Private Equity in the Hospital Industry

Janet Gao *Indiana University*
Yongseok Kim *Indiana University*
Merih Sevilir *Indiana University*

Abstract

We examine employment and patient outcomes at hospitals acquired by private equity (PE) firms and PE-backed hospitals. While employment declines at PE-acquired hospitals, core medical workers (physicians, nurses, and pharmacists) increase significantly. The proportion of wages paid to core workers increases at PE-acquired hospitals whereas the proportion paid to administrative employees declines. These results are most pronounced for deals where the acquirers are publicly traded PE-backed hospitals. Non-PE-backed acquirers also cut employment but do not increase core workers or reduce administrative expenditures. Finally, PE-backed acquirers are not associated with worse patient satisfaction or mortality rates compared to their non-PE-backed counterparts.

Key words: Private Equity, Hospital Acquisitions, Employment, Operational Efficiency, Real Patient Outcomes and Satisfaction

1 Introduction

It is estimated that private equity (PE) firms invested around $200 billion into the U.S. healthcare industry over the last decade, including sizeable amounts into hospitals.[1] Hospitals are economically very important, accounting for nearly 20% of total GDP. Aside from providing critical healthcare to local communities, the hospital industry ranks among the top ten job providers in all U.S. states, especially to female workers. There are opposing views regarding the growing presence of PE firms in the hospital industry. Proponents claim that they provide hospitals with much needed capital to invest in new technologies that improve patient care, and their managerial and operating experience can help turn around struggling hospitals. Opponents, on the other hand, voice concerns that PE firms load hospitals with debt, sell assets, lay off workers, and even close hospitals, diminishing the availability of quality healthcare and local jobs. In this paper, we seek to shed light on this important and current debate by examining employment and patient outcomes at hospitals acquired by private equity (PE) firms.

PE firms can participate in hospital acquisitions in two ways. First, a PE firm directly acquires a hospital or a system of hospitals. Second, a PE firm performs roll-up acquisitions where a previously PE-acquired hospital makes subsequent hospital acquisitions. Aside from PE firms, other for-profit institutions have also been active acquirers in the hospital industry. In our analysis, we track the changes in target hospitals after they are acquired by PE or PE-backed hospitals. To provide a balanced view regarding the role of PE acquirers, we compare their targets both relative to a matched control group of non-target hospitals and relative to targets of non-PE, for-profit acquirers.

There are several ways through which PE firms could influence target hospitals. One natural source of efficiency improvement is to cut employment at acquired hospitals. At the same time, PE firms can provide acquired hospitals with capital to hire and retain core medical workers, including physicians, nurses, and pharmacists. In addition, PE firms may be able to improve administrative efficiency. Prior studies estimate that approximately 30% of health care spending is considered wasteful, with estimated waste

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

due to administrative burden and complexity exceeding $250 billion (Shrank et al., 2019). Given their core competency of reducing waste and their management expertise, PE firms could provide an intervention mechanism by cutting administrative expenditures at acquired hospitals. Finally, leveraging on their expertise related to the going-public process, PE firms may take the acquired hospitals public and give them access to public capital markets. Ultimately, these changes could benefit patients and communities through the increased viability of acquired hospitals.

We compile a comprehensive sample of 1,218 M&A deals in the hospital industry over the period spanning from 2001 to 2018. Our focus is on 414 deals where the acquirer is a for-profit organization. These deals involve 994 unique target hospitals. We examine various outcomes at target hospitals relative to a matched control group of hospitals that have not been acquired. The target and control hospitals are matched by Census region, metropolitan area status, year, and pre-acquisition hospital characteristics. Our specification imposes a multitude of controls, including hospital and local county characteristics, hospital fixed effects, event fixed effects, and event-time fixed effects. Hospital fixed effects help us track the conditions of the same hospital over time. Event fixed effects allow us to focus the comparison on changes within a pair of target and matched control hospitals.

We find that employment declines by 8–9% at acquired hospitals relative to the matched control group. Importantly, we observe significant employment cuts at target hospitals of both PE and non-PE acquirers, suggesting that cutting employment is not exclusively limited to PE acquirers. While overall employment declines, the proportion of core employees out of total employees (core worker ratio), defined as physicians, nurses, and pharmacists, increases by 50% at hospitals acquired by publicly traded PE-backed hospitals. Core worker ratio does not change at hospitals acquired by private PE-backed hospitals or at targets of non-PE acquirers. This result remains robust when we measure core employees not as a ratio but as the number of core employees or core employees per treated patient.

After examining total employment and core employees at target hospitals, we turn our attention to wages. This analysis is motivated by the anecdotal evidence that many

U.S. hospitals struggle with large wage bills and excessive administrative spending. Given that wage expenditures represent one of the most significant cost centers for hospitals, one might expect PE-backed acquirers to cut costs by reducing total wages. Indeed, we find evidence consistent with this conjecture that acquired hospitals experience a significant decline in their total wage bill. Reductions in wage expenditures could be a direct result of reduced employment, but also could arise from lower wage rates for core workers or non-core, administrative workers. We thus investigate the changes in wages paid to these two types of workers. We find that the proportion of total wages paid to core workers increases significantly at hospitals acquired by publicly traded PE-backed hospitals, yet core workers' hourly wage rates stay unchanged. Wages paid to administrative and general employees, both in terms of the proportion of total wages and hourly wage rates, decline substantially at hospitals acquired by publicly traded PE-backed hospitals. These results suggest that PE-backed acquirers do not suppress core workers' pay. They achieve cost savings by reducing their wage bill involving administrative workers. In contrast, these changes are not present at target hospitals of non-PE-backed acquirers.

Tracking the timing of the above changes at target hospitals, we find that employment cuts, increases in core workers, and reductions in administrative wages do not occur prior to PE acquisitions. Instead, those metrics change sharply starting the year of the acquisition, and the trends persist for several years after the event. The lack of pre-event trends alleviates the concern that PE firms may select targets that already exhibit improvements along those observable dimensions prior to the deal.

Our results on employment and wages are much more pronounced for PE-backed acquirers which also have access to public capital markets. This observation raises an interesting question as to whether the differential outcomes for publicly traded PE-backed acquirers reflect their access to public capital markets, or whether they can be also attributed to the presence of PE-backing in such hospitals. To investigate this question, we compare the core worker ratio at hospitals acquired by publicly traded PE-backed acquirers and publicly traded acquirers without PE-backing. Although we observe an increase in the core worker ratio for both types of acquirers, the magnitude of the increase is

much larger at hospitals acquired by PE-backed publicly traded hospitals. Similarly, the increase in wages paid to core workers is greater at target hospitals of publicly traded PE-backed acquirers. These findings suggest that employment outcomes at target hospitals depend critically on whether the acquirer hospital has access to public capital markets as well as whether it is PE-backed.

We provide one final piece of evidence on the role of PE acquirers in affecting labor outcomes. One unique feature of our data germane to the hospital industry is that we can observe acquisitions of both for-profit and nonprofit hospitals. To the extent that nonprofit hospitals may operate less efficiently due to their lack of investor accountability, PE acquirers could be more effective in improving such hospitals. Consistent with this conjecture, we find that overall employment declines more substantially at nonprofit hospitals than for-profit hospitals. Similarly, nonprofit hospitals exhibit a greater increase in their core employee ratio as well as the proportion of wages paid to core employees. Consistent with anecdotal evidence that nonprofit hospitals carry higher administrative overhead, such hospitals cut the proportion of wages paid to administrative employees to a greater extent. These findings suggest that PE firms are instrumental in acquiring nonprofit hospitals and promoting their efficiency by making them accountable to investors.

The changes in employment outcomes we have documented so far might have an important impact on hospital patients—arguably the most important stakeholders in this industry. On the one hand, the improved core employee ratio at PE-acquired hospitals can lead to better patient care and outcomes especially given the importance of nurses in providing quality health care. On the other hand, as often discussed in the popular press, the overall reduction in employment may imply worse patient outcomes and experiences. To see how patients fare at PE-acquired hospitals, we examine mortality rates, readmission rates, and patient satisfaction outcomes at acquired hospitals.

We find no evidence that patients at PE-acquired hospitals experience increases in mortality rates due to heart attack and heart failure, while those at non-PE-acquired hospitals do exhibit marginally higher mortality rates due to heart failure. Patients at all target hospitals experience higher death rates related to pneumonia, but the increase

is small relative to the sample average. Compared to the control group, readmission rates do not increase for PE-acquired hospitals. In fact, readmission rates associated with heart failure even decline at PE-acquired hospitals. Finally, while we document a robust decline in patient satisfaction at an average target hospital, consistent with the results in Beaulieu et al. (2020), we observe that patient satisfaction declines more at targets of non-PE acquirers. In contrast, target hospitals of publicly traded PE-backed acquirers do not exhibit declines in any patient satisfaction score. This result is in line with our prior finding that these acquirers increase the proportion of core employees who are critical in providing quality health care. Overall, results from real patient outcomes and patient satisfaction surveys do not suggest deteriorating patient outcomes at PE-acquired hospitals.

Existing studies on hospital mergers, with the exception of Bruch et al. (2020) and Liu (2021), do not differentiate between nonprofit and for-profit acquirers. Most of the research examines the price impact of hospital mergers and cost savings generated by hospital mergers (Dafny, 2009; Lewis and Pflum, 2017; Schmitt, 2017; Cooper et al., 2019; Dafny et al., 2019; Craig et al., 2021). Beaulieu et al. (2020) examine the quality of healthcare at acquired hospitals, but do not focus on for-profit acquirers or PE acquirers. Bruch et al. (2020) reveals operational improvement at PE-acquired hospitals. We extend the literature by focusing on for-profit acquirers and examining their impact on employment and patient outcomes. Our results suggest that PE acquirers' role is not limited to cutting employment, as they also increase the presence of core medical workers. Moreover, our paper documents meaningful differences in post-acquisition outcomes between PE and non-PE acquirers, which allow us to generate more nuanced and comprehensive understanding of the role of PE investors in this industry.

Two studies examine the role of PE investors in the nursing home industry (Gandhi et al., 2020; Gupta et al., 2021). Gandhi et al. (2020) document positive effects of PE firms on nursing homes in highly competitive markets. Gupta et al. (2021), on the other hand, find that PE owners reduce the quality of care at nursing homes. Our analysis complements these studies by examining PE acquirers in the hospital industry.

Specifically, our findings suggest that PE-backed acquirers are associated with higher core employee ratio, higher administrative efficiency, and no deterioration in patient outcomes. In contemporaneous work, Liu (2021) investigates the mechanisms through which PE firms increase healthcare prices and attributes a large portion of such price impact to PEs' superior bargaining power with respect to private insurers. Different from this study, our paper primarily focuses on employment outcomes at PE-acquired hospitals and evaluates the effect of PE acquirers relative to the effect of non-PE acquirers. Since Liu (2021) does not look at non-PE acquirers, it remains under-explored how non-PE acquirers affect hospital operations and prices, relative to PE-acquirers.

Our paper contributes to the growing literature examining the labor effects of PE buyouts (see, among others, Kaplan (1989) and Davis et al. (2014)). We discuss our findings in detail within the context of this literature in Section 5.1.2. More generally, our paper is related to the emerging literature studying the intersection of healthcare and finance. Complementary to our focus on how PE firms affect labor and patient outcomes in the hospital industry, recent contributions have examined the effect of financial and credit constraints on hospital outcomes. For example, Adelino et al. (2015, 2021) examine how nonprofit hospitals respond to financial constraints in adjusting their investment policy and treatment quality. Aghamolla et al. (2021) examine the impact of credit access on the health care quality of for-profit hospitals.

2 Background: Private Equity Acquisitions in the Hospital Industry

There are several 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. Subsequent to being acquired, some hospitals conduct additional acquisitions, commonly referred to as "roll-up acquisitions." We track the acquisitions made by PE firms and PE-backed hospitals throughout our sample period and label these acquirers "PE-backed acquirers."

We further differentiate PE-backed acquirers based on whether or not they have access

to public capital markets. Some PE-backed hospitals go public and acquire more hospitals as a publicly traded company. We refer to acquirers in such deals as *PE-Backed Public Acquirers*. Other PE-backed hospitals make future acquisitions as private hospitals. We refer to acquirers in such deals as *PE-Backed Private Acquirers*. Finally, when the acquirer is a PE firm itself, it is also referred to as *PE-Backed Private Acquirers*.

An important feature of our paper is that we compare acquisitions conducted by PE-backed acquirers with those where the acquirer is a for-profit hospital but has no PE backing. This differentiates us from most existing studies on PEs, which draw inferences about PE firms by comparing outcomes observed for PE-backed targets and control firms with no PE-backing. Because of the richness of the data regarding hospital acquisitions, we are able to compare PE-acquired hospitals with both control hospitals which do not go through an acquisition as well as hospitals which are acquired by non-PE-backed acquirers. This allows us to understand how PE acquirers perform relative to non-PE acquirers. To this end, we refer to acquirers that have had no PE-backing as *Non-PE-Backed Acquirers*. Such acquirers could be private hospitals as well as publicly traded hospitals. Initially we combine both private and publicly traded hospitals into a single category. Later in our tests, to obtain a more detailed understanding of the role of PE-backed publicly traded acquirers relative to non-PE-backed public ones, we split this category into *Non-PE Backed Private Acquirers* and *Non-PE Backed Public Acquirers*.

3 Data and Sample

We collect data from several sources. Information regarding hospital characteristics and performance comes from Centers for Medicare & Medicaid Services (CMS). We extend the list of hospital mergers and acquisitions compiled by Cooper et al. (2019) to 2018 using information from various sources, including SDC, Factset, and Becker's Hospital Review. Data on patient outcomes such as mortality and readmission rates come from Hospital Compare Outcome Measures, published by the CMS and Hospital Quality Alliance (HQA). Finally, we extract patient satisfaction data from the Hospital Consumer

Assessment of Healthcare Providers and Systems (HCAHPS) survey.

3.1 Hospital Characteristics Data

We obtain hospital characteristics data from the Healthcare Cost Report Information System (HCRIS) maintained by CMS. Medicare-certified institutional providers are required to submit their annual cost report to a Medicare Administrative Contractor (MAC). Such information is then compiled into HCRIS.

From these reports, we gather data regarding hospitals' employment and operational characteristics. We start by collecting variables 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. In other words, annual employment equals paid hours divided by 2,080 (40 hours a week multiplied by 52 weeks). We consider total employment in log terms (*Log(Employment)*).

The hospital cost reports provide detailed wage breakdown across 53 different categories. We categorize employees into core medical workers and non-core workers. Core medical workers include physicians (including contract physicians), nurses, and pharmacist, who are essential to providing quality health care. Non-core workers include administrative and general staff, maintenance and repair workers, those in charge of housekeeping, cafeteria, etc. We construct a metric of core worker composition *%Core Workers*, as the percentage of hospital employees that are physicians, nurses, and pharmacists. In robustness analysis, we also consider the log number of core workers (*Log(Core Workers)*) as well as core workers divided by all treated patients (*Core Workers/Patients*). We measure the number of treated patients using the adjusted discharge measure in Schmitt (2017), defined as the number of inpatient discharges multiplied by $(1 + \frac{outpatient\ charges}{inpatient\ charges})$. This adjustment is necessary for two reasons. First, information on outpatient discharges, i.e., the number of patients treated outside a hospital, is not available to us. Second, since outpatient treatment generally takes up less hospital resources and requires less time from nurses and physicians than inpatient treatment, the adjustment discounts the number of outpatients proportionately.

Aside from calculating the proportion of core workers, we also construct metrics measuring the wages paid to core workers. Our measures include the proportion of wage expenditures paid to core workers (i.e., *%Core Wages*) and the average hourly wage rate for core workers (*Log(Core Wage Rate)*). Hourly wage rate is computed as the total wages paid divided by the total paid hours within each occupation category.

Finally, we consider an important component of hospital overhead costs referring to wages paid to administrative and general purpose employees, a subset of non-core workers. As shown in Shrank et al. (2019), administrative expenditures represent a significant source of excessive and potentially wasteful spending in the hospital industry. We thus analyze whether PE acquirers help improve administrative efficiency by reducing salary expenses related to administrative and general workers. For this purpose, we define *%Admin Wages* as the percentage of wage expenditure that is paid to administrative and general employees (including those employees working under a contract). We also consider the hourly wage rate of administrative and general workers (*Log(Admin Wage Rate)*).

3.2 Hospital Mergers and Acquisitions Data

Data on hospital mergers and acquisitions (M&A) activity come from multiple sources. 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.

We start from the AHA's Annual Survey of Hospitals and identify the changes in system identifiers of individual hospitals. These changes in system classification likely suggest changes in hospital ownership. We 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 Platinum, FactSet, and most importantly, Becker's Hospital Review. In this process, we match the list of AHA system changes with acquisitions recorded in those databases according to the names and locations of target and acquirer hospitals, as well as the completion date of the deals. We also supplement the acquisition list based on information from SDC, FactSet, and Becker's and record deals that are not correctly captured by changes in AHA system IDs. When the matching between Becker's

and AHA is ambiguous, we manually search internet resources including local newspaper articles and American Hospital Directory (AHD) to verify the accuracy of the matches.

The above process gives us 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. The HCRIS data allow us to track a hospital after it is acquired.

3.3 Classification of Acquirers

We group M&A deals based on acquirer types. Among the 1,218 deals in our sample, 414 are acquisitions by for-profit organizations, involving 994 target hospitals. We focus on acquisitions conducted by for-profit acquirers and classify acquirers into private equity (PE) backed acquirers and non-PE-backed acquirers. We obtain information regarding PE acquirers from Preqin, CapitalIQ, and descriptions in Becker's, and manually verify this information. In the manual verification process, we supplement our data regarding the identities of hospital acquirers from news articles. In our final sample, we have 198 deals where the acquirer is PE-backed, involving 658 target hospitals. Among the deals involving PE-backed acquirers, 117 deals involve a PE-backed private acquirer, and 81 involve a PE-backed publicly traded acquirer. Furthermore, among the 117 deals with a PE-backed private acquirer, 18 deals are direct acquisitions by a PE firm. We have 216 deals where the acquirer is non-PE-backed, involving 336 hospitals. Among these deals, 164 are conducted by a private acquirer and 52 by a publicly traded acquirer. The average deal conducted by non-PE-backed acquirers involves 1.56 target hospitals, while the average deal by PE-backed acquirers involves 3.32 target hospitals.

3.4 Patient-level Outcomes and Patient Satisfaction

We obtain information on patient outcomes from Hospital Compare Outcome Measures, which is publicly disclosed by CMS and 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. 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 hospitals' quality of care. 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.[2] In untabulated analyses, we examine other outcomes including mortality and readmission rates regarding other diseases such as stroke as well as infection rate and complications during treatment. From these additional analyses, We obtain similar results to the ones reported in the paper.

Patient satisfaction scores come from the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey. The survey questions include many aspects of patient experience and satisfaction with a hospital. We narrow down to the following five questions that seem most representative of the quality of care provided by a hospital: the 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 and discloses the percentage of respondents in each category. We assign scores of 1–3 to each category, with 3 corresponding to top satisfaction category and 1 to the lowest one. We then take the weighted average of those scores, with the weight being the percentage of respondents in a given category. Appendix B provides more detailed explanation and examples for this classification scheme.

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

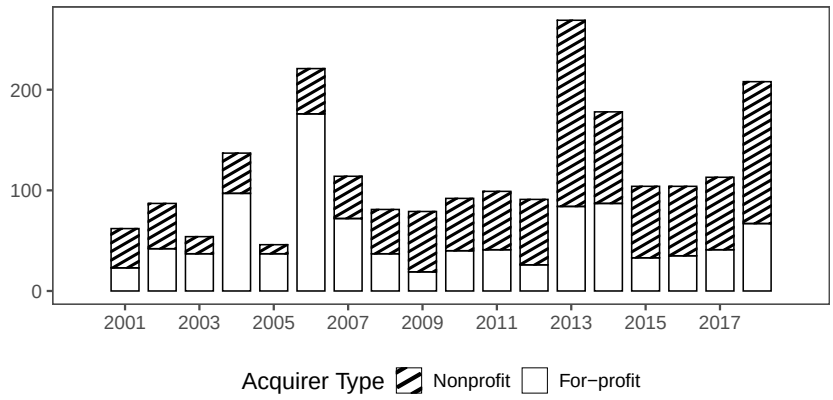
3.5 Initial Sample Construction

With data gathered from the above sources and procedures, we compile a hospital unit-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. If a hospital is acquired multiple times within the sample period, we exclude it from our analysis since it is unclear how to define pre- and post-acquisition periods for that hospital. We also require hospitals not to have any gaps in their observations and to appear in the data for at least five years in the sample. 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.

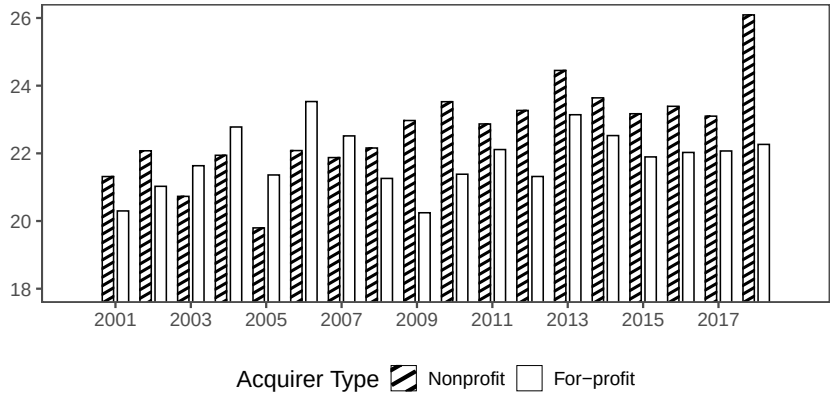
3.6 Univariate Analysis

The hospital industry has experienced persistent growth in its M&A activity over the past two decades. Figure 1 illustrates this time trend. Panel A reports the total number of 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. There is a peak in the number of deals in 2013, with around 240 hospitals being acquired. Deal activity spiked again in 2018, when the total asset value of target hospitals reached $175 billion, a record-high value in recent history. Over our sample period, 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 a growing and an economically meaningful role in the M&A landscape in the hospital industry.

Figure 2 reports the composition of deals involving different types of targets of for-profit acquirers. In Panel A, we first separate deals based on the type of the acquirer (i.e., PE-backed private, PE-backed public, and non-PE). For each acquirer type, we



(A) Number of Target Hospitals

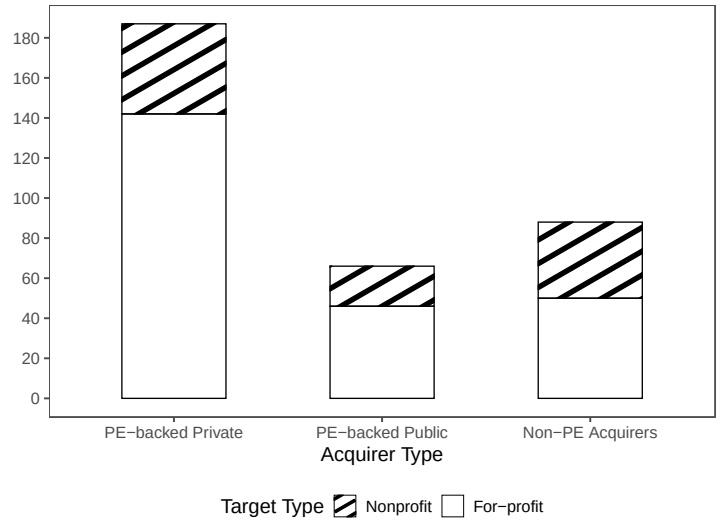


(B) Total Asset Value of Target Hospitals (log)

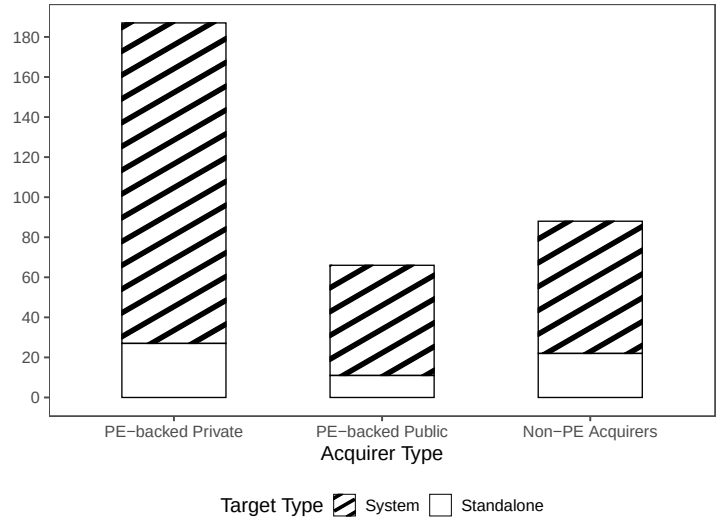
Figure 1. Hospital Mergers and Acquisitions Activity By Acquirer Type. This figure shows the time series patterns of hospital M&A activity in our sample. We classify acquired hospitals into two groups based on whether the acquirer is a for-profit or a nonprofit institution. Panel A reports the number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

plot the number of targets based on their for-profit status prior to the acquisition. The height of the patterned (white) columns represents the number of targets that operated as nonprofit (for-profit) organizations before the deal. The patterns suggest that PE-backed acquirers account for the majority of the deals made by for-profit entities (74%), and within PE-backed acquirers, private PE-backed acquirers acquired more hospitals than publicly traded PE-backed ones. Across all acquirer categories, more than half of target hospitals have for-profit status (70%). In Panel B, we decompose target hospitals based on whether they belonged to a system of hospitals prior to the acquisition. We find that the vast majority (around 80%) of target hospitals belonged to a system.

In Table 1, we report and compare the characteristics of target hospitals during the



(A) Nonprofit and For-profit Targets



(B) System and Standalone Targets

Figure 2. Composition of Target Hospitals. This figure reports the breakdown of our sample of target hospitals by various types of for-profit acquirers. We first separate target hospitals based on the type of their acquirers, i.e., PE-backed private, PE-backed public, and non-PE. In Panel A, we classify targets into two groups based on whether they operated as for-profit or nonprofit hospitals prior to being acquired. In Panel B, we group targets based on whether they belonged to a system of hospitals or were stand-alone prior to being acquired. The height of the each column represents the number of target hospitals within each classification.

four years prior to their acquisition and the characteristics of hospitals that are never acquired during our sample period. Target hospitals have similar employment size and slightly higher core worker ratio than non-targets. For an average target (non-target) hospital, wages paid to core employees and administrative workers account for 18% (20%) of total wages. We note that this fraction ranks among the highest across the 53 occupations

provided in HCRIS data. In terms of real patient outcomes, target hospitals have lower mortality rates related to heart failure and pneumonia, but higher mortality related to heart attack. Target hospitals also have worse patient satisfaction outcomes across all dimensions than non-target hospitals. Finally, in terms of operating characteristics, target hospitals have more beds, higher case mix index, 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), they have a smaller proportion of Medicare patients (65 years or older) than other hospitals.

TABLE 1 ABOUT HERE

4 Empirical Methodology

Given that target and control hospitals differ significantly in many important dimensions, we follow the existing work on hospital mergers such as Schmitt (2017) and Prager and Schmitt (2021) and conduct a matched sample analysis. In this analysis, we compare each target hospital to a matched control hospital over a $[-4, +4]$ year event window around the year of the acquisition.

The matched control group is constructed as follows. We start with an initial pool of hospitals that includes all hospitals that have not been acquired in the corresponding event window. We also exclude hospitals that acquire other hospitals in our sample period. For each target hospital, we find one "nearest neighbor" hospital in the control pool based on a Mahalanobis matching method with replacement. The matched control hospital needs to locate in the same Census Region and have the same Metropolitan area status as the target hospital. More importantly, the group of matched control unit needs to have the closest Mahalanobis distance to the target hospitals based on their average hospital characteristics during the four year period prior to the acquisition and total employment during year $t-1$ and $t-2$ to the deal. The hospital characteristics that we use in the matching process include the log number of beds, the case mix index (a measure of clinical complexity of a hospital's service), the fraction of Medicare discharges (the

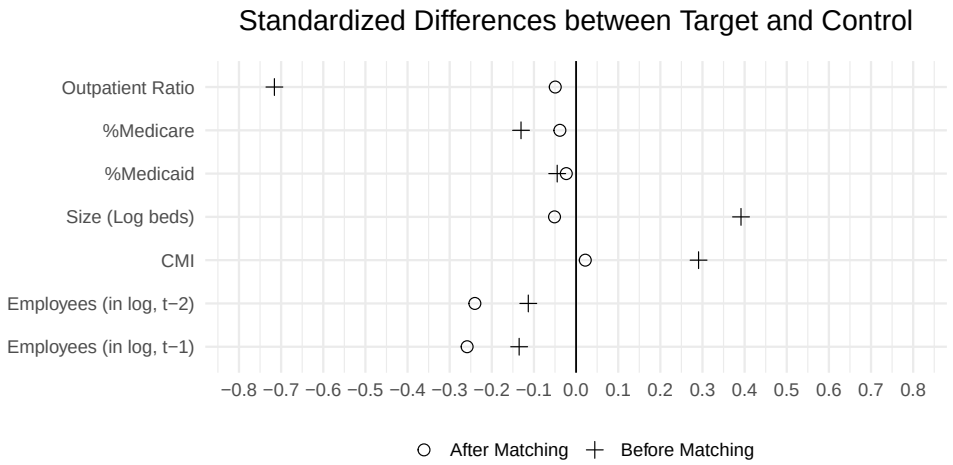


Figure 3. Covariate Balance. This figure shows the values of standardized differences between target and matched control hospitals. The difference is computed as values in target hospitals minus values in control hospitals. Detailed variable definitions are provided by Appendix A.

fraction of inpatients with Medicare insurance), the fraction of Medicaid discharges, and the fraction of outpatient charges. Matching based on employment during during $t-1$ and $t-2$ helps us control for pre-existing trend in employment growth prior to the acquisition.[3]

Figure 3 summarizes the covariate balance before and after matching. Similarity between target and control hospitals is measured by standardized difference, given by the average difference between the matched pairs (target − control) divided by the standard deviation computed over all observations. After matching, we observe increased similarity between target and control hospitals, although the similarity is lower in the employment dimension than in other dimensions we match on. While target hospitals have lower employment ex ante compared to control hospitals, target and control groups exhibit parallel pre-event trend in employment, discussed later in Figure 4.

Our testing sample is an event-hospital unit-year panel, whereby an event refers to an acquisition of a hospital. With each event, we track the target hospital and its matched control over the $[-4, +4]$ years around the event. This panel has 4,880 observations spanning the period from 2001 through 2018. Table 2 reports the summary statistics related to key variables in our matched sample. The average hospital in this sample employs 925 people, with 4% corresponding to core workers and 6% of the total wages

[3]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 and Hainmueller 2012).

paid to core workers. It also pays 12% of total salaries to administrative and general workers. Our sample hospitals have 198 beds and an outpatient ratio of 0.4 on average.

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:

$$Y_{e,i,t} = \beta Target_{e,i,t} + \gamma \cdot X_{i,t} + \alpha_i + \mu_e + \tau_t + \epsilon_{e,i,t}, \tag{1}$$

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 employment, the core worker ratio, the ratio of core worker wages to total wages, the ratio of administrative and general worker wages to total wages, hourly wage rates for both types of workers, real patient outcomes, and patient satisfaction scores. *Target* is an indicator variable that turns to one for a target hospital in deal e from the acquisition year onward. X_{it} represents a vector of hospital and county-level controls. 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 African American).

We control for hospital fixed effects (α_i), event 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; event fixed effects help us compare within a pair of treated and control hospitals; and event-time fixed effects are a set of 9 indicators for each year in the event window. They absorb the common time-series changes across the matched pair around the event. Similar to existing studies (e.g., Schmitt, 2017; Gupta et al., 2021; Liu, 2021), we cluster standard errors by hospital.[4] In this framework, we are interested in β, which measures how a target hospital changes subsequent to being acquired, compared to the concurrent

[4]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.

changes in the conditions of its matched control hospital.

In our main analyses, we separately estimate the effects of different types of acquirers on target hospitals and estimate the following model:

$$Y_{e,i,t} = \beta_1 PE\ Backed\ Public\ Acquirer_{e,i,t} + \beta_2 PE\ Backed\ Private\ Acquirer_{e,i,t} + \beta_3 Non\ PE\ Backed\ Acquirer_{e,i,t} + \gamma \cdot X_{i,t} + \alpha_i + \mu_e + \tau_t + \epsilon_{e,i,t}, \quad (2)$$

where *PE Backed Public Acquirer* turns to one for a hospital after it is acquired by a PE-backed, publicly traded hospital, and zero otherwise. *PE Backed Private Acquirer* turns to one for hospitals acquired directly by a PE firm, or by a PE-backed private hospital. *Non-PE Backed Acquirer* indicates hospitals acquired by non-PE-backed hospitals.

5 Main Results

5.1 Employment Outcomes

We start our analysis by examining changes in the number and composition of employees at acquired hospitals, relative to those at matched control hospitals. Ex ante, there are reasons to believe that PE acquirers may cut jobs and also expand certain types of employment at target hospitals. On the one hand, PE firms may cut excess employment to reduce operating costs at target hospitals. On the other hand, PE acquirers could provide capital and management expertise to target hospitals, ultimately increasing their ability to hire core medical workers, who are crucial in providing quality health care.

5.1.1 Total Number of Employees

Table 3 presents our results related to employment outcomes at acquired hospitals following the specification of Equation 1 and Equation 2. After estimating Equation 2, we report p-values from the Wald Chi-square test to assess whether coefficients from two types of acquirers are statistically significantly different from each other.

Table 3 About Here

Columns (1) and (2) report results on how employment changes at target hospitals subsequent to being acquired. In Column (1), we use a relatively sparse fixed effect structure, including only hospital fixed effects and year fixed effects, effectively comparing target hospitals to all control hospitals. In Column (2), we impose event fixed effects and event-time fixed effects to narrow down the comparison between a matched treatment and control pair. Results from these tests indicate a robust decline in employment at acquired hospitals. After being acquired, the average target hospital reduces its employment by 8–9%.

In Column (3), we separately examine the changes in employment at target hospitals for PE-backed and non-PE-backed acquirers. Targets of PE-backed acquirers experience an average employment cut of 9.8%, while those of non-PE-backed acquirers experience a smaller cut, around 6.8%. These magnitudes are not statistically significantly different from each other. Finally, in Column (4), we separate PE-backed acquirers into private and publicly traded ones. Results suggest a significantly larger decline in employment at targets of publicly traded PE-backed acquirers (14%) compared to targets of PE-backed private acquirers (8%) and targets of non-PE-backed acquirers.

The reduction in employment potentially suggests a cost-cutting motive by acquirers. An important question is whether by cutting employment, PE-backed acquirers compromise the quality of healthcare and patient welfare at the hospitals they acquire. We attempt to answer this question in two ways. We start by looking at changes in the fraction of "core" employees such as physicians, nurses, and pharmacists. Later in our analysis, we examine patient outcomes (i.e., mortality and readmission rates, and patient satisfaction scores) to see if changes in the employee composition at target hospitals are reflected in patient outcomes and experiences.

5.1.2 Core Workers

In this section, we examine the changes in core workers at a target hospital. We define core workers as physicians, nurses, and pharmacists and track changes in a hospital's core worker ratio, given by the ratio of core workers to total employees in the hospital. Table 4

reports the results. In Columns (1) and (2), we examine the average difference between target and control hospitals around the acquisition. Results suggest that an average target hospital increases its core worker ratio by 0.2–0.3 percentage points compared to the control group. In Columns (3) and (4), we examine the changes in core worker ratio for hospitals bought by different types of acquirers. We observe that the proportion of core medical workers increases at targets of PE-backed acquirers while it remains unchanged at targets of non-PE-backed acquirers. Crucially, the increase in the ratio of core employees at PE-acquired targets occurs exclusively at hospitals acquired by PE-backed publicly traded hospitals. The estimates suggest that PE-backed public acquirers lead to about a 2-percentage-point increase in the core worker ratio at target hospitals. This magnitude accounts for a 50% increase relative to the average core worker ratio in target hospitals prior to the acquisition.

Table 4 About Here

Next, we address potential concerns related to our measure of core worker ratio. One argument is that our results might be driven by hospitals replacing routine, non-core workers with automation technology or outsourced labor. This could mechanically reduce total employment counts and lead to an increase in core worker ratio. To address this concern, we adopt two alternative measures of core employees. The first is the number of core employees per patient (*Core Workers/Patients*). Not only the denominator is immune to hospitals' automation or outsourcing, this ratio is also informative of the quality of care received by patients in a hospital. Our second metric is the log number of core workers, without a scalar. Finally, we assess the possibility that our results could be influenced by contract physicians. Many physicians are affiliated with hospitals through a contract and do not contribute to full-time employee counts. While our measures include contract labor reported in HCRIS, it is possible that this item may not perfectly capture physicians' contract hours. As such, we design a new core worker ratio based on only nurses and pharmacists (*%Nurses and Pharm.*).

Table 5 provides results from these additional measures. Results from Column (1) reveal that the core worker-to-patient ratio does not change in PE-acquired hospitals com-

pared to the ratio at control hospitals, while hospitals acquired by non-PE-backed hospitals experience a reduction in their core worker per patient ratio. Column (2) shows that PE-backed public acquirers are associated with a significant increase in the number of core employees per patient. In contrast, this ratio declines at hospitals acquired by PE-backed private and non-PE-backed acquirers. We find a similar pattern regarding total core workers, as shown in Column (4). These findings are consistent with those in Table 4, suggesting that acquirers with access to public capital markets may benefit from having "deeper pockets" relative to private acquirers in terms of retaining and hiring core employees.

TABLE 5 ABOUT HERE

In Columns (5) and (6), we find that the ratio of nurses and pharmacists to total employees increases significantly at hospitals acquired by PE-backed acquirers. This effect is again driven by PE-backed publicly traded acquirers. In comparison, the presence of nurses and pharmacists declines at hospitals acquired by non-PE-backed hospitals.

Overall, our results so far suggest that PE acquirers' role is not limited to cost cutting by reducing employment. Publicly traded PE-backed hospitals actively adjust employee composition, reducing non-core employment and at the same time preserving or increasing the number of core employees such as nurses and physicians. This result is particularly important in light of the recent evidence in Lasater et al. (2021) showing that higher nurse-to-patient staffing ratios positively affect patient outcomes.

Our results on the relation between PE acquirers and employment are consistent with the findings from earlier studies on the productivity and employment implications of PE investment. Many earlier studies document a decline in employment associated with PE buyouts (Kaplan and Stromberg, 2009). Kaplan (1989) studies the economic outcomes at firms acquired by PE in leveraged buyout transactions, and shows that a median firm loses 12% of employment on an industry adjusted basis immediately after the buyout. Muscarella and Vetsuypens (1990) examine 72 firms that complete an initial public offering (IPO) after an LBO between 1983 and 1987, and for the 26 firms they can track, employment declines by an average of 0.6 percent between the LBO and the

IPO. Using U.S. Census Bureau data covering manufacturing plants of 131 firms going through PE buyouts from 1981 to 1986, Lichtenberg and Siegel (1990) find that on an industry-adjusted basis, employment falls by 1.2% per year after buyout compared to 1.9% rate of decline per year before the buyout. Wright et al. (1992) and Amess and Wright (2007) also find that buyouts in the UK lead to modest employment declines.

Recent papers find more nuanced effects of PE investment on human capital and productivity, often suggesting a positive role of PE involvement in improving worker skill and technology adoption. This implication is similar to our observation that publicly traded PE-backed acquirers are associated with increased core (skilled) labor at target hospitals. Using data on buyouts in France, Boucly et al. (2011) find that employment grows faster at PE-acquired firms than at controls. They interpret this result as PE relaxing the financial constraints of target firms. Agrawal and Tambe (2016) use an individual-level data set obtained from an online job-search platform in the US, and find that buyouts increase IT-related investments, enhance employee human capital and increase the survival likelihood of target firms. Olsson and Tåg (2017) analyze individual-level employment data for PE buyouts in Sweden, and present strong evidence for labor market polarization. Antoni et al. (2019) use establishment and worker-level data from PE buyouts in Germany, and document a reduction in overall employment but an increase in hiring involving IT jobs. Our findings add to these findings on how PE firms affect labor outcomes in the hospital industry.

5.2 Wage Analysis

Wages, especially those paid to administrative and general employees, represent a significant portion of operating expenses in the hospital industry. We thus examine how wages change at target hospitals. Our analysis covers three aspects of wages. First, we examine the total wage bill of a target hospital (*Log(Total Wages)*), which helps shed light on whether PE-backed acquirers achieve cost-cutting by reducing wage expenditures. Whether total wage bill declines at PE-acquired hospitals is not obvious a priori. While PE acquirers cut employment, they also raise the proportion of core workers, who are

highly skilled and command higher pay. After analyzing total wages in target hospitals, we examine wages paid to core workers. Specifically, we look at the percentage of total wages paid to core workers (*%Core Wages*) and the hourly wage rates of core workers (*Log(Core Wage Rate)*). This examination helps address the possibility that PE acquirers increase the quantity of core employees at the expense of suppressing their wages.

Panel A of Table 6 reports results from this analysis. From Columns (1) and (2), we observe that target hospitals of both PE- and non-PE-backed acquisitions experience a reduction in their wage bills. This reduction is most prominent among targets of PE-backed publicly traded acquirers. At the same time, results from Columns (3) and (4) suggest that PE-backed public acquirers do not suppress core workers' wage ratio. In fact, the percentage of wages paid to core employees increases by 3 percentage points at hospitals acquired by publicly traded PE-backed hospitals. This is a meaningful magnitude relative to the sample average of the core wages ratio of 0.06. Finally, in Columns (5) and (6), we do not find evidence indicating that core employees are paid lower hourly wages at target hospitals of PE-backed acquirers. Taken together, our results suggest that, while PE acquirers cut costs through reducing total wage expenditures, this reduction is not driven by salary cut of core workers. In the next section, we examine wage expenses for administrative and general employees.

TABLE 6 ABOUT HERE

Shrank et al. (2019) estimate that administrative inefficiency accounts for a major source of wasteful spending at hospitals. PE acquirers potentially have the expertise to reduce such wasteful expenditures and improve the efficiency of target hospitals. We test this conjecture by directly examining the changes in wages paid to administrative and general workers. Similar to our analysis for core worker wages, we consider two dimensions of administrative wages: the proportion of total wages paid to administrative and general workers (*%Admin Wages*), and the log of hourly wage rate for administrative and general workers (*Log(Admin Wage Rate)*).

Panel B of Table 6 reports the results. In Column (1), we find that administrative wage

ratio declines significantly at target hospitals of PE-backed acquirers, but not at targets of non-PE-backed acquirers. Estimates from Column (2) further indicate that this decline is concentrated on targets of PE-backed private acquirers. While targets of PE-backed public acquirers also exhibit a decline in administrative wage ratio, this effect is small and statistically insignificant at conventional levels. This could be due to PE-backed public acquirer aggressively cutting total wage expenditure. We next turn to hourly wage rates for administrative workers. Results in Column (4) show that PE-backed public acquirers are associated with significantly lower hourly wage rates for administrative workers relative to the control group. This reduction is not observed for other acquirer types.

Overall, these results are consistent with the argument that PE acquirers help improve the operating efficiency of target hospitals by reducing the overall wage bill of the hospital, especially the component of the wages paid to administrative workers. At the same time, PE acquirers do not pay less to core employees who are critical in providing quality health care.

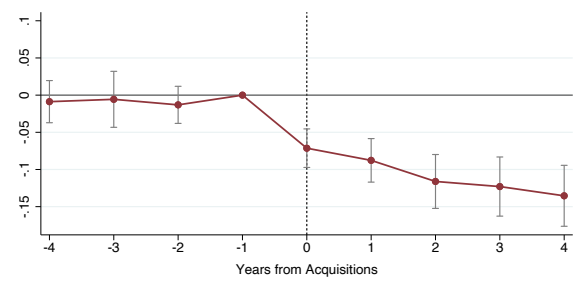
5.3 Dynamic Effects of PE Acquisitions

We track how employment and wages evolve at target hospitals each year around the event window. This examination allows us to trace the timeline of changes implemented by PE and non-PE acquirers. Moreover, by checking whether the changes we document have started to take place in target hospitals prior to the acquisition, we evaluate the extent to which PE firms select improving hospitals based on observable characteristics.

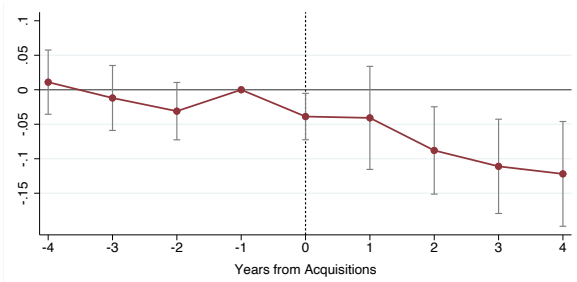
We estimate the dynamic effect of hospital acquisitions using the model below:

$$Y_{e,i,t} = \Sigma_{k=-4}^{4} \beta_{1,k} PE\ Acquirer_{e,i,t=k} + \Sigma_{k=-4}^{4} \beta_{2,k} NonPE\ Acquirer_{e,i,t=k} + \gamma \cdot X_{i,t} + \alpha_i + \mu_e + \tau_t + \epsilon_{e,i,t}, \quad (3)$$

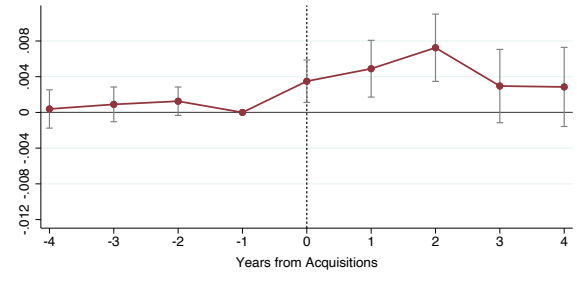
where k indicates years during the event window. $PE\ Acquirer_{e,i,t=k}$ is an indicator for whether hospital i is acquired by a PE firm or PE-backed hospital k years prior to the observation point. $NonPE\ Acquirer_{e,i,t=k}$ is defined analogously. In this estimation, the



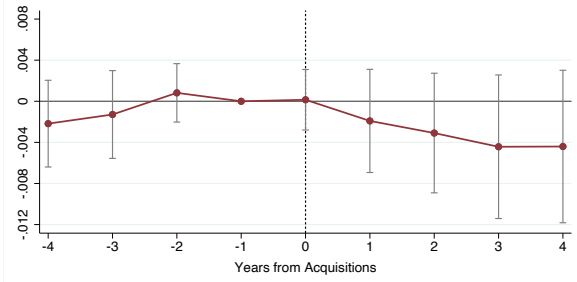
(A) *Log(Employment)*, PE Acquirers



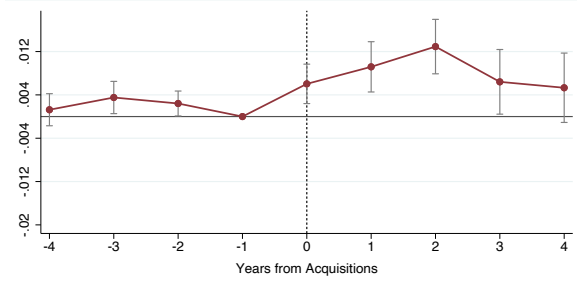
(B) *Log(Employment)*, Non-PE Acquirers



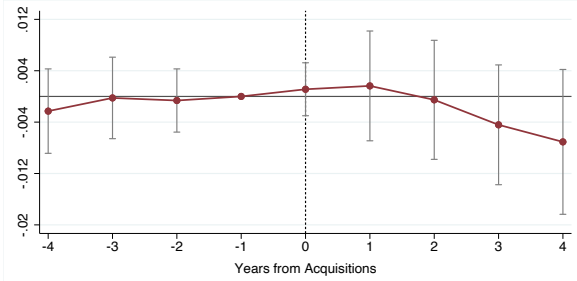
(C) *%Core Worker*, PE Acquirers



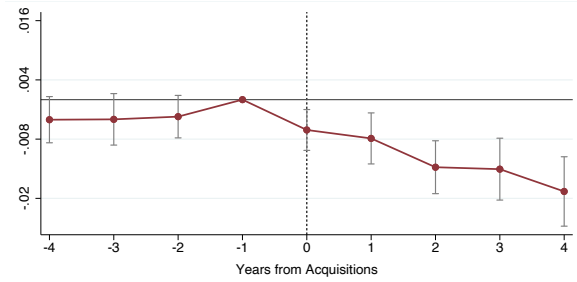
(D) *%Core Worker*, Non-PE Acquirers



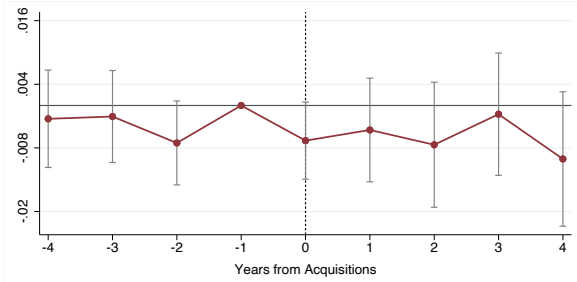
(E) *%Core Wages*, PE Acquirers



(F) *%Core Wage*, Non-PE Acquirers



(G) *%Admin Wage*, PE Acquirers



(H) *%Admin Wage*, Non-PE Acquirers

Figure 4. Dynamic Effect of PE and Non-PE Acquirers. This figure shows the changes in total employment, core worker ratio, core worker wage ratio, and administrative worker wage ratio over the acquisition event window. The left-side panels represent effects from PE acquirers (β_1) and the right-side panels report effects from non-PE acquirers (β_2). 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.

year prior to the event $k = -1$ is omitted as the benchmark year.

Figure 4 depicts the results. Panels A and B report coefficients for *Log(Employment)*,

Panels C and D report results for *%Core Workers*, Panels E and F present results for *%Core Wages*, and Panels G and H report *%Admin Wages*. We present the coefficients for PE acquirers ($\beta_{1,k}$) on the left panels and the coefficients for non-PE acquirers ($\beta_{2,k}$) on the right, so that the effects of PE and non-PE acquirers can be compared directly. We do not observe any significant pre-event changes for PE targets or non-PE targets. Following the acquisitions, targets of PE firms and PE-backed hospitals experience strong and persistent employment cuts, reductions in administrative wages, and significant increases in the percentage of core workers. While targets of non-PE acquirers also experience reductions in employment, there is no increase in the ratio of core workers in any year following the acquisition in these hospitals. If anything, core worker ratio seems to decline for those target hospitals. Administrative wage expenditures do not seem to change either.

These observations are consistent with our baseline findings. Importantly, the lack of pre-event trend suggests that our results are unlikely to be driven exclusively by PE-backed acquirers targeting hospitals that already exhibit signs of improvement along these dimensions. Put differently, while we do not claim that PE acquirers improve the core worker ratio and reduce administrative wages at any random hospital they acquire, our findings are unlikely to be explained by a pure selection mechanism. The significant and abrupt post-event effects are consistent with PE acquirers to increase the core employee profile and administrative efficiency of the hospitals they acquire.

5.4 Publicly Traded Acquirers and PE Backing

Our results so far suggest that PE-backed publicly traded acquirers are associated with larger layoffs at their target hospitals, but also greater increases in the core workers. To what extent do these outcomes reflect PE-backing in such hospitals? Alternatively, do they simply reflect the benefit of having access to public capital markets? To answer this question, we compare the changes at hospitals acquired by PE-backed publicly traded hospitals with the changes at hospitals acquired by non-PE-backed publicly traded hospitals. This analysis is similar in spirit to Cao and Lerner (2009) comparing the performance of PE-backed and non-PE-backed IPO firms.

Table 7 reports the results from this analysis. The outcome variables are total employment, core worker ratio, core wage ratio, administrative wage ratio, and administrative wage rates. Acquirers are first decomposed into PE-backed and non-PE-backed, and within each category, further decomposed into publicly traded and private acquirers. We compare the coefficients between the two types of public acquirers and report the statistical significance of the difference in their coefficients. For simplicity, coefficients of private acquirers are suppressed.

TABLE 7 ABOUT HERE

Our results suggest that within publicly traded acquirers, those with PE-backing cut employment and increase core workers to a greater extent than those without PE-backing. Public acquirers without PE-backing also increase core worker ratio and core wage ratio, although these changes are significantly smaller (0.004 and 0.006 compared to 0.019 and 0.027). While we do not find a difference in the administrative wage ratio between the targets of PE- and non-PE-backed public acquirers, those with PE-backing are associated with a lower hourly wage rate for administrative employees.

Our results reveal that the increase in core worker ratio cannot be fully explained by the public status of the acquirer. Instead, publicly traded PE-backed hospitals seem to enjoy the benefits of being PE-backed as well as having access to public capital markets. These results complement the results in Cao and Lerner (2009) that PE-backed IPO firms outperform non-PE-backed firms in their stock price performance. They also provide support for the argument that PE investors affect their portfolio companies in the long run, as argued in Kaplan and Stromberg (2009) and Biesinger et al. (2020).

5.5 For-Profit and Nonprofit Targets

Popular press often argues that PE firms acquire hospitals with non-profit status, convert them into for-profit hospitals and downsize them. Meanwhile, others claim that PE firms improve operating efficiency of nonprofit hospitals by creating accountability to investors. We formally examine these opposing anecdotal views by comparing post-

acquisition outcomes between for-profit and nonprofit target hospitals. To do so, we divide the targets of PE-backed acquirers into two groups, based on whether they operated as nonprofit or for-profit organizations prior to the acquisition.

Table 8 reports results from this analysis. Compared to for-profit targets, nonprofit targets of PE-backed acquirers exhibit significantly larger increases in core worker ratio and wages paid to core workers. In fact, targets with for-profit status prior to the acquisition experience little or no change in their core worker ratio. Nonprofit targets of PE-backed acquirers also reduce administrative wages to a greater extent than for-profit ones, although the difference is not statistically significant at conventional levels.

TABLE 8 ABOUT HERE

Through this analysis, we identify a novel role for PE firms in transforming non-profit organizations into for-profit ones, and improving their efficiency.

6 Real Patient Outcomes

We next examine whether PE acquirers' profit maximization motives conflict with patient interest and well-being. To do so, we track the changes in patient outcomes at acquired hospitals across various dimensions, including mortality rates, readmission rates of discharged patients, and survey evidence regarding patient satisfaction.

6.1 Patient Mortality and Readmission Rates

Mortality 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.

In the CMS Hospital Compare database, mortality rates are reported with 3-year

rolling windows. In other words, for year 2007, we only observe the cumulative mortality rates calculated based on data from 2005–2007. To gauge the effect of an acquisition on mortality rates, we adopt a first-difference approach. 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 $[t+4, t+6]$. For each post-event window, we compute the change in mortality rate for a given hospital from the pre-event window to the post-event window. 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 rate following a hospitalization from pre-acquisition years to post-acquisition years. We do not compute the difference relative to earlier pre-event windows because that would lead to more sample attrition. We also exclude the windows that straddle the year of the acquisition because mortality rates in those windows are only partially affected by the treatment.

We regress the changes in mortality rates on acquirer types, 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:

$$\Delta Y_{e,i,\tau} = \beta_1 PE\ Acquirer_{e,i,\tau} + \beta_2 NonPE\ Acquirer_{e,i,\tau} + \gamma \cdot \Delta X_{i,t} + \mu_e + \nu_{e,i,\tau}, \quad (4)$$

where $\Delta Y_{e,i,\tau}$ represents the changes in mortality rate from the pre-event window to a post-event window, indexed by τ. $\Delta X_{i,t}$ represents the first-difference in control variables, and μ_e stands for event fixed effects.

Panel A of Table 9 reports the results from estimating Equation 4. We present coefficients from regressions with and without event fixed effects. For this analysis, we do not partition PE-backed acquirers based on their public trading status due to limited data related to mortality and readmission rates.

Table 9 About Here

We do not find that PE-backed acquirers are associated with increases in heart attack mortality or heart failure mortality than control hospitals. In comparison, non-PE acquir-

ers are associated with higher mortality rates related to heart failure. Both PE-backed and non-PE-backed acquirers are associated with around a 1-percent increase in pneumonia mortality, though this increase is small relative to the sample mean (12) of this variable.

We next turn to readmission rates after discharge, which are 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. The sample construction and regression setup are the same as in the mortality analysis.

Panel B reports the results from this analysis. We find that hospitals acquired by PE-backed acquirers experience a significant decrease in readmission rates among discharged patients diagnosed with heart failure conditions by about 0.5 percentage point. The readmission rates among heart attack and pneumonia patients do not differ between PE-acquired hospitals and control hospitals. Similar effects are observed for non-PE-backed acquirers, although those acquirers are associated with a weaker decline in heart failure readmission but a stronger decline in pneumonia 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 target hospitals of PE-backed acquirers differ from the control group, or from the targets of non-PE acquirers in those dimensions either. Our body of evidence does not provide a clear sign that PE-backed acquirers reduce the quality of medical treatment at target hospitals compared to targets of non-PE acquirers as well as control hospitals. Our finding complements the results from the nursing home industry where nursing homes acquired by PE firms do not necessarily exhibit deterioration of health outcomes (Gandhi et al., 2020).

6.2 Patient Satisfaction

We next investigate patient satisfaction at acquired hospitals. As mentioned in Section 3.4, we use survey-based data to measure patient satisfaction. This survey asks patients to evaluate their experience and the quality of service at their hospital by giving an overall rating to the hospital as well as by ranking the quality of communication with

doctors, the quality of communication with nurses, whether they receive help as soon as they need it and whether they would recommend the hospital to others.

Results in Panel A of Table 10 suggest that patient satisfaction scores across all dimensions decline significantly at hospitals bought by non-PE acquirers, which is consistent with the findings in Beaulieu et al. (2020). Yet, patient satisfaction at target hospitals of PE-backed acquirers shows little change, declining significantly only in "communication with nurses." Panel B shows that while targets of non-PE and PE-backed private acquirers show deteriorating patient satisfaction, PE-backed public acquirers are associated with no decline. The differential changes in patient satisfaction between PE-backed public acquirers and other types of acquirers are statistically significant for all survey questions.

TABLE 10 ABOUT HERE

These observations are particularly interesting in light of our earlier results on the ratio of core medical workers, the wages of core workers, and administrative salaries at acquired hospitals. Recall that PE-backed publicly traded acquirers are uniquely associated with a significant increase in core workers and a reduction in administrative wages. This could be explained by those acquirers having both access to public capital markets and accountability to public shareholders. In other words, they have both stronger incentives and greater means to improve the efficiency of acquired hospitals than other types of acquirers. On the downside, PE-backed publicly traded acquirers are associated with the greatest cut in overall employment, with a potential negative impact on the job prospects of the communities where they are located. However, employment cuts, especially those involving non-core employees could be one way of turning hospitals into more efficient and viable entities with an improved ability to maintain quality healthcare for their community.

7 Changes in Patient and Operational Characteristics subsequent to Acquisitions

In the last step of our analysis, we discuss the possibility that changes in patient outcomes around PE-backed acquisitions could be driven by acquired hospitals changing their patient composition and the type of medical procedures. Without data on individual patients and treatments, we follow Schmitt (2017) and directly examine the changes in observable hospital characteristics around acquisitions.

Table 11 reports the changes in various operating characteristics of target hospitals, including the log number of beds, case-mix index, outpatient ratio, the percent of medicare patients, and the percent of medicaid patients relative to all patients. Changes in these characteristics are then compared across acquirer types. Panel A presents the effects for PE-backed acquirers and non-PE-backed acquirers. Panel B further looks into the effects of PE-backed private and public acquirers, respectively.

Table 11 About Here

We do not find any change in target hospital size, as measured by the log number of beds, or operation complexity, proxied by the case mix index. We next investigate the outpatient ratio at target hospitals. Despite outpatient procedures being a cost efficient source of revenue for hospitals, PE acquirers do not seem to rely more on outpatient services. If anything, outpatient ratio declines at some PE-acquired hospitals. Finally, we look at patient mix using the percentage of patients enrolled in medicare and medicaid programs. Hospitals acquired by PE-backed institutions do not exhibit significant changes in patient composition, although PE private acquirers are associated with a small decline in the percentage of medicare patients. Notably, changes in both outpatient ratio and medicare patient fractions do not show up for publicly traded PE-backed acquirers. There is no change in medicaid patients for any acquirer type, alleviating the concern that PE-acquired hospitals cater to younger and wealthier patients.

Overall, our investigation reveals little change in patient composition and operating

characteristics at target hospitals of PE-backed acquirers. While we cannot observe the changes in the patient population of target hospitals, we provide several arguments alleviating the concern that our results might be purely driven by changes in the patient composition at target hospitals. To start, we do not see PE-backed public acquirers to decrease the percentage of medicare and medicaid patients, or to rely more on outpatient services. Second, our sample hospitals involve only acute-care hospitals providing a large array of basic services ranging from cardiology to neurology. This suggests limited scope for PE acquirers to shift their services to younger and wealthier patients and offer, for example, more profitable services such as cosmetic surgery. In addition, even if PE-acquired hospitals cater services to younger and wealthier patients, it is not clear why those patients would be less critical and more satisfied in evaluating hospitals through higher patient satisfaction scores.

8 Conclusion

Hospitals are an important sector of the economy. They not only provide essential healthcare, but also a high fraction of jobs in the U.S. As the hospital industry has been going through a tremendous level of M&A activity, in-depth research is needed to understand how such activity affects jobs, efficiency and patient outcomes at acquired hospitals. The need for research becomes even more pressing when one recognizes the increasing pace of acquisitions conducted by for-profit institutions such as PE firms and publicly traded hospitals.

While we find that PE acquirers are associated with significant employment cuts at acquired hospitals, they are also associated with a growing presence of core medical workers. Comparing those results to non-PE acquirers, we find that non-PE acquirers cut employment without increasing core worker ratio at the hospitals they acquire. Consistent with these findings, patient satisfaction roughly stays unchanged for PE acquirers but worsens significantly at target hospitals of non-PE acquirers. Finally, we do not observe a deterioration in real patient outcomes such as mortality rates or readmission rates at

PE-acquired hospitals, alleviating the concerns that PE firms improve efficiency at the expense of patients.

Overall, our study provides a nuanced view regarding the role of PE firms in the hospital industry. While PE acquirers seem to suppress employment growth, they provide management expertise and accountability to investors that could help improve target hospitals.

References

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

Adelino, M., Lewellen, K., and Sundaram, A. (2015). Investment decisions of nonprofit firms: Evidence from hospitals. *The Journal of Finance*, 70(4):1583–1628.

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

Agrawal, A. and Tambe, P. (2016). Private equity and workers' career paths: The role of technological change. *The Review of Financial Studies*, 29(9):2455–2489.

Amess, K. and Wright, M. (2007). The wage and employment effects of leveraged buyouts in the UK. *International Journal of the Economics of Business*, 14(2):179–195.

Antoni, M., Maug, E., and Obernberger, S. (2019). Private equity and human capital risk. *Journal of Financial Economics*, 133(3):634–657.

Beaulieu, N. D., Dafny, L. S., Landon, B. E., Dalton, J. B., Kuye, I., and McWilliams, J. M. (2020). Changes in quality of care after hospital mergers and acquisitions. *New England Journal of Medicine*, 382(1):51–59.

Biesinger, M., Bircan, C., and Ljungqvist, A. (2020). Value creation in private equity. *Working Paper*.

Boucly, Q., Sraer, D., and Thesmar, D. (2011). Growth LBOs. *Journal of Financial Economics*, 102(2):432–453.

Bruch, J. D., Gondi, S., and Song, Z. (2020). Changes in hospital income, use, and quality associated with private equity acquisition. *JAMA Internal Medicine*, 180(11):1428–1435.

Cao, J. and Lerner, J. (2009). The performance of reverse leveraged buyouts. *Journal of Financial Economics*, 91(2):139–157.

Cooper, Z., Craig, S. V., Gaynor, M., and Van Reenen, J. (2019). The price ain't right? hospital prices and health spending on the privately insured. *The Quarterly Journal of Economics*, 134(1):51–107.

Cooper, Z., Gibbons, S., Jones, S., and McGuire, A. (2011). Does hospital competition save lives? evidence from the english nhs patient choice reforms. *The Economic Journal*, 121(554):228–260.

Craig, S. V., Grennan, M., and Swanson, A. (2021). Mergers and marginal costs: New evidence on hospital buyer power. *The RAND Journal of Economics*, 52(1):151–178.

Dafny, L. (2009). Estimation and identification of merger effects: An application to hospital mergers. *The Journal of Law and Economics*, 52(3):523–550.

Dafny, L., Ho, K., and Lee, R. S. (2019). The price effects of cross-market mergers: Theory and evidence from the hospital industry. *The RAND Journal of Economics*, 50(2):286–325.

Davis, S. J., Haltiwanger, J., Handley, K., Jarmin, R., Lerner, J., and Miranda, J. (2014). Private equity, jobs, and productivity. *American Economic Review*, 104(12):3956–90.

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

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

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

Ho, V. and Hamilton, B. H. (2000). Hospital mergers and acquisitions: Does market consolidation harm patients? *Journal of Health Economics*, 19(5):767–791.

Kaplan, S. (1989). The effects of management buyouts on operating performance and value. *Journal of Financial Economics*, 24(2):217–254.

Kaplan, S. N. and Stromberg, P. (2009). Leveraged buyouts and private equity. *Journal of Economic Perspectives*, 23(1):121–46.

Lasater, K. B., Sloane, D. M., McHugh, M. D., Cimiotti, J. P., Riman, K. A., Martin, B., Alexander, M., and Aiken, L. H. (2021). Evaluation of hospital nurse-to-patient staffing ratios and sepsis bundles on patient outcomes. *American Journal of Infection Control*, 49(7):868–873.

Lewis, M. S. and Pflum, K. E. (2017). Hospital systems and bargaining power: Evidence from out-of-market acquisitions. *The RAND Journal of Economics*, 48(3):579–610.

Lichtenberg, F. R. and Siegel, D. (1990). The effects of leveraged buyouts on productivity and related aspects of firm behavior. *Journal of Financial Economics*, 27(1):165–194.

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

Muscarella, C. J. and Vetsuypens, M. R. (1990). Efficiency and organizational structure: A study of reverse LBOs. *The Journal of Finance*, 45(5):1389–1413.

Olsson, M. and Tåg, J. (2017). Private equity, layoffs, and job polarization. *Journal of Labor Economics*, 35(3):697–754.

Prager, E. and Schmitt, M. (2021). Employer consolidation and wages: Evidence from hospitals. *American Economic Review*, 111(2):397–427.

Propper, C., Burgess, S., and 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(7-8):1247–1272.

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

Shrank, W. H., Rogstad, T. L., and Parekh, N. (2019). Waste in the US health care system: Estimated costs and potential for savings. *JAMA*, 322(15):1501–1509.

Wright, M., Thompson, S., and Robbie, K. (1992). Venture capital and management-led, leveraged buy-outs: a European perspective. *Journal of Business Venturing*, 7(1):47–71.

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 hospitals during the four years prior to their acquisition and all non-target hospitals. 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
Employment and Costs			
Log(Employment)	6.44	6.44	0.00
%Core Workers	0.04	0.04	0.00***
Log(Core Workers)	3.37	3.31	−0.06**
Core Workers/Patients (×100)	0.31	0.24	−0.06***
Log(Total Wages)	17.16	17.23	0.07***
%Core Wages	0.07	0.06	−0.01***
Core Wage Rate ($ per hour)	40.69	35.83	−4.86***
%Admin Wages	0.13	0.12	−0.01***
Admin Wage Rate ($ per hour)	25.77	25.97	0.20
Patient Outcomes			
Mortality for Heart Attack (AMI)	15.00	15.73	0.73***
Mortality for Heart Failure	11.65	11.30	−0.35***
Mortality for Pneumonia	13.16	12.17	−0.99***
Readmission for Heart Attack (AMI)	18.01	19.32	1.31***
Readmission for Heart Failure	23.10	24.64	1.54***
Readmission for Pneumonia	17.40	18.44	1.04***
Patient Satisfaction			
Nurse Comm.	2.74	2.68	−0.07***
Doctor Comm.	2.78	2.75	−0.03***
Receive Help	2.59	2.48	−0.11***
Hospital Rating	2.62	2.51	−0.11***
Recommendation	2.66	2.57	−0.09***
Hospital Characteristics			
Beds	116.68	180.08	63.40***
CMI	1.31	1.38	0.06***
%Medicare	0.46	0.40	−0.06***
%Medicaid	0.13	0.14	0.01***
%Outpatient	0.57	0.41	−0.17***

Table 2
Summary Statistics for the Matched Sample
This table reports the summary statistics for the matched sample of targets and controls. Both target and control hospitals remain in the sample during the [-4, +4] event period. Detailed variable definitions are provided by Appendix A.

	Obs.	Mean	Std	Median	P25	P75
Employment and Wages						
Log(Employment)	4,866	6.59	0.70	6.60	6.13	7.07
%Core Workers	3,872	0.04	0.02	0.04	0.03	0.05
Log(Core Workers)	3,872	3.45	0.77	3.42	2.93	3.99
Core Workers/Patients (×100)	3,871	0.25	0.12	0.24	0.17	0.31
Log(Total Wages)	4,871	17.46	0.80	17.52	16.99	17.98
%Core Wages	3,873	0.06	0.03	0.06	0.05	0.08
Core Wage Rate ($ per hour)	4,734	38.38	9.26	36.94	32.02	42.57
%Admin Wages	4,870	0.12	0.04	0.11	0.09	0.14
Admin Wage Rate ($ per hour)	4,684	27.20	7.49	26.11	21.59	32.10
Patient Outcomes						
Mortality for Heart Attack (AMI)	2,002	15.31	1.73	15.20	14.00	16.30
Mortality for Heart Failure	2,186	11.30	1.61	11.10	10.00	12.30
Mortality for Pneumonia	2,196	12.46	2.69	12.00	10.40	14.00
Readmission for Heart Attack (AMI)	1,582	18.64	1.76	18.80	17.20	20.00
Readmission for Heart Failure	1,894	23.82	2.13	23.80	22.20	25.20
Readmission for Pneumonia	1,903	17.91	1.55	17.90	16.90	19.00
Patient Satisfaction						
Nurse Comm.	2,859	2.67	0.09	2.68	2.62	2.73
Doctor Comm.	2,859	2.73	0.07	2.74	2.69	2.78
Receive Help	2,859	2.47	0.13	2.48	2.39	2.55
Hospital Rating	2,859	2.53	0.13	2.54	2.45	2.62
Recommendation	2,859	2.59	0.12	2.60	2.51	2.68
Hospital Characteristics						
Beds	4,880	197.47	126.92	167	109	260
CMI	4,862	1.41	0.21	1.41	1.25	1.55
%Medicare	4,880	0.38	0.12	0.38	0.29	0.46
%Medicaid	4,880	0.14	0.10	0.12	0.06	0.20
%Outpatient	4,879	0.42	0.13	0.40	0.32	0.51

Table 3
Employment at Target Hospitals

This table examines changes in the employment at target hospitals around acquisitions. The dependent variable is the log of total employees (measured in full-time equivalent employees based on employed hours). *Target* turns to one for target hospitals after they are acquired. *PE-Backed Acquirers* turns to one for a target hospital after it is acquired by a PE firm or a PE-backed hospital. *PE-Backed Private Acquirers* turns to one for a target hospital after it is acquired by a private PE-backed hospital or a PE firm, and *PE-Backed Public Acquirers* turns to one for a target hospital after it is acquired by a publicly traded PE-backed hospital. *Non-PE Backed Acquirers* turns to one for a target hospital after it is acquired by a non-PE-backed hospital. 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 *Log(Beds)*, *CMI*, *%Medicare*, *%Medicaid*, and *%Outpatient*. County Controls include *%Black*, *%Asian*, *Log(Pop)*, and *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.: *Log(Employment)*	(1)	(2)	(3)	(4)
Target	−0.0855***	−0.0918***		
	(−7.76)	(−7.44)		
PE-Backed Acquirers			−0.0982***	
			(−7.72)	
PE-Backed Private Acquirers				−0.0821***
				(−6.04)
PE-Backed Public Acquirers				−0.1416***
				(−6.62)
Non-PE Backed Acquirers			−0.0678***	−0.0682***
			(−2.75)	(−2.77)
Hospital Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	No	No	No
Event FEs	No	Yes	Yes	Yes
Event Time FEs	No	Yes	Yes	Yes
p-values for:				
H_0: PE = Non-PE			0.23	
H_0: PE Private = Non-PE				0.58
H_0: PE Public = Non-PE				0.02
H_0: PE Public = PE Private				<0.01
Adjusted R^2	0.98	0.98	0.98	0.98
Observation	4,831	4,831	4,831	4,831

Table 4
Core Workers at Target Hospitals

This table examines changes in the proportion of core workers at target hospitals around acquisitions. Core workers are defined as nurses, physicians, and pharmacists. The dependent variable is *%Core Workers*, defined as the ratio of core workers in a hospital to total employees. 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 *Log(Beds)*, *CMI*, *%Medicare*, *%Medicaid*, and *%Outpatient*. County Controls include *%Black*, *%Asian*, *Log(Pop)*, and *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.: *%Core Workers*	(1)	(2)	(3)	(4)
Target	0.0030***	0.0022*		
	(2.74)	(1.79)		
PE-Backed Acquirers			0.0033**	
			(2.39)	
PE-Backed Private Acquirers				−0.0017
				(−1.41)
PE-Backed Public Acquirers				0.0188***
				(8.58)
Non-PE Backed Acquirers			−0.0017	−0.0017
			(−0.82)	(−0.82)
Hospital Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes
Year FEs	Yes	No	No	No
Event FEs	No	Yes	Yes	Yes
Event Time FEs	No	Yes	Yes	Yes
p-values for:				
H_0: PE = Non-PE			0.03	
H_0: PE Private = Non-PE				0.97
H_0: PE Public = Non-PE				<0.01
H_0: PE Public = PE Private				<0.01
Adjusted R^2	0.74	0.73	0.73	0.76
Observations	3,850	3,850	3,850	3,850

Table 5
Core Workers at Target Hospitals - Alternative Definitions
This table examines the change in alternative measures of core medical workers at target hospitals around acquisitions. In Columns (1) and (2), we present results related to *Core Workers/Patients*, the number of nurses, physicians, and pharmacists per patient. The number of patients is estimated by adjusted discharges, defined as the number of discharged inpatients multiplied by (1+outpatient charges/inpatient charges). In Columns (3) and (4), we present results related to the log of total number of core workers, i.e., *Log(Core Workers)*. In Columns (5) and (6), we use only the total number of nurses and pharmacists in calculating the ratio of core workers relative to all employees as *%Nurses and Pharm.* Control variables are the same as in Table 4. 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 4. 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.:	*Core Workers/Patients*		*Log(Core Workers)*		*%Nurses and Pharm.*	
	(1)	(2)	(3)	(4)	(5)	(6)
PE-Backed Acquirers	−0.0000		−0.0199		0.0037***	
	(−0.15)		(−0.55)		(3.13)	
PE-Backed Private Acquirers		−0.0003***		−0.1233***		−0.0015
		(−3.22)		(−3.49)		(−1.40)
PE-Backed Public Acquirers		0.0008***		0.2980***		0.0179***
		(6.65)		(5.90)		(10.00)
Non-PE Backed Acquirers	−0.0003*	−0.0003*	−0.0886	−0.0883*	−0.0032*	−0.0030*
	(−1.72)	(−1.73)	(−1.65)	(−1.65)	(−1.96)	(−1.88)
Hospital Controls	Yes	Yes	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes	Yes
Event FEs	Yes	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
p-values for						
H_0: PE = Non-PE	0.11		0.23		<0.01	
H_0: PE Private = Non-PE		1.00		0.54		0.42
H_0: PE Public = Non-PE		<0.01		<0.01		<0.01
H_0: PE Public = PE Private		<0.01		<0.01		<0.01
Adjusted R^2	0.75	0.77	0.90	0.90	0.72	0.75
Observations	3,850	3,850	3,850	3,850	4,825	4,825

Table 6
Wages at Target Hospitals

This table examines changes in wages at target hospitals around acquisitions. Panel A presents results related to total wages and core worker wages at target hospitals. The dependent variable of Columns (1) and (2) is the log of total wage expenditure of a hospital. The dependent variable of Columns (3) and (4) is *%Core Wages*, the ratio between salaries paid to core medical workers relative to all salaries, and the dependent variable of Columns (5) and (6) is the log of core medical workers' hourly wage. Panel B reports results for wages of administrative and general workers. The dependent variable in Columns (1) and (2) is *%Admin Wages*, the percentage of total wages paid to administrative and general workers, including contract labor related to administrative and general workers. The dependent variable for Columns (3) and (4) is the log of hourly wage rate for administrative and general workers. 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 4. 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.

Panel A: Total and Core Wages at Targets by Acquirer Type

Dep. Var.:	*Log(Total Wages)*		*%Core Wages*		*Log(Core Wage Rate)*	
	(1)	(2)	(3)	(4)	(5)	(6)
PE-Backed Acquirers	−0.0972***		0.0059***		0.0103	
	(−6.81)		(2.90)		(0.76)	
PE-Backed Private Acquirers		−0.0773***		−0.0014		0.0178
		(−4.96)		(−0.70)		(1.19)
PE-Backed Public Acquirers		−0.1507***		0.0272***		−0.0104
		(−6.81)		(9.74)		(−0.54)
Non-PE Backed Acquirers	−0.0975***	−0.0980***	−0.0001	−0.0001	−0.0059	−0.0061
	(−3.89)	(−3.90)	(−0.03)	(−0.04)	(−0.43)	(−0.44)
Hospital Controls	Yes	Yes	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes	Yes
Event FEs	Yes	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
p-values for:						
H_0: PE = Non-PE	0.99		0.06		0.27	
H_0: PE Private = Non-PE		0.44		0.68		0.14
H_0: PE Public = Non-PE		0.10		<0.01		0.83
H_0: PE Public = PE Private		<0.01		<0.01		0.17
Adjusted R^2	0.98	0.98	0.74	0.76	0.76	0.76
Observations	4,831	4,831	3,851	3,851	4,698	4,698

Panel B: Admin Wages at Targets by Acquirer Type

Dep. Var.:	*%Admin Wages*		*Log(Admin Wage Rate)*	
	(1)	(2)	(3)	(4)
PE-Backed Acquirers	−0.0094***		−0.0096	
	(−4.30)		(−0.69)	
PE-Backed Private Acquirers		−0.0114***		0.0084
		(−5.19)		(0.55)
PE-Backed Public Acquirers		−0.0039		−0.0560***
		(−1.03)		(−2.63)
Non-PE Backed Acquirers	−0.0016	−0.0016	0.0127	0.0123
	(−0.49)	(−0.48)	(0.64)	(0.62)
Hospital Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes
Event FEs	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes
p-values for:				
H_0: PE = Non-PE	0.02		0.29	
H_0: PE Private = Non-PE		<0.01		0.86
H_0: PE Public = Non-PE		0.61		0.01
H_0: PE Public = PE Private		0.04		<0.01
Adjusted R^2	0.78	0.78	0.82	0.83
Observations	4,830	4,830	4,650	4,650

Table 7
Public Acquirers With and Without PE-backing

This table compares the differential effects from PE-backed publicly traded acquirers and non-PE-backed public acquirers. The dependent variables include the log of employment, core employee ratio, the percentage of wages paid to core employees, the percentage of wages paid to administrative and general employees, and log of hourly wage paid to core and administrative and general employees. Acquirers are divided into PE-backed private, PE-backed public, Non-PE backed private, and Non-PE backed public. Coefficients for PE-backed private and non-PE backed private acquirers are suppressed. The row with H_0 provides p-values from Wald Chi-square tests indicating whether coefficients for *PE-Backed Public Acquirers* and *Non-PE Backed Public Acquirers* are statistically significantly different from each other. Control variables are the same as in Table 4. 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.:	(1) *Log(Employment)*	(2) *%Core Workers*	(3) *%Core Wages*	(4) *%Admin Wages*	(5) *Log(Core Wage Rate)*	(6) *Log(Admin Wage Rate)*
PE-Backed Public Acquirers	−0.1416***	0.0188***	0.0271***	−0.0039	−0.0104	−0.0560***
	(−6.62)	(8.57)	(9.73)	(−1.03)	(−0.54)	(−2.63)
Non-PE Public Acquirers	−0.0612**	0.0038**	0.0062***	−0.0035	0.0008	0.0154
	(−2.42)	(2.42)	(3.09)	(−1.24)	(0.05)	(0.68)
Private Acquirer Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Hospital Controls	Yes	Yes	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes	Yes
Event FEs	Yes	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes	Yes
p-values for H_0: PE Public = Non-PE Public	0.01	<0.01	<0.01	0.93	0.58	0.01
Adjusted R^2	0.98	0.76	0.77	0.78	0.76	0.83
Observations	4,831	3,850	3,851	4,830	4,698	4,650

Table 8
For-profit and Nonprofit Targets
This table presents results differentiating nonprofit and for-profit targets. Target for-profit status is characterized based on its status prior to the acquisition. The row with H_0 provides p-values from Wald Chi-square tests indicating whether coefficients for for-profit targets and nonprofit targets are statistically significantly different from each other. Control variables are the same as in Table 4. 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.:	(1) *Log(Employment)*	(2) *%Core Workers*	(3) *%Core Wages*	(4) *%Admin Wages*
For-Profit PE Targets	−0.0763***	0.0018	0.0041**	−0.0087***
	(−5.70)	(1.30)	(1.97)	(−4.29)
Nonprofit PE Targets	−0.1693***	0.0116***	0.0160***	−0.0117**
	(−7.45)	(3.26)	(2.87)	(−2.27)
Hospital Controls	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes
Event FEs	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes
p-values for				
H_0: Nonprofit = For-Profit	<0.01	<0.01	0.04	0.57
Adjusted R^2	0.98	0.74	0.75	0.78
Observations	4,831	3,850	3,851	4,830

Table 9
Mortality and Readmission at Target Hospitals

This table examines the mortality and readmission rates of 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 a pre-acquisition window to post-acquisition windows. 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 4. 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.

Panel A: Changes in Mortality

Dep. Var.: Δ*Mortality for*	*Heart Attack (AMI)*		*Heart Failure*		*Pneumonia*	
	(1)	(2)	(3)	(4)	(5)	(6)
PE-Backed Acquirers	−0.0804	0.0535	0.1980	0.2608	1.1233***	0.8133**
	(−0.38)	(0.19)	(0.89)	(1.18)	(3.96)	(2.18)
Non-PE Backed Acquirers	−0.0638	−0.1719	0.3832	0.6445***	0.8733***	1.1464***
	(−0.23)	(−0.74)	(1.52)	(2.98)	(2.65)	(3.85)
Hospital Controls (differenced)	Yes	Yes	Yes	Yes	Yes	Yes
County Controls (differenced)	Yes	Yes	Yes	Yes	Yes	Yes
Event FEs	No	Yes	No	Yes	No	Yes
p-values for H_0: PE = Non-PE	0.96	0.55	0.57	0.22	0.48	0.49
Adjusted R^2	0.06	0.46	0.03	0.50	0.05	0.32
Observations	300	298	344	343	350	349

Panel B: Changes in Readmission

Dep. Var.: Δ*Readmission for*	*Heart Attack (AMI)*		*Heart Failure*		*Pneumonia*	
	(1)	(2)	(3)	(4)	(5)	(6)
PE-Backed Acquirers	0.3098	0.2368	−0.4628**	−0.4791**	−0.2442	−0.1234
	(1.51)	(1.05)	(−2.07)	(−2.14)	(−1.20)	(−0.67)
Non-PE Backed Acquirers	0.4556**	−0.0112	0.0203	−0.0789	−0.7642***	−0.8841***
	(2.23)	(−0.06)	(0.07)	(−0.39)	(−3.14)	(−3.76)
Hospital Controls (differenced)	Yes	Yes	Yes	Yes	Yes	Yes
County Controls (differenced)	Yes	Yes	Yes	Yes	Yes	Yes
Event FEs	No	Yes	No	Yes	No	Yes
p-values for H_0: PE = Non-PE	0.52	0.40	0.09	0.19	0.05	0.01
Adjusted R^2	0.18	0.66	0.20	0.65	0.06	0.46
Observations	256	255	320	319	326	325

Table 10
Patient Satisfaction

This table examines changes in patient satisfaction of target hospitals around acquisitions. Panel A reports results for PE and non-PE acquirers. Panel B reports results for PE-backed Private, PE-backed Public, and non-PE acquirers. In each panel, we examine five dimensions of satisfaction: nurses' communication with patients (*Nurse Comm.*), doctors' communication with patients (*Doctor Comm.*), whether patients can get help when needed (*Receive Help*), patients' overall rating of the hospital (*Hospital Rating*), and whether patients would recommend this hospital to others (*Recommend*). 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 4. 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.

Panel A: PE-Backed and Non-PE Backed Acquirers

Dep. Var.:	(1) *Nurse Comm.*	(2) *Doctor Comm.*	(3) *Receive Help*	(4) *Hospital Rating*	(5) *Recommend*
PE-Backed Acquirers	−0.0193***	−0.0088	−0.0109	−0.0087	−0.0157
	(−2.73)	(−1.49)	(−0.94)	(−0.82)	(−1.61)
Non-PE Backed Acquirers	−0.0244***	−0.0257***	−0.0250**	−0.0454***	−0.0382***
	(−3.08)	(−4.29)	(−2.06)	(−4.24)	(−4.25)
Hospital Controls	Yes	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes
Event FEs	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes
p-values for H_0: PE = Non-PE	0.51	<0.01	0.30	<0.00	0.03
Adjusted R^2	0.80	0.77	0.78	0.77	0.82
Observations	2,823	2,823	2,823	2,823	2,823

Panel B: PE-Backed Private, PE-Backed Public, and Non-PE Backed Acquirers

Dep. Var.:	(1) *Nurse Comm.*	(2) *Doctor Comm.*	(3) *Receive Help*	(4) *Hospital Rating*	(5) *Recommend*
PE-Backed Private Acquirers	−0.0284***	−0.0166**	−0.0322***	−0.0336***	−0.0339***
	(−3.51)	(−2.58)	(−2.82)	(−2.69)	(−3.02)
PE-Backed Public Acquirers	−0.0084	0.0004	0.0143	0.0207	0.0059
	(−0.97)	(0.05)	(0.81)	(1.62)	(0.45)
Non-PE Backed Acquirers	−0.0243***	−0.0256***	−0.0248**	−0.0452***	−0.0380***
	(−3.08)	(−4.29)	(−2.04)	(−4.20)	(−4.22)
Hospital Controls	Yes	Yes	Yes	Yes	Yes
County Controls	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes
Event FEs	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes
p-values for:					
H_0: PE Private = Non-PE	0.64	0.17	0.58	0.39	0.73
H_0: PE Public = Non-PE	0.10	<0.01	0.04	<0.01	<0.01
H_0: PE Public = PE Private	0.04	0.05	0.01	<0.01	0.01
Adjusted R^2	0.80	0.77	0.78	0.78	0.82
Observations	2,823	2,823	2,823	2,823	2,823

Table 11
Operating Characteristics at Target Hospitals

This table examines changes in operating characteristics at target hospitals around acquisitions. Panel A reports results for PE-backed acquirers and non-PE backed acquirers. Panel B further decomposes PE-backed acquirers into PE-backed private acquirers and PE-backed public acquirers. 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 4. 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.

Panel A: PE-Backed and Non-PE Backed Acquirers

Dep. Var.:	(1) *Log(Beds)*	(2) *CMI*	(3) *%Outpatient*	(4) *%Medicare*	(5) *%Medicaid*
PE-Backed Acquirers	0.0117	0.0055	−0.0207***	−0.0073	0.0036
	(0.80)	(0.72)	(−3.95)	(−1.52)	(0.60)
Non-PE Backed Acquirers	−0.0114	−0.0180	−0.0067	0.0035	−0.0017
	(−0.51)	(−1.36)	(−0.84)	(0.59)	(−0.20)
County Controls	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes
Event FEs	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes
p-values for H_0: PE = Non-PE	0.29	0.10	0.04	0.08	0.52
Adjusted R^2	0.97	0.90	0.94	0.90	0.78
Observations	4,872	4,854	4,871	4,872	4,872

Panel B: PE-Backed Private, PE-Backed Public, and Non-PE Backed Acquirers

Dep. Var.:	(1) *Log(Beds)*	(2) *CMI*	(3) *%Outpatient*	(4) *%Medicare*	(5) *%Medicaid*
PE-Backed Private Acquirers	0.0212	0.0043	−0.0252***	−0.0116**	0.0038
	(1.36)	(0.51)	(−4.37)	(−2.28)	(0.62)
PE-Backed Public Acquirers	−0.0155	0.0089	−0.0078	0.0052	0.0030
	(−0.67)	(0.73)	(−1.13)	(0.61)	(0.28)
Non-PE Backed Acquirers	−0.0116	−0.0180	−0.0066	0.0036	−0.0017
	(−0.52)	(−1.36)	(−0.83)	(0.60)	(−0.20)
County Controls	Yes	Yes	Yes	Yes	Yes
Hospital FEs	Yes	Yes	Yes	Yes	Yes
Event FEs	Yes	Yes	Yes	Yes	Yes
Event Time FEs	Yes	Yes	Yes	Yes	Yes
p-values for:					
H_0: PE Private = Non-PE	0.15	0.13	<0.01	0.02	0.51
H_0: PE Public = Non-PE	0.89	0.12	0.89	0.87	0.70
H_0: PE Public = PE Private	0.12	0.72	0.02	0.06	0.94
Adjusted R^2	0.97	0.91	0.94	0.90	0.78
Observations	4,872	4,854	4,871	4,872	4,872

Appendix A Variable Definitions

A 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.
- *%Core Workers*: The ratio of nurses, physicians (including contract labor), and pharmacists relative to all employee (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 Physician - Part A - Administrative (Line Number 4), Physician - Part A - Teaching (Line Number 4.01), Contract labor: Physician - Part A - Administrative (Line Number 13), Nursing Administration (Line Number 38), and Pharmacy (Line Number 40).
- *Core Workers/Patients*: The ratio of nurses, physicians, and pharmacists, measured in full-time equivalent employees based on paid hours, relative to total discharges. The information is obtained from the HCRIS Worksheet S-3, Part II. Core workers include Physician - Part A - Administrative (Line Number 4), Physician - Part A - Teaching (Line Number 4.01), Contract labor: Physician - Part A - Administrative (Line Number 13), Nursing Administration (Line Number 38), and Pharmacy (Line Number 40).
- *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 Physician - Part A - Administrative (Line Number 4), Physician - Part A - Teaching (Line Number 4.01), Contract labor: Physician - Part A - Administrative (Line Number 13), Nursing Administration (Line Number 38), and Pharmacy (Line Number 40).
- *%Nurses and Pharm.*: The ratio of nurses and pharmacists relative to all employee (measured in full-time equivalent employees based on paid hours). The information is obtained from the HCRIS Worksheet S-3, Part II. Nurses and Pharmacists include Nursing Administration (Line Number 38), and Pharmacy (Line Number 40).
- *Log(Total Wages)*: The log of total wages. The information is obtained from the HCRIS Worksheet S-3, Part II.
- *%Core Wages*: The ratio of salary payment to nurses, physicians, and pharmacists relative to the payment to all workers. The information is obtained from the HCRIS Worksheet S-3, Part II. Core workers include Physician - Part A - Administrative (Line Number 4), Physician - Part A - Teaching (Line Number 4.01), Contract labor: Physician - Part A - Administrative (Line Number 13), Nursing Administration (Line Number 38), and Pharmacy (Line Number 40).
- *Log(Core Wage Rate)*: The log of hourly wages for nurses and physicians. The information is obtained from the HCRIS Worksheet S-3, Part II. Core workers include Physician - Part A - Administrative (Line Number 4), Physician - Part A - Teaching (Line Number 4.01), Contract labor: Physician - Part A - Administrative (Line Number 13), Nursing Administration (Line Number 38), and Pharmacy (Line Number 40).
- *%Admin Wages*: The ratio of salary payment to administrative and general workers (including contract labor) relative to the payment to all workers. 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).

B Patient Outcome and Satisfaction 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.

C Independent Variables

- *Target*: An indicator variable that turns to one for target hospitals after they are acquired.
- *PE-Backed Acquirers*: An indicator variable that turns to one for a target hospital after it is acquired by a PE firm or a PE-backed hospital.
- *PE-Backed Private Acquirers*: An indicator variable that turns to one for a target hospital after it is acquired by a private PE-backed hospital or a PE firm.
- *PE-Backed Public Acquirers*: An indicator variable that turns to one for a target hospital after it is acquired by a publicly traded PE-backed hospital.
- *Non-PE Backed Acquirers*: An indicator variable that turns to one for a target hospital after it is acquired by a bob-PE backed hospital.

D Control Variables

- *Log(Beds)*: The log of number of beds.

- *CMI*: The cost-mix index.
- *%Medicare*: The ratio of Medicare discharges relative to total discharges.
- *%Medicaid*: The ratio of Medicaid discharges 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 a t 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 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*