	0.17	0.17	0.30	0.68
Obs	424	499	515	528	275	662	607
Adj. R^2	0.52	0.68	0.15	0.74	0.50	0.63	0.76

Table 12
Patient Satisfaction at Target Hospitals

This table examines the changes in patient satisfaction at target hospitals around acquisitions. In columns (1) and (2), we analyze patient satisfaction with nurses' communication, while in columns (3) and (4), we focus on satisfaction with doctors' communication. Columns (5) and (6) report patient satisfaction concerning whether patients received help as soon as they wanted, and Columns (7) and (8) report patients' overall rating of the hospital. In columns (9) and (10), we investigate patients' willingness to recommend the hospital to friends and family. *PE Target* turns to one after a hospital is acquired by a PE acquirer. *NonPE Target* turns to one after a hospital is acquired by a non-PE acquirer. Rows with H_0's provide p-values from Wald Chi-square tests indicating whether two coefficients are statistically significantly different from each other. Control variables are the same as in Table 3. See Appendix A for variable definitions. t-statistics are reported in parentheses and standard errors are heteroskedasticity robust and clustered by hospital. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

Dep. Var.:	*Nurse Comm.*		*Doctor Comm.*		*Receive Help*		*Hospital Rating*		*Recommendation*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Post-Event Window	[0, 4]	[5, 8]	[0, 4]	[5, 8]	[0, 4]	[5, 8]	[0, 4]	[5, 8]	[0, 4]	[5, 8]
PE Target	−0.0298***	−0.0450***	−0.0130*	−0.0268*	−0.0358**	−0.0618**	−0.0267	−0.0714**	−0.0322**	−0.0544**
	(−3.08)	(−2.67)	(−1.89)	(−1.86)	(−2.42)	(−2.20)	(−1.58)	(−2.40)	(−2.13)	(−2.09)
NonPE Target	−0.0446***	−0.0465	−0.0211**	−0.0208	−0.0517**	−0.0405	−0.0507**	−0.0582	−0.0488***	−0.0548
	(−3.51)	(−1.43)	(−2.08)	(−0.92)	(−2.46)	(−1.00)	(−2.54)	(−1.35)	(−3.12)	(−1.40)
Hospital Controls										
County Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Matched Pair FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
H_0: PE=NonPE	0.28	0.96	0.45	0.80	0.47	0.59	0.26	0.76	0.37	0.99
Obs	1,833	934	1,833	934	1,833	934	1,833	934	1,833	934
Adj. R^2	0.81	0.79	0.76	0.78	0.80	0.76	0.75	0.74	0.80	0.80

Table 13
Mortality and Readmission Rates at Target Hospitals
This table examines the mortality and readmission rates at target hospitals around acquisitions. Panel A reports the results for mortality rates. The dependent variables are the 30-day risk-standardized mortality rate following heart attack hospitalization, heart failure hospitalization, and pneumonia hospitalization. Panel B reports the results for readmission rates. The dependent variables are the 30-day risk-standardized readmission rates for patients discharged from the hospital with a principal diagnosis of heart attack, heart failure, and pneumonia, respectively. Mortality rates and readmission rates are presented in percentage points. The regressions take a first-difference approach, with both the dependent variables and continuous control variables representing changes from the pre-acquisition window to a post-acquisition window. *PE Target* turns to one after a hospital is acquired by a PE acquirer. *NonPE Target* turns to one after a hospital is acquired by a non-PE acquirer. Rows with H_0's provide p-values from Wald Chi-square tests indicating whether two coefficients are statistically significantly different from each other. Control variables are the same as in Table 3. See Appendix A for variable definitions. t-statistics are reported in parentheses and standard errors are heteroskedasticity robust and clustered by hospital. *, **, and *** indicate statistical significance at the 10%, 5%, and 1%, respectively.

(A) Changes in Mortality

Dep. Var.:	*Heart Attack (AMI)*		*Heart Failure*		*Pneumonia*	
	(1)	(2)	(3)	(4)	(5)	(6)
PE Target	−0.0702	0.4779	0.2126	−0.5163	0.6729	−0.1525
	(−0.14)	(0.99)	(0.36)	(−0.87)	(1.29)	(−0.33)
NonPE Target	−1.2259*	−2.1883***	0.9621	0.5946	0.6779	1.0721*
	(−1.87)	(−4.80)	(1.47)	(1.12)	(0.79)	(1.78)
Hospital Controls (differenced)	Yes	Yes	Yes	Yes	Yes	Yes
County Controls (differenced)	Yes	Yes	Yes	Yes	Yes	Yes
Matched Pair FEs		Yes		Yes		Yes
H_0: PE=NonPE	0.11	0.00	0.27	0.22	0.99	0.14
Obs	175	175	199	199	199	199
Adj. R^2	0.10	0.55	0.06	0.53	0.07	0.57

(B) Changes in Readmission

Dep. Var.:	*Heart Attack (AMI)*		*Heart Failure*		*Pneumonia*	
	(1)	(2)	(3)	(4)	(5)	(6)
PE Target	0.3644	−0.0570	0.4897	0.2870	−0.1837	−0.7147
	(0.65)	(−0.11)	(0.77)	(0.54)	(−0.39)	(−1.46)
NonPE Target	−0.3770	−0.3371	0.6336	0.0371	−0.5383	−0.8393**
	(−0.58)	(−0.95)	(0.89)	(0.06)	(−0.92)	(−2.03)
Hospital Controls (differenced)	Yes	Yes	Yes	Yes	Yes	Yes
County Controls (differenced)	Yes	Yes	Yes	Yes	Yes	Yes
Matched Pair FEs		Yes		Yes		Yes
H_0: PE=NonPE	0.20	0.63	0.85	0.75	0.55	0.86
Obs	126	126	163	163	163	163
Adj. R^2	0.13	0.57	0.18	0.57	0.09	0.52

Appendix A. Variable Definitions

Appendix A.1. Employment Variables

- *Log(Employment)*: The log of total employees (measured in full-time equivalent employees based on paid hours). The information is obtained from the HCRIS Worksheet S-3, Part II.

- *Log(Total Wages)*: The log of total wages. The information is obtained from the HCRIS Worksheet S-3, Part II.

- *Log(Core Workers)*: The log number of nurses, physicians, and pharmacists (measured in full-time equivalent employees based on paid hours). The information is obtained from the HCRIS Worksheet S-3, Part II. Core workers include Non-physician anesthethist Part A (Line Number 2), Non-physician anesthethist Part B (Line Number 3), Physician - Part A - Administrative (Line Number 4), Physician - Part A - Teaching (Line Number 4.01), Physician and Non Physician-Part B (Line Number 5), Interns & residents (in an approved program) (Line Number 7), Contracted interns & residents (in an approved program) (Line Number 7.01), Contract labor: Direct Patient Care (Line Number 11), Contract labor: Physician - Part A - Administrative (Line Number 13), Home office: Physician Part A - Administrative (Line Number 15), Home office & Contract Physician Part A - Teaching (Line Number 16), Nursing Administration (Line Number 38), and Pharmacy (Line Number 40).

- *Log(Core Wage Rate)*: The log of hourly wages for nurses, pharmacists, and physicians. The information is obtained from the HCRIS Worksheet S-3, Part II. Core workers include Non-physician anesthethist Part A (Line Number 2), Non-physician anesthethist Part B (Line Number 3), Physician - Part A - Administrative (Line Number 4), Physician - Part A - Teaching (Line Number 4.01), Physician and Non Physician-Part B (Line Number 5), Interns & residents (in an approved program) (Line Number 7), Contracted interns & residents (in an approved program) (Line Number 7.01), Contract labor: Direct Patient Care (Line Number 11), Contract labor: Physician - Part A - Administrative (Line Number 13), Home office: Physician Part A - Administrative (Line Number 15), Home office & Contract Physician Part A - Teaching (Line Number 16), Nursing Administration (Line Number 38), and Pharmacy (Line Number 40).

- *Log(Admin Workers)*: The log number of administrative and general workers (measured in full-time equivalent employees based on paid hours). The information is obtained from the HCRIS Worksheet S-3, Part II. Administrative and general workers include Administrative & General (Line Number 27) and Administrative & General under contract (Line Number 28).

- *Log(Admin Wage Rate)*: The log of hourly wages for administrative and general workers (including contract labor). The information is obtained from the HCRIS Worksheet S-3, Part II. Administrative and general workers include Administrative & General (Line Number 27) and Administrative & General under contract (Line Number 28).

Appendix A.2. Patient Outcome Variables

- *Mortality for Heart Attack (AMI)*: 30-day risk-standardized mortality rate following heart attack hospitalization, in percentage points.
- *Mortality for Heart Failure*: 30-day risk-standardized mortality rate following heart failure hospitalization, in percentage points.
- *Mortality for Pneumonia*: 30-day risk-standardized mortality rate following pneumonia hospitalization, in percentage points.
- *Readmission for Heart Attack (AMI)*: 30-day risk-standardized readmission rates for patients discharged from the hospital with a principal diagnosis of heart attack, in percentage points.
- *Readmission for Heart Failure*: 30-day risk-standardized readmission rates for patients discharged from the hospital with a principal diagnosis of heart failure, in percentage points.
- *Readmission for Pneumonia*: 30-day risk-standardized readmission rates for patients discharged from the hospital with a principal diagnosis of pneumonia, in percentage points.
- *Nurse Comm.*: A variable computed by $3\times$("Top-box" Answer %) $+2\times$ ("Middle-box" Answer %)$+1\times$("Bottom-box" Answer %) for the Communication with Nurses questions.
- *Doctor Comm*: A variable computed by $3\times$("Top-box" Answer %) $+2\times$ ("Middle-box" Answer %) $+ 1 \times$ ("Bottom-box" Answer %) for the Communication with Doctors questions.
- *Receive Help*: A variable computed by $3\times$("Top-box" Answer %) $+2\times$ ("Middle-box" Answer %)$+1\times$("Bottom-box" Answer %) for the Responsiveness of Hospital Staff questions.
- *Hospital Rating*: A variable computed by $3\times$("Top-box" Answer %) $+2\times$ ("Middle-box" Answer %)$+1\times$("Bottom-box" Answer %) for the Overall Rating of Hospital questions.
- *Recommendation*: A variable computed by $3\times$("Top-box" Answer %) $+2\times$("Middle-box" Answer %)$+1\times$("Bottom-box" Answer %) for the Willingness of Recommendation questions.

Appendix A.3. HCCI Risk-adjusted Prices and Patient Characteristics

- *Female (Simple)*: The fraction of female patients at a hospital in a given year.
- *Female (Weighted)*: The proportion of the total amount paid by female patients at a hospital in a given year.
- *Age (Simple)*: The average age of patients' age at a hospital in a given year. Age is an integer ranging from 1-7, indicating the following seven age bands: 1: 0-17, 2: 18-24, 3: 25-34, 4: 35-44, 5: 45-54, 6: 55-64, 7: 65+.

- *Age (Weighted)*: The weighted average age of patients at a hospital in a given year, where the weights are based on the total amount paid by each patient to the hospital during that year. Age is an integer ranging from 1-7, indicating the following seven age bands: 1: 0-17, 2: 18-24, 3: 25-34, 4: 35-44, 5: 45-54, 6: 55-64, 7: 65+.

- *Income (Simple)*: The average income of patients at a hospital in a given year. We infer patient income from their residential location because we do not directly observe patients' income levels. Zipcode-level income data come from IRS' adjusted gross income (AGI).

- *Income (Weighted)*: The weighted average income of patients at a hospital in a given year, where the weights are based on the total amount paid by each patient to the hospital during that year. We infer patient income from their residential location because we do not directly observe patients' income levels. Zipcode-level income data come from IRS' adjusted gross income (AGI).

- Price for *Inpatient*: A hospital-year level inpatient price index, adjusted for the risk associated with variations in patient mix, as described in Internet Appendix Section I.

- Price for *Hip Replacement*: A hospital-year level hip replacement price index, adjusted for the risk associated with variations in patient mix, as described in Internet Appendix Section I.

- Price for *Knee Replacement*: A hospital-year level knee replacement price index, adjusted for the risk associated with variations in patient mix, as described in Internet Appendix Section I.

- Price for *C-Section*: A hospital-year level C-section price index, adjusted for the risk associated with variations in patient mix, as described in Internet Appendix Section I.

- Price for *Vaginal Delivery*: A hospital-year level vaginal delivery price index, adjusted for the risk associated with variations in patient mix, as described in Internet Appendix Section I.

- Price for *PTCA*: A hospital-year level PTCA price index, adjusted for the risk associated with variations in patient mix, as described in Internet Appendix Section I.

- Price for *Colonoscopy*: A hospital-year level colonoscopy price index, adjusted for the risk associated with variations in patient mix, as described in Internet Appendix Section I.

- Price for *MRI*: A hospital-year level MRI price index, adjusted for the risk associated with variations in patient mix, as described in Internet Appendix Section I.

Appendix A.4. Independent Variables

- *PE Target*: An indicator variable that turns to one for a target hospital after it is acquired by a PE firm or a PE-owned hospital.

- *NonPE Target*: An indicator variable that turns to one for a target hospital after it is acquired by a non-PE owned, for-profit acquirer.

Appendix A.5. Other Variables

- *Log(Beds)*: The log of number of beds.
- *Log(Patients)*: The log of number of patients. The number of patients is estimated by adjusted discharges, defined as the number of discharged inpatients multiplied by total charges/inpatient charges.
- *Log(Gross Patient Sales)*: The log of gross patient sales.
- *Log(Net Patient Sales)*: The log of net patient sales, which is gross sales after deducting rebate and discounts offered to patients.
- *CMI*: The case mix index.
- *%Medicare*: The ratio of discharges with Medicare insurance relative to total discharges.
- *%Medicaid*: The ratio of discharges with Medicaid insurance relative to total discharges.
- *%Outpatient*: The ratio of outpatient charges relative to total charges.
- *%Black*: The fraction of Black in a given county at a given year.
- *%Asian*: The fraction of Asian in a given county at a given year.
- *Log(Pop)*: The log of population in a given county at a given year.
- *Log(FMR)*: The log of one bedroom rent price in a give county in a given year.

Appendix B. Patient Satisfaction Survey Questions

HCAHPS categorizes survey responses into "top-box," "middle-box," and "bottom-box" for each question, with top-box indicating the most positive response and bottom-box indicating the least positive. Accordingly, we assign a numerical score of 3 for top-box, 2 for middle-box, and 1 for bottom-box. The list below reports our numerical classification scheme.

COMMUNICATION WITH NURSES

- During this hospital stay, how often did nurses treat you with courtesy and respect?
  1 – *Never* or *Sometimes*; 2 – *Usually*; 3 – *Always*
- During this hospital stay, how often did nurses listen carefully to you?
  1 – *Never* or *Sometimes*; 2 – *Usually*; 3 – *Always*
- During this hospital stay, how often did nurses explain things in a way you could understand?
  1 – *Never* or *Sometimes*; 2 – *Usually*; 3 – *Always*

COMMUNICATION WITH DOCTORS

- During this hospital stay, how often did doctors treat you with courtesy and respect?
  1 – *Never* or *Sometimes*; 2 – *Usually*; 3 – *Always*
- During this hospital stay, how often did doctors listen carefully to you?
  1 – *Never* or *Sometimes*; 2 – *Usually*; 3 – *Always*
- During this hospital stay, how often did doctors explain things in a way you could understand?
  1 – *Never* or *Sometimes*; 2 – *Usually*; 3 – *Always*

RESPONSIVENESS OF HOSPITAL STAFF

- During this hospital stay, after you pressed the call button, how often did you get help as soon as you wanted it?
  1 – *Never* or *Sometimes*; 2 – *Usually*; 3 – *Always*
- How often did you get help in getting to the bathroom or in using a bedpan as soon as you wanted?
  1 – *Never* or *Sometimes*; 2 – *Usually*; 3 – *Always*

OVERALL RATING OF HOSPITAL

- Using any number from 0 to 10, where 0 is the worst hospital possible and 10 is the best hospital possible, what number would you use to rate this hospital during your stay?
  1 – *6* or *lower*; 2 – *7* or *8*; 3 – *9* or *10*

WILLINGNESS TO RECOMMEND HOSPITAL

- Would you recommend this hospital to your friends and family?
  1 – *Definitely no* or *Probably no*; 2 – *Probably yes*; 3 – *Definitely yes*