Hospital Behavior Over the Private Equity Life Cycle

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Private equity is an increasing presence in US healthcare, with unclear consequences. Leveraging unique data sources and difference-in-differences designs, we examine the largest private equity hospital takeover in history. The affected hospital chain sharply shifts its advertising strategy and pursues joint ventures with a rival industry. Inpatient throughput is increased by capturing more patients through the emergency department and managing shorter, less treatment-intensive stays. The hospitals also seem to shun births but are exposed to more uncompensated care. Outpatient surgical care volume declines, but remaining cases focus on higher complexity procedures. Importantly, behavior changes persist even after private equity divests. (JEL I11, I18, L21, L41)

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A pronounced shift among US businesses has taken place over the past quarter of a century. Prior to then, firms would typically raise capital via stock issues in public markets in order to finance expansions and investments as well as to shore up their balance sheets. However, 21st century corporate finance has witnessed the rise and now dominance of private funding to achieve these business aims (Mauboussin and Callahan 2020; McKinsey & Company 2022). Private market funding can originate among a mix of investment industries, such as real estate trusts and venture capital firms, but private equity (i.e., "PE") companies, specifically, loom large in this space, with extensive amounts of capital (i.e., "dry powder") available to deploy.[1] The prevalence and growth of private equity throughout the US economy has also attracted ambivalent views. While evidence suggests that these investors can improve companies' performance—and hence valuations—as well as drive job creation, some stakeholders may suffer, especially those working for the company now under private equity ownership and direction (Jensen 1986, 1988; Shleifer and Summers 1988; Kaplan 1989; Leslie and Oyer 2008; Davis *et al*. 2014; Argawal and Tambe 2016; Olsson and Tag 2017; Antoni *et al*. 2019; Davis *et al*. 2019).

A specific sector of the US economy that has been a prominent target for private equity funds and associated controversy is healthcare. In 2018 alone, $100 billion of private equity funding flowed into the sector—a roughly 20-fold increase compared to two decades prior (Appelbaum and Bratt 2020). And over the past ten years, nearly $800 billion of private equity capital in total has been invested into US healthcare companies (Scheffler, Alexander, and Godwin 2021). The well-documented aggressive push by private equity into healthcare is consistent with the industry perception that the opportunities and performance of these assets tend to eclipse the non-healthcare companies found within many private equity portfolios (Bain & Company 2022). However, a variety of industry participants, experts, advocates, and regulators have voiced concerns, if not objections, to this contemporary circumstance.[2]

[1] Industry reports estimate as much as $700 billion in currently available private equity funding for North American investments alone (see McKinsey & Company 2022).

[2] For example, the California legislature recently went as far as introducing a bill to curtail private equity investments in healthcare firms within the state. A media description and legislative history can be found here: https://www.wsj.com/articles/california-bill-to-rein-in-private-equity-health-care-buyouts-dies-11599250052.

More specifically, many question whether private equity's business objectives are compatible with patient's best interests (e.g., see Gondi and Song 2019; Gustafsson, Seervai, and Blumenthal 2019; Sanger-Katz, Creswell, and Abelson 2019; Sharfstein and Slocum 2019). Strong profit motives, coupled with set financial endpoints over relatively short time horizons (e.g., selling the company within six years), create high-powered incentives that could encourage rent-seeking behavior (e.g., consolidation to raise service prices) as well as efforts to distort provider agency away from what is optimal for patients. Consequently, a nascent literature has emerged to examine the implications of private equity investments in US healthcare.

Recent empirical work has explored private equity effects focused on nursing homes (Huang and Bowblis 2019; Braun *et al*. 2020, 2021a; Gandhi, Song, and Upadrashta 2020; Gupta *et al*. 2021) as well as physician practices (Tan *et al*. 2019; Konda *et al*. 2019; Braun *et al*. 2021b; Singh *et al*. 2022). There are indications that the involvement of private equity investors can lead to higher service prices and lower quality care within these industries; yet, the findings are mixed across studies—leaving these two strands of literature inconclusive. A complementary set of studies on a particularly noteworthy industry tied to private equity investments involves US hospitals. Not only is the hospital industry vital to the healthcare system, but in November 2006, financial history was made when the largest leveraged buyout deal across all sectors of the US economy took place as Bain Capital, Kohlberg Kravis Roberts (KKR), and Merrill Lynch Global Private Equity collectively acquired the Hospital Corporation of America (HCA) for $33 billion (HCA Healthcare 2006; Sorkin 2006; Dowd 2017).[3] At the time of the transaction, HCA operated as the largest for-profit hospital chain in the US and was a publicly listed US company (NYSE: HCA). After the historic "mega deal", HCA and its roughly 170 hospitals across 21 states remained under private equity control until returning to public markets in March 2011. The initial public offering (IPO) in 2011 is estimated to have netted Bain Capital over $1 billion (on an initial investment of just $64

[3] Of note, larger deals have since taken place, but this was the largest private equity deal in US history at that time.

million) and generated a return of over 200% for the remaining investors (Dowd 2017).[4] Despite the clear significance of this monumental acquisition and the prominence of the targeted company within US healthcare, surprisingly little is known about how this massive private equity takeover affected HCA hospitals.

A few obliquely related studies have explored private equity involvement in hospitals, more generally. Bruch, Gondi, and Song (2020) find that in the first three years following a private equity acquisition hospitals' charges and net income are higher, with virtually no changes in payer mix.[5] Similarly, Cerullo *et al*. (2021) interpret their findings as hospitals substituting toward more profitable service line offerings soon after a private equity investment is made. However, both studies have important limitations, including the reliance on self-reported and annual financial data, short-run analyses, and inability to observe actual care delivery outcomes. Cerullo *et al*. (2022) extend these previous two studies by examining utilization and health outcomes; however, the authors are confined to hospital stays for just five conditions and a single payer (Medicare) where they find no clear effects. They also fail to differentiate between investment and divestment activities by private equity firms. Finally, Liu (2022) brings commercially insured claims data to bear on this question. The author benefits from observed transaction prices (which are positively associated with private equity ownership), but the data are restricted to outpatient claims (i.e., no inpatient data) over the 2013-2019 period. The data therefore miss the period when HCA was under private equity control and barely span the typical ownership duration for a given private equity fund and its portfolio company.

We take a different approach. First, since the majority (57%) of all US hospitals undergoing private equity ownership over the past two decades belonged to HCA (Offodile *et al*. 2021), we focus our empirics on this specific healthcare market shock. Second, we intentionally examine the private equity *investment* as well as *divestment* decisions to capture hospital behavior changes over the full life cycle of private equity

[4] This specific IPO would be HCA's third public offering debut over its corporate history. The two previous IPOs occurred at its public company founding in the late 1960s and then in the early 1990s after a brief period of being privately held.

[5] In a related descriptive two-period ("long difference") study, Offodile *et al*. (2021) find that hospitals with private equity ownership between 2003 and 2017 are associated with higher charges and operating margins in 2017.

ownership. Third, we compile and leverage several data sources unique to this literature. We specifically benefit from proprietary data on hospital advertising expenditures as well as data from the Center for Medicare and Medicaid Services (CMS) obtained through a Freedom of Information Act (FOIA) request that detail ownership structures for the universe of ambulatory surgery centers (ASCs) operating across the US—an influential industry that rivals hospitals for profitable outpatient procedural care. These novel data assets allow us to directly investigate if the infusion of private equity capital and private equity management causes HCA hospitals to revise/expand its marketing activities and/or to engage in joint ventures with non-hospital companies. The latter strategic maneuver could create important opportunities for hospitals to diversify their revenue streams and/or recapture valuable referrals that would otherwise be lost to competitors. We then complement these national analyses with over a decade of all-payer encounter data from Florida—the state with the greatest density of HCA hospitals, accounting for nearly 30% of HCA aggregate hospital revenues, at the time of the private equity acquisition in 2006. Crucially, these all-payer data capture changes in payer mix, case mix, and treatment intensity across the two most important domains of hospital-based care (inpatient stays and outpatient surgical services), which directly speak to if, and how, hospital care delivery is impacted by the private equity funds' acquisition as well as their eventual liquidation of their ownership positions.

We rely on standard difference-in-differences (DD) empirical strategies across all three distinct data assets and components of our investigation. We ultimately find that the arrival of private capital and control leads HCA to adopt various new business strategies and deploy available financial resources in new ways among its corporate chain of hospitals. Specifically, HCA dramatically transitions from committing virtually no advertising funds for outdoor mediums (e.g., billboards) to spending over $1 million per quarter during and after its private equity acquisition. This marketing shift does not come at the expense of the other most common hospital advertising medium (television) and is in sharp contrast to other major hospitals and health systems throughout the US. HCA also begins to actively invest in an otherwise rival industry (ambulatory surgery centers, or ASCs) whose firms regularly compete away profitable outpatient procedural cases from hospitals. Prior to private equity ownership, HCA only infrequently entered into

ASC-related joint ventures; however, after being taken private, the company consistently acquires new ASC ownership stakes year-over-year, with a peak of 41 investments in 2010 alone. Similar to the findings for advertising expenditures, HCA's behavior while under private equity ownership (and beyond) is a clear departure from what is observed for other hospitals, health systems, and prominent ASC chains. Importantly, a new, more aggressive advertising campaign as well as acquiring more diversified revenue streams via strategic joint ventures are consistent with new management pressures (and possibly new and needed sources of capital) after coming under private equity ownership and direction.

Our clinical care findings from Florida HCA hospitals indicate that, under private ownership, HCA appears to focus more on increasing inpatient throughput. The number of admissions steadily rises, in part through drawing more patients through the hospitals' emergency departments. The share of hospital stays originating in the emergency department is as much as 20% higher than the baseline (pre-private equity) rate, and this behavior change is at least suggestive of strategic complementarities between wanting to attract more patients via the emergency department and more aggressively advertising to consumers (as noted above). At the same time, HCA hospital stays become shorter and less treatment intensive. Patients spend 5-10% less time in the hospital and are roughly 10% less likely to have any procedure performed during the stay soon after the private equity ownership transition. Despite the reduction in treatment intensity per stay, mortality rates are, if anything, slightly lower after HCA is under private equity control.

Of note, the greater emphasis on converting emergency department patients into inpatient stays appears to come at a cost. The share of HCA hospital stays falling into uncompensated care (i.e., bad debt and charity care) increases by 130% soon after the private equity acquisition and more than triples by the end of our analytic period. This financially undesirable effect is likely reflective of binding federal regulations (i.e., "EMTALA") that constrain hospitals' ability to avoid caring for indigent patients presenting to their emergency departments. Yet, HCA appears willing to accept this downside since it continues the emergency department throughput strategy—thereby increasing its uncompensated inpatient care exposure—even after the private equity owners cash-out.

Following the introduction of private equity ownership and direction, Florida HCA hospitals additionally pivot away from noteworthy service lines. Specifically, they strongly refrain from newborn deliveries (declines of 20% or more) for both the Medicaid and commercially insured markets. The reductions also take place without shutting down the labor and delivery units (i.e., an intensive margin effect, rather than extensive margin) and are indicative of a strategic shift to avoid less profitable, and perhaps even loss-making, hospitalizations. Interestingly, these same hospitals dial back their volume of outpatient surgery cases by 18-21% as well, without obviously discriminating against certain payers. However, the remaining cases are sharply more focused on higher complexity procedures, with higher list prices. Devoting more of their outpatient service delivery to higher complexity cases can also be a way to better leverage the hospital's comparative advantages in care production as well as insulate themselves against business stealing by rivals. Across both inpatient and outpatient care, HCA hospitals shift more of their care delivery to the (rapidly growing) Medicare Advantage market and witness declining shares of patients from the traditional (fee-for-service) Medicare program.

In sum, and in contrast with the modest related literature to date, our more comprehensive empirical estimates reveal a variety of substantive hospital behavior changes during and after private equity ownership. Importantly, many of these strategic shifts persist even after HCA reemerges as a public company. A plausible interpretation is that private equity ownership drives corporate changes that the hospital chain and its new public shareholders expect to be profitable over the long-run. The effects we document consequently suggest that private equity investors worked to make HCA a more successful and better positioned company, without obviously harming consumer welfare. While the contemporary influx of private equity funds into US healthcare continues to raise concerns, the evidence from a record-setting buyout does not reveal clear market failures that would encourage regulatory intervention.

I. Advertising Expenditures

A. *Data*

The advertising data are proprietary information collected by Kantar Media. The data exist for a host of economic sectors, firm types, product types, and mediums (e.g.,

outdoor, radio, television, etc.); however, we focus on hospitals and medical centers' advertising behavior in the outdoor (e.g., billboards) and spot television (TV) domains from 2003 through 2017 at the quarterly level. For each distinct advertising entity used in our analyses (described next), we calculate the aggregate amount spent by advertising domain in nominal ('000) dollars per quarter-year across all media markets ("DMAs"). DMAs are a longstanding industry construction that reflect collections of counties where common programming and accompanying advertisements take place. We are also able to examine changes in advertising behavior by using the "units" of advertisements purchased, as opposed to the expenditure amounts.

B. *Empirical Strategy and Estimation*

The treatment group is straightforward in our analytic context—i.e., it is HCA and all associated outdoor and TV advertising conducted in a given quarter-year. The inclusion criteria for control group hospitals/medical centers takes into account the fact that HCA is a national hospital chain with significant advertising activity throughout this 15-year study period. For example, in the early years of our analytic window HCA advertises within 17 unique DMAs, and during the later years, HCA advertises in as many as 40 distinct DMAs. Thus, we require members of the control comparison group to advertise in more than 5 but less than 80 DMAs. The upper limit is to ensure that we include other large hospital chains (e.g., Ascension advertises in 64 DMAs and Tenet advertises in 75 DMAs) but also to exclude national campaigns tied to hospital philanthropy seeking, advocacy efforts, and the like (e.g., American Hospital Association, St. Jude's network, etc.). We additionally limit the control group to advertisers with nonzero expenditures in all 60 quarters spanning 2003 to 2017. Doing so leaves us with 181 unique control group hospital systems/medical centers for the outdoor ad spending analyses and 182 unique controls for the TV ad spending analyses.

In the interest of transparency, we begin our empirics by plotting the raw data trends for HCA across the two advertising mediums of interest. We then do likewise for five prominent hospital chains (i.e., Ascension, LifePoint, Tenet, Trinity Health, and Universal Health Services) in order to implement a crude comparison of the raw data

trends from 2003-2017. We then move to a standard difference-in-differences (DD) event study estimation framework:

$$Y_{at} = \sum_{\substack{j=-16 \\ j\neq -8}}^{42} \delta_j \mathbb{I}[Treated_a \times (Time = j)] + \lambda_a + \gamma_t + \varepsilon_{at} \quad (1)$$

The parsimonious DD specification includes hospital advertiser (λ) and quarter-year (γ) fixed effects. Our hospital advertiser-by-time outcomes (Y) for each hospital advertiser (a) at quarter-year (t) are as described above, and the *Treated* variable is equal to one for HCA and zero otherwise. The resulting series of delta coefficients (δ_j) can inform the presence or absence of differential trending across the treatment and control groups prior to the private equity event (t = 0) as well as any differential behavior (and any dynamics in the effects) after HCA newly enters private equity ownership during the fourth quarter of 2006 and when private equity ownership is terminated by the second quarter of 2011 (t = 16). The standard errors are clustered at the advertiser level (182 and 183 distinct entities for the outdoor advertising expenditures and the TV advertising expenditures estimations, respectively).

C. *Results*

Figure 1 describes HCA national advertising expenditures per quarter for each of the two mediums of interest. Interestingly, from 2003 through 2006, HCA outdoor advertising was limited (typically less than $100,000 per quarter) while TV advertising was often several multiples of the outdoor advertising levels—suggesting that the company marketing strategy was primarily focused on reaching consumers through TV, rather than outdoor signage (e.g., billboards next to busy roads). During the second year of private equity ownership, however, the HCA marketing strategy appears to take a dramatic and permanent shift. The TV trend is fairly consistent over the remaining years of data (though with seasonality), but outdoor quarterly advertising increases to over $1 million by the conclusion of private equity ownership in early 2011 and remains on an upward trajectory that eventually peaks at approximately $1.7 million in quarterly expenditures

by 2017. Importantly, the more than 10-fold increase in outdoor advertising spending is not simultaneously occurring with HCA hospital chain expansion. In fact, when examining the aggregate supply of HCA hospitals across the US and over time, there is little indication that the company begins to agressively buy-up or develop new hospitals when coming under private equity ownership. The total number of HCA hospitals actually declines from its highest point in 2004 to a nadir in 2012 (Appendix Figure A1). Thus, higher HCA advertising expenditures are not driven by an increase in the number of hospitals belonging to the chain.

Figure 2 goes further and demonstrates that the abrupt and large advertising strategy shift by HCA is not observed by other prominent hospital chains. HCA's outdoor advertising activity is below average among this subset of hospital chains during the 2003-2006 period, and its upward climb starting in 2008 is also not mirrored by the other chains. The non-HCA trends in Figure 2 show seasonal fluctuations but are otherwise largely flat for this 15-year period. Figure 3 formally tests for HCA differential advertising behavior using our full set of control comparison units described in Section IB and the event study specification given by Equation (1). It is clear from panel (a) and panel (b) in Figure 3 that even with the inclusion of many more control comparison units, the DD event study estimates largely recover the same pattern for HCA advertising behavior change as revealed in Figures 1 and 2. Specifically, the abrupt trend change and magnitude of outdoor advertising expenditures appears unique to HCA over this period and suggests a tactical management change (and possibly use of fresh capital) after the company becomes privately held.

II. ASC Ownership Stakes

A. *Background and Data*

Medical services have been rapidly migrating to outpatient delivery for many years (Munnich and Parente 2018; Baker, Bundorf, and Kessler 2019)—with even the hospital industry demonstrating inpatient and outpatient revenue streams that are now roughly equal in size (AHA 2020). Ambulatory surgery centers (ASCs), however, rival hospitals and often steal profitable business belonging to traditional Medicare and privately insured patients from hospitals' outpatient surgical departments (Munnich and Parente 2014;

MedPAC 2021). The ASC industry currently captures 60% or more of all outpatient procedural care (Frack, Grabenstatter, and Williamson 2017) and is composed of over 5,000 individual firms spread out across the US (Munnich and Richards 2022), with a total market value approaching $30 billion.[6] ASCs are also overwhelmingly privately held, for-profit firms where physicians' financial interests are known to directly influence the choice over treatment setting—i.e., opting for an ASC versus a hospital outpatient department for a given case (e.g., Munnich *et al*. 2021; Richards, Seward, and Whaley 2021; Geruso and Richards 2022). That said, hospitals are also known to pursue joint ventures with the ASC industry—consistent with a "can't beat them, join them" business strategy in contested markets. Doing so can diversify hospitals' revenue streams and possibly even allow hospitals to share in the financial gains that surrounding ASCs enjoy at the expense of rival hospitals.

To test if private equity ownership influences HCA's strategic decisions concerning ASC joint ventures, we leverage data on ASC ownership details that was obtained by a FOIA request to the Centers of Medicare and Medicaid Services (CMS) in April 2019. The data provide an exhaustive list of individual owners (most commonly physicians) as well as organizational owners (e.g., hospital, health systems, ASC corporate chains, limited liability corporations, as well as institutional investors) belonging to a uniquely identified ASC. A complete ownership record is observed so long as the relevant ASC was certified by Medicare and operational by January 1st, 2005 or later. This latter data limitation means that we cannot observe ASCs that shutdown before January 2005; however, for ASCs still open as of January 2005, even if their market debut was many years prior to 2005, we are able to reconstruct their complete historical ownership record (both the name of the owner and the timing of ownership).[7]

B. *Empirical Strategy and Estimation*

[6] An industry press article remarking on these forecasts can be found here: https://www.beckersasc.com/asc-news/asc-market-to-hit-33b-by-2028-7-other-analysis-takeaways.html.

[7] Further descriptions of the FOIA data as well as estimates of the effects of physician-level ownership in ASCs can be found in Munnich *et al*. (2021).

Paralleling our empirics for advertising expenditures, we begin by presenting the raw counts of new ASC ownership events by year for HCA as well as seven other nationally recognized hospital chains present in the ASC ownership data. The seven comparison chains are Ascension, Catholic Health Initiatives, Community Health Systems, LifePoint, Tenet, Trinity, and Universal Health Services. We then extend the analyses to a DD event study setup. A challenge in doing so is that the FOIA data does not classify owners with any granularity beyond "individual" and "organization". Thus, we cannot simply subset to hospitals and health systems. Instead, we manually examine over 6,000 distinct organization names belonging to the "organization" subgroup and retain 125 unique entities (with HCA as one of those entities) that are recognizable as either large hospital systems, hospital chains, ASC chains, or national institutional investors—excluding the three private equity firms involved in the HCA takeover in 2006. Of note, the overwhelming majority of entities were small private firms (i.e., "LLCs" and "LLPs") and financiers.[8]

For each ASC investor entity, we calculated the total number of new ASC ownership investments made per year from 2000 through 2014, which includes true zeros for a given investor-year pairing. The accompanying DD estimating equation is as follows:

$$Y_{it} = \sum_{\substack{j=-7 \\ j\neq -1}}^{7} \delta_j \mathbb{I}[Treated_i \times (Time = j)] + \theta_i + \gamma_t + \varepsilon_{at} \qquad (2)$$

The specification in Equation (2) includes ASC investor (θ) and year (γ) fixed effects. The outcome (Y) for ASC investor (i) in year (t) is the aggregate number of new ASC investments, including zero when appropriate, and the *Treated* variable is equal to one for HCA and zero otherwise. Just as before, we use the resulting series of delta coefficients (δ_j) to examine differential trends in the outcome for HCA before, during,

[8] Additionally, many entities show up multiple times due to slight derivations in company names over time, which further shrinks the number of truly distinct ASC investor entities observed among the over 6,000 we began with.

after its private equity takeover. The standard errors are clustered at the ASC owner entity level—125 in total.

C. *Results*

Figure 4 shows that HCA engaged in relatively few new joint ventures with its ASC rivals prior to 2007—a trend common amongst the other seven hospital chains shown in Figure 4. However, once HCA becomes a privately held company, there is a striking uptick in ASC joint ventures. 17 are made in 2008 alone. Then, there is a more than doubling in 2010 when 41 new joint ventures take place before a fall in new ASC investments in 2011 when 13 occur for HCA.[9] The strategic shift also appears to persist after HCA re-emerges as a public company after early 2011. Importantly, none of the other seven hospital chains demonstrate comparable behavior over this period. HCA investment activity in the rival ASC industry is a clear outlier, which we formally test with Equation (2) and our wider set of control comparison ASC investors described above. The event study DD estimates are presented in Figure 5 and reaffirm what is seen in the raw data trends belonging to Figure 4. HCA demonstrates no differential behavior in the lead up to private equity ownership, but then becomes differentially involved in ASC joint ventures during the private equity period and continues to do so even after private equity returns the hospital chain to public markets.

III. Patient Care

A. *Data*

We benefit from the universe of inpatient and outpatient (ambulatory) surgery discharge records that encompass all hospitals and all payers in Florida (including the self-insured and bed/debt charity care groups). The data are maintained and distributed by the Florida Agency for Health Care Administration (AHCA) and span 2003 through 2013. The encounter data are also at the quarter-year level and contain rich information on patient characteristics, services received, and payer type. Such historical and comprehensive data

[9] Of note, the lack of ASC investments in 2009 (which is seemingly off-trend) is not necessarily surprising since this would be the year of the Great Recession—presenting a host of financial challenges and liquidity constraints for firms across the US economy.

are crucial to studying HCA hospitals' behavior over the full private equity lifecycle (i.e., private equity investment and divestment financial endpoints), especially to observe sufficient pre-investment and post-divestment time windows.

Additionally, Florida is a key state for the national HCA hospital chain at the time of its private equity takeover. According to the American Hospital Association (AHA) annual survey, Florida had the greatest density of HCA hospitals of any state in 2006, with only Texas having a comparable number.[10] Florida HCA hospitals also accounted for $24.7 billion in aggregate hospital revenues (29% of national HCA hospital revenues) in that year. On average, Florida HCA hospitals are similar in size (in terms of bed counts) as well as the quantity of full-time workers when compared to HCA hospitals found elsewhere around the US (Table 1). Both sets of HCA hospitals have just under a 6% average operating margin in 2006 as well (Table 1). Taken together, the quality of the historical inpatient and outpatient data, coupled with the relevance of Florida to the HCA company at the time of private equity acquisition, suggests that these analyses can complement the empirics from Sections I and II and generate valuable insights regarding actual clinical care delivery adjustments made by HCA hospitals during and after private equity ownership—something that is conspicuously absent from the existing empirical literature.

B. *Empirical Strategy and Estimation*

We first match hospitals using hospital name and exact address from the discharge data to HCA ownership information (by year) according to the corresponding AHA survey data. Then, for our treatment (HCA) and control (non-HCA) Florida hospitals, we restrict to general acute care hospitals consistently present in the Florida discharge data from Q1 2003 through Q4 2013. Doing so leaves us with 35 HCA hospitals and 101 control hospitals observed in the analytic data.[11]

[10] For example, the third most HCA hospital dense state was Georgia, but it only had one-third the number of HCA hospitals as those found in Florida. Authors' calculations from the 2006 AHA data.

[11] Of the 39 Florida HCA hospitals observed in the AHA data in 2006 (Table 1), one is a specialty hospital, one is divested from HCA, and two are not consistently classified as general acute care hospitals in the Florida discharge data. Also, two control group hospitals do not have an outpatient surgery department and are therefore not present in the outpatient-specific analyses.

For the inpatient analyses, we first examine hospital-by-quarter total admissions (i.e., hospital stays), share of patients classified as emergent, the share of patients originating from the hospital's emergency department, the presence of a labor and delivery unit, and the share of inpatient admissions for births. To examine changes in treatment intensity, we restrict to non-birth hospital stays and measure the length of stay (LOS), share of stays involving at least one procedure, share of stays involving a cardiac procedure (e.g., cardiac catheterization), share of stays involving surgery, share of stays with laboratory testing, share of stays with radiology testing (e.g., CT and MRI scans), share of stays involving use of the intensive care unit (ICU), average total charges per stay (nominal thousands of dollars), and the inpatient mortality rate. We then examine any shifts in payer mix using a mutually exclusive and exhaustive set of payer-specific variables (i.e., bad debt/charity care, commercial, Medicaid, Medicare Advantage, Medicare FFS, self-insured, and an 'all others' composite group). When moving to the outpatient procedural discharge records (i.e., the hospital outpatient departments, or HOPDs), we measure the aggregate case volume, number of unique physicians performing cases at a given HOPD, a constructed case complexity index, the volume of procedures using laparoscopic technology, use of any robotic technology, and the average total charges per case in nominal thousands of dollars.[12] Across both discharge data sets, we collapse the data to the hospital-quarter-year level for our DD analyses.

We implement two versions of a DD estimation. The first is the more standard 2x2 setup, with the exception that we use two distinct post-periods in the specification (i.e., one for during and one for after private equity ownership). We then translate the DD

[12] Our case complexity index is derived from the current procedural terminology (CPT) code-specific facility fees from the traditional (i.e., FFS) Medicare fee schedule for outpatient procedures. While HOPDs are paid via "ambulatory procedure codes" (APCs), which are groupings of CPTs, Medicare annually (and publicly) posts a CPT-level fee schedule for ASCs. Since 2008, ASC fees have been mechanically linked to HOPD fees for the same service (e.g., see Munnich and Richards 2022), which creates a correspondence to the CPTs listed in the discharge records for a given HOPD case (note, no APCs are listed in the data and we are unaware of a readily available crosswalk). Additionally, Medicare aims to reimburse providers for average costs—creating an imperfect gradient of case complexity, proxied by Medicare reimbursement level. To capture variation in the mix of cases (rather than idiosyncratic fluctuations in reimbursement levels) over time, we impose the 2011 CPT-level Medicare facility fee schedule on our full analytic data. 2011 was also the year the fee reforms that mechanically linked ASC and HOPD fees going forward were fully phased in. Use of laparoscopic or robotic technology for a given case is identified by the corresponding CPT codes listed on the relevant discharge record.

analyses into a full, flexible event study spanning the 11-year analytic period. Both specifications include hospital (η) and quarter-year (γ) fixed effects and cluster the standard errors at the hospital level. *Y* are the outcomes of interest for each hospital (*h*) in quarter-year (*t*).

$$Y_{ht} = \delta_1 PEOwnership_{ht} + \delta_2 PEDivestment_{ht} + \eta_h + \gamma_t + \varepsilon_{ht} \quad (3)$$

$$Y_{ht} = \sum_{\substack{j=-15 \\ j\neq -3}}^{28} \delta_j \mathbb{I}[Treated_h \times (Time = j)] + \eta_h + \gamma_t + \varepsilon_{ht} \quad (4)$$

In Equation (3), *PEOwnership* turns on for the 35 treatment group HCA hospitals during HCA's private equity ownership (Q4 2006 through Q1 2011), with *PEDivestment* turning on immediately after (Q2 2011) when HCA has returned to public markets. Equation (4) has an identical interpretation as our previous event study models in Sections I and II.

C. *Inpatient Care Results*

Table 2 shows that HCA hospitals increase their admissions over time, especially by the time of private equity sell-off when the number of inpatient stays per quarter is 12% higher than during their pre-private equity period (2003-2005). Columns 2 and 3 in Table 2 reveal that a likely mechanism to increase their admissions is bringing in more patients via the hospitals' emergency departments. Inpatients admissions are both more likely to be classified as emergent status during and after private equity ownership as well as being transferred to the inpatient side through the hospital's own emergency department. For the latter behavior change, specifically, the relative increases over HCA hospitals' baseline are 7% during private equity control and climbing to nearly 16% following divestment. The corresponding event study estimates in Figure 6 align with these interpretations.[13] There is an absence of differential trending in the pre-acquisition period

[13] Of note, a span of four quarters is excluded for the outcome capturing the share of inpatient admissions originating in the hospital's own emergency department. During this time, the data administrators transitioned to a new variable to record this information, which involved a transition period for hospitals that permitted optional recording of the information (and hence low and inconsistent reporting across

for HCA hospitals, and then all three outcomes show positive trend changes once private equity ownership begins, with the behavior changes persisting even after HCA transitions back to being a public company.

While more patients are coming through HCA emergency departments and increasing inpatient volumes over time, the estimates in Table 3 indicate that these additional admissions are not coming from births—a service line that is typically unprofitable for hospitals (Cerullo *et al*. 2021). There is only suggestive evidence in Table 3 and Figure 7 that the affected hospitals are closing down their labor and delivery units; instead, there is an intensive margin adjustment whereby these hospitals continue to provide labor and delivery care but do substantially less of it over time. Once HCA is privately held, the share of inpatient stays for a newborn birth falls by approximately 13% compared to the pre-period rate (Table 3 and panel (b) Figure 7), with the effect larger (20% decline in column 2 of Table 3) after private equity liquidates its ownership position. Importantly, the event study estimates in Figure 8 reveal that the relative shrinking of labor and delivery care is found among the commercially insured as well as Medicaid insurance groups—the two most common payers for births nationally. The intensive margin effect is also present among HCA hospitals with a consistently open labor and delivery unit throughout our study period (panel (a) Figure 8)—again revealing the intensive margin effect.

Table 4 examines the treatment intensity of inpatient care for the hospital stays that are not newborns. According to the previous results in Tables 2 and 3, these non-birth admissions are unsurprisingly trending up over time, but rather than private equity owners pushing care delivery teams to engage in more aggressive or complex (and plausibly higher reimbursing) care for these patients, HCA hospitals transition to a strategy of shorter, less care-intensive hospital stays. For example, the average length of stay (LOS) falls by roughly 3% during private equity ownership and then by 9% following divestment. At the same time, the share of inpatient admissions including any procedures declines by 4% and 8% for the private equity investment and divestment periods,

hospitals, time, and discharge records). The exclusion of these variable transition quarters is the reason for the drop in observations in column 3 of Table 2 and the four missing event time plotted estimates in panel (c) of Figure 6.

respectively. Even the share of hospital stays involving a surgery or ICU use declines with time. Despite the consistent reductions in treatment intensity over this period, average mortality rates for HCA hospitals exhibit a suggestive drop of 7-10% relative to their pre-private equity performance (column 9 in Table 4). There is some evidence that HCA hospitals also increase their charges (i.e., "list prices") in column 10 of Table 4; however, the estimates are not precise and imply perhaps modest changes of 2-4%. The event study estimates in Figure 9 as well as Appendix Figure A2 reinforce the inferences drawn from Table 4 and the underlying (and simpler) 2x2 DD specification from Equation (3). Taken together, the results from Table 4, Figure 9, and Appendix Figure A2 are consistent with a new company-wide strategy that prioritizes throughout in the hospitals (i.e., more admissions but shorter stays) instead of maximizing service intensity/complexity for a given admission once private equity becomes involved.

The findings in Table 5 also demonstrate that the mix of payers noticeably shifts during and after private equity ownership. Specifically, the share of hospital stays written off as bad debt or charity care (i.e., uncompensated care) jumps by 130% once HCA is taken private and is more than triple the baseline level after HCA returns to public markets. This large uptick (from a low base) is consistent with a potential downside from attracting more patients to a hospital's emergency department (e.g., via increased advertising—Section I): more uncompensated care due to an absence of insurance and the binding federal EMTALA regulations that require the patient to be seen and stabilized irrespective of ability to pay. Exposure to the Medicaid market declines in the short-run; though, the event study results in panel (b) of Figure 10 indicate that some of this shift predates the arrival of private equity owners for the hospital chain. The estimates in Table 5 as well as panel (c) and panel (d) of Figure 10 suggest a gradual decline in traditional (i.e., FFS) Medicare's share of HCA hospitals' payer mix and a seemingly sharp increase in the share of admissions devoted to Medicare Advantage patients. Appendix Figure A4 presents the remaining event study findings tied to the outcomes contained in Table 5.

D. *Outpatient Care Results*

Moving to the outpatient surgery side of hospital care delivery (i.e., the HOPDs) in Table 6, we see substantive drops in total case volumes per quarter for HCA hospitals. The

magnitude of the effect is roughly 18-21% compared to their per-period average output and fairly stable during the private equity ownership phase and the chain's re-emergence as a public company (panel (a) Figure 11). Importantly, the decline in quantities of outpatient surgeries is present even when restricting to the two dominant payers within this space (Appendix Figure A6)—i.e., the commercially insured and traditional (FFS) Medicare markets (Hall *et al*. 2017).

Notwithstanding the lower levels of HOPD activity among HCA hospitals, they strongly focus on higher complexity cases once under private equity ownership (column (3) in Table 6). The investment and divestment periods demonstrate relative effects sizes of 23-36%, respectively, and the behavior change is immediate and growing as evidenced by the event study results in panel (b) of Figure 11. Interestingly, the volume of cases utilizing laparoscopic technology decreases by 17-32% over these same periods—indicating that the higher complexity cases are not tied to the use of the otherwise costly technology (which is often associated with higher reimbursements). While use of robotic technology for outpatient surgery is quite rare across all hospitals during this time span, HCA hospitals do seem to differentially adopt the technology—and hence make costly capital investments—by the end of our study period (column 5 in Table 6 and Appendix Figure A5). Doing so is at least consistent with continuing a long-run strategy of targeting more complex and technologically advanced cases within the outpatient surgery market. Additionally, given the shift toward higher complexity outpatient procedures, it is unsurprising that total charges (i.e., "list prices") for these cases climbs by 13-23% during and after private equity ownership (column 6 in Table 6; panel (d) in Figure 11).

We conclude our patient care empirics with an examination of payer mix changes for HCA outpatient surgeries in Table 7 and Figure 12. As these are uniformly elective services, the exposure to uncompensated care (i.e., bad debt/charity cases) is expectedly small and unchanged with private equity ownership (column 1 of Table 7)—which also contrasts with what was observed for inpatient care in Section IIIC. Likewise, there seems to be greater avoidance of Medicaid outpatient procedures, at least in the short-run. The share of outpatient procedures devoted to Medicaid patients declines by roughly 30% after the private equity acquisition (column 2 of Table 7); the share also does not rebound until the divesture occurs in early 2011 (panel (a) in Figure 12). Not unlike what was

evident for inpatient care in Section IIIC, there is a modest and gradual decline in traditional (FFS) Medicare's component of the hospital chain's HOPD payer mix, with a largely offsetting increase in exposure to the Medicare Advantage market. The greater tilt toward Medicare Advantage outpatient surgery cases, specifically, is both sharp and growing throughout the investment and divestment periods (panel (b) in Figure 12). The 2x2 estimates in column 4 of Table 7 indicate that the relative changes are as much as an 82% increase over the affected hospitals' (admittedly low) baseline rates. Interestingly, there is some suggestive evidence that, following the private equity acquisition, HCA hospitals provide more outpatient procedural care for cash-paying patients—though this is relatively rare at the outset and the event study findings in panel (d) in Figure 12 lack sufficient precision to draw clear inferences.

IV. Conclusions

Private equity is playing a growing role within US healthcare, with no sign of abating. Many stakeholders, policymakers, and regulators have raised questions about the potential effects on patients and the healthcare system; some have already gone so far as to advocate for prohibiting private equity investments in key healthcare industries. Yet, the rhetoric and public discourse has so far outpaced the evidence.

To help close this knowledge gap, we deliberately leverage several advantageous data sources that are unique to the existing literature and allow us to go well beyond the few and limited empirical studies on private equity involvement in US hospitals known to date. While our DD estimations show a variety of important—and sometimes large—behavior changes, they are consistent with the private equity owners deploying new strategic management decisions as well as financial resources to permanently shift the HCA hospital chain into a new, better performing state. More patients are transferred into inpatient care via the hospital's emergency department, but hospital stays are also shorter and less intensive. There is also no evidence of quality care erosion. Mortality rates are, if anything, slightly lower. Although HCA hospitals shrink (but not close) their labor and delivery units following the private equity acquisition, they simultaneously accommodate two- to three-times as many uncompensated (charity) care hospitalizations as they did prior to being privately held. On the outpatient procedural care side, private equity owners

seem to emphasize playing to the hospitals' comparative advantage—i.e., do fewer total cases but focus on the higher complexity surgeries. Higher complexity cases are typically tied to higher reimbursements and may be more difficult for competitors to steal due to the more extensive physical and human capital inputs belonging to their production functions. HCA also adopts a new direct-to-consumer advertising strategy, which leads to much greater advertising expenditures in aggregate. The company simultaneously becomes an early adopter of the now common hospital-ASC joint venture strategy. Each of these substantive business decisions may have never occurred in the absence of outside management (i.e., private equity ownership) and possibly the absence of outside capital––e.g., if liquidity constraints were tighter prior to the influx of private funding.

In sum, the record-making leveraged buyout of HCA mattered for financial history as well as the short- and long-run behavior and performance of the hospital chain. However, the strategic shifts do not obviously point to consumer harms and market failures. Policymakers and regulators may therefore do more to protect consumer welfare by maintaining their focus on blunting anticompetitive effects in hospital markets tied to horizontal integration (e.g., see Gowrisankaran, Nevo, and Town 2015; Schmitt 2017; Cooper *et al*. 2019; Beulieu *et al*. 2020; Gaynor *et al*. 2021; Prager and Schmitt 2021) and/or vertical integration with physician practices (e.g., see Baker, Bundorf, and Kessler 2016; Carlin, Feldman, and Dowd 2016; Koch *et al*. 2017; Dranove and Ody 2019; Lin, McCarthy, and Richards 2021; Richards, Seward, and Whaley 2021; Whaley *et al*. 2021), as opposed to trying to limit the mix of financing models and ownership structures used throughout the industry.

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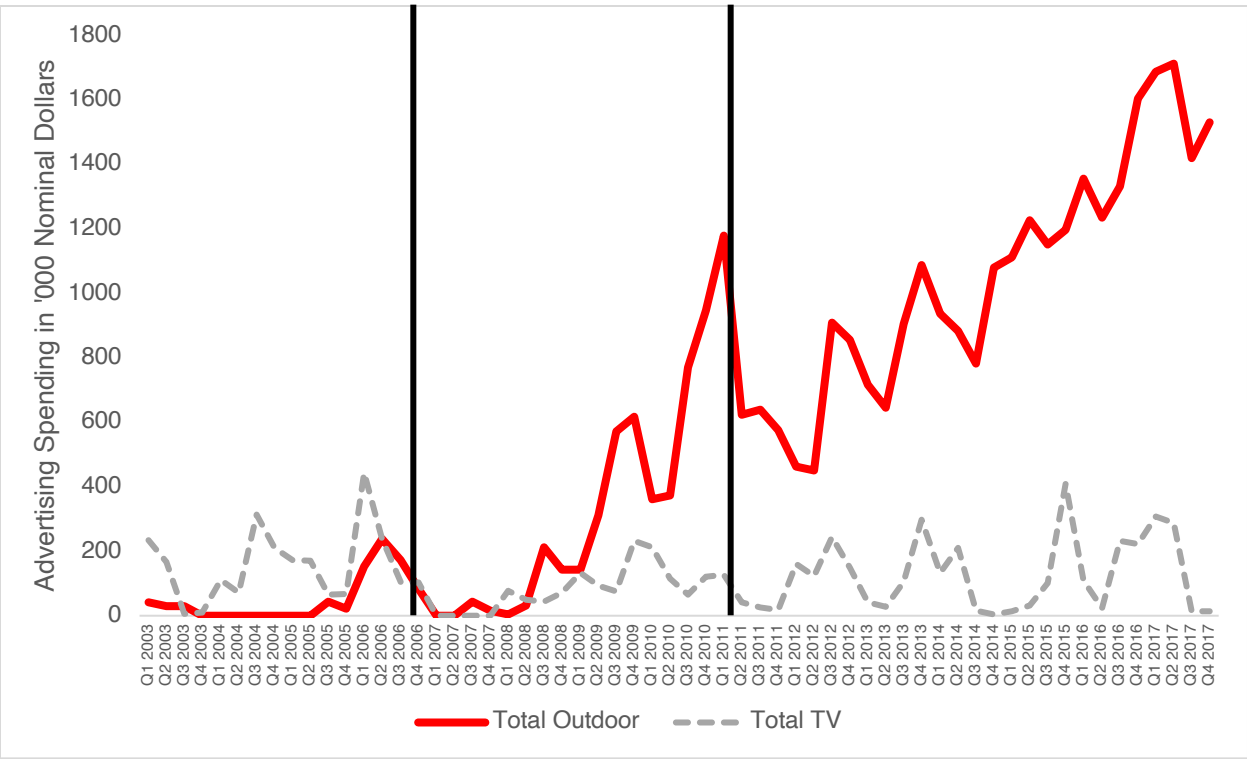


FIG 1. NATIONAL HCA ADVERTISING SPENDING OVER TIME BY MEDIUM

Notes: Advertising data are from Kantar Media and span the first quarter of 2003 through the final quarter of 2017. Advertising expenditures are in thousands of dollars and nominal terms. The vertical lines indicate the beginning and end of private equity ownership of the HCA hospital chain.

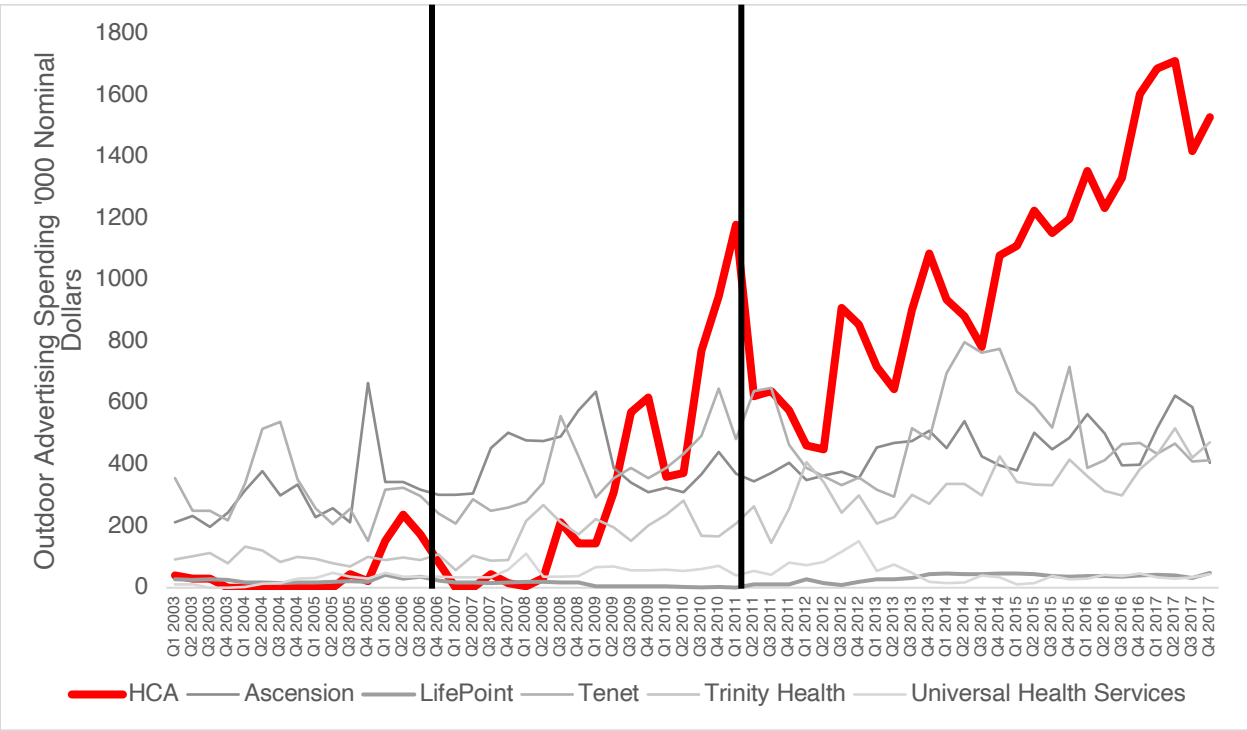
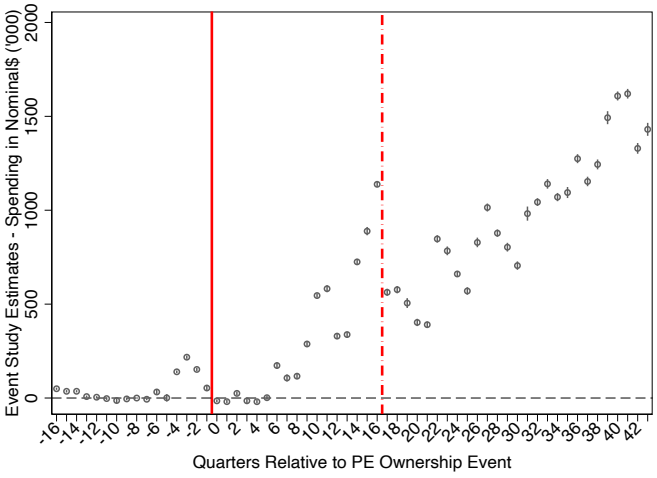
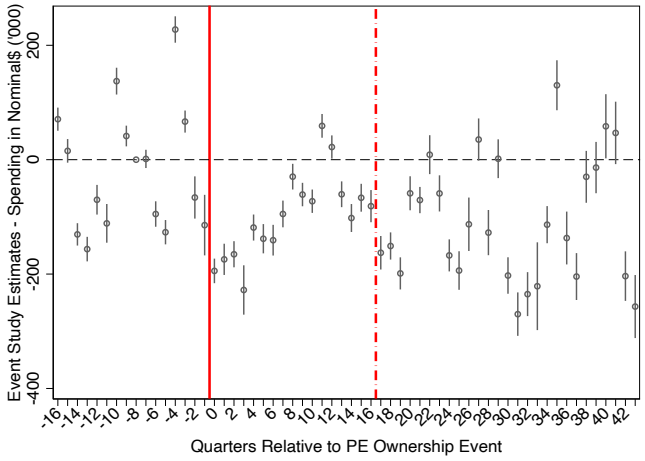


FIG 2. COMPARING HCA OUTDOOR ADVERTISING TO OTHER PROMINENT HEALTH SYSTMES 2003-2017

Notes: Advertising data are from Kantar Media and span the first quarter of 2003 through the final quarter of 2017. Advertising expenditures are in thousands of dollars and nominal terms. The vertical lines indicate the beginning and end of private equity ownership of the HCA hospital chain.



(a) Outdoor



(b) Television

FIG 3. DIFF-IN-DIFF EVENT STUDY ESTIMATES FOR PRIVATE EQUITY OWNERSHIP EFFECTS ON HCA ADVERTISING EXPENDITURES

Notes: Advertising data are from Kantar Media. There are 181 control group units in panel (a), and 182 control group units in panel (b). Controls are comprised of large hospital chains and health systems.

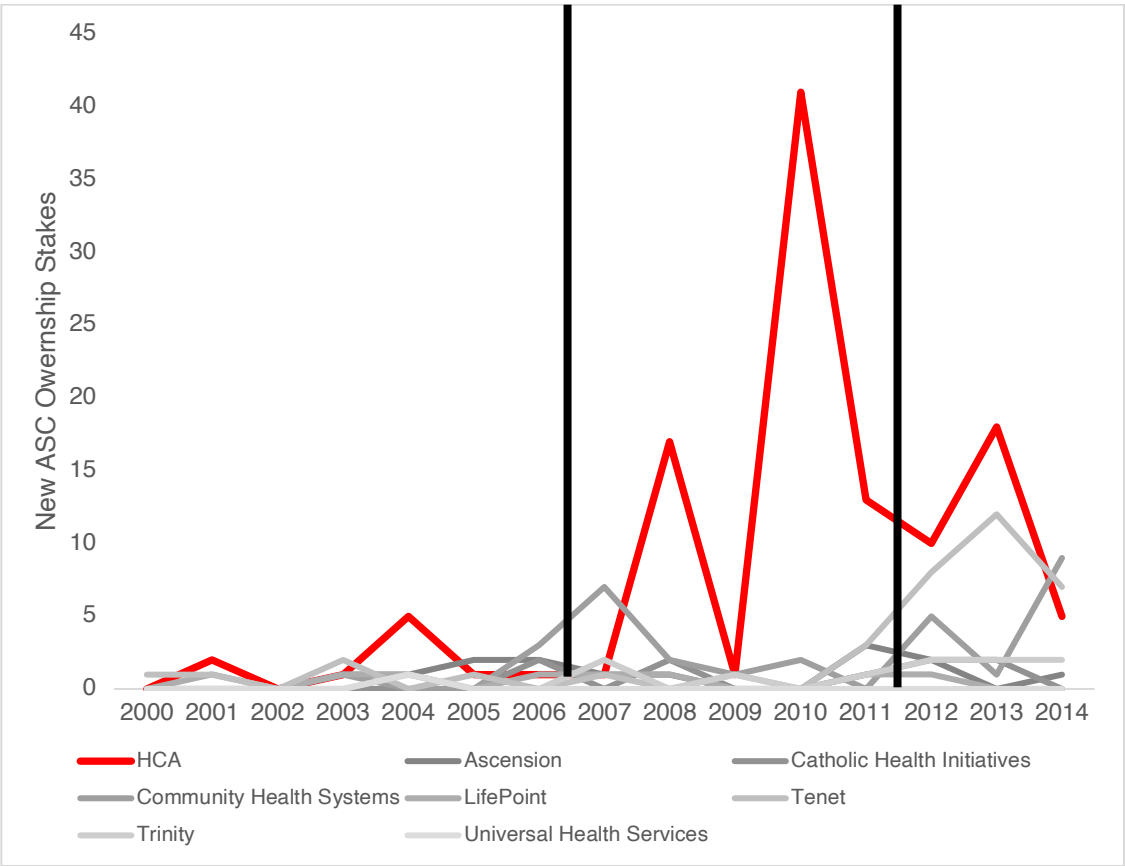


FIG 4. COMPARING HCA OWNERSHIP STAKES IN AMBULATORY SURGERY CENTERS TO OTHER PROMINENT HEALTH SYSTEMS 2000 – 2014

Notes: Count of new ambulatory surgery center (ASC) ownership stakes made per year. ASC ownership information is from a FOIA request to the Centers for Medicare and Medicaid Services (CMS). Vertical bars demarcate the years of private equity ownership for HCA.

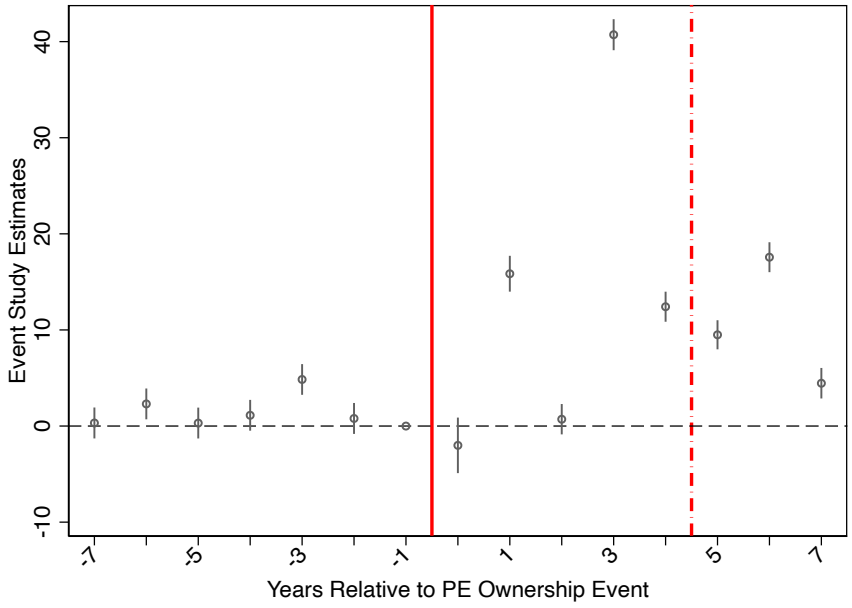


FIG 5. DIFF-IN-DIFF EVENT STUDY ESTIMATES FOR PRIVATE EQUITY OWNERSHIP EFFECTS ON HCA ASC OWNERSHIP STAKES

Notes: Ownership data are from a FOIA request to CMS. There are 124 distinct control group units in the underlying estimation, which is a mix of large hospitals, health systems, ASC chains, and institutional investors.

TABLE 1—COMPARING FLORIDA HCA HOSPITALS TO HCA HOSPITALS IN OTHER STATES IN 2006

	Florida HCA Hospitals	All Other States HCA Hospitals
	Mean (SD)	Mean (SD)
Number of Beds	232.3 (98.3)	208.9 (177.4)
Number of Admissions	11,252.2 (5,230.7)	9,461.3 (8,375.4)
Full-Time Equivalents	779.5 (376.7)	781.7 (737.2)
Total Revenue ($ millions)	633 (330)	496 (484)
Operating Margin (%)	5.6 (13.5)	5.8 (17.6)
Observations (N)	39	127

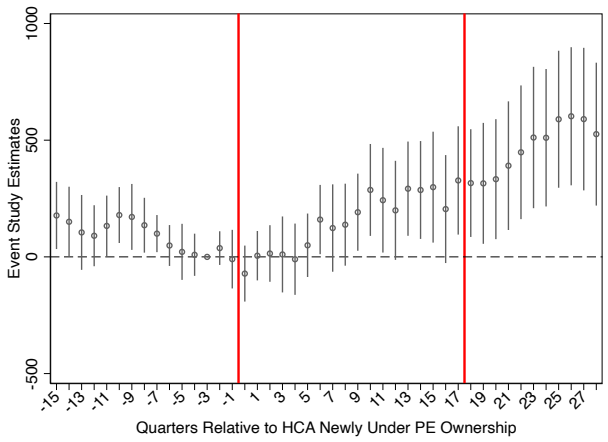
Notes: Data are from the American Hospital Association (AHA) 2006 annual survey and Cost Reports (HCRIS). Six non-Florida hospitals could not be matched to the Cost Reports data. In 2006, Florida contains the most HCA hospitals of any state and represents 24% of HCA hospitals. These same Florida HCA hospitals also account for 29% ($24.7 billion) of total hospital revenues for the HCA system reported in the 2006 Costs Reports.

TABLE 2—DIFF-IN-DIFF ESTIMATES FOR PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON HOSPITAL INPATIENT THROUGHPUT

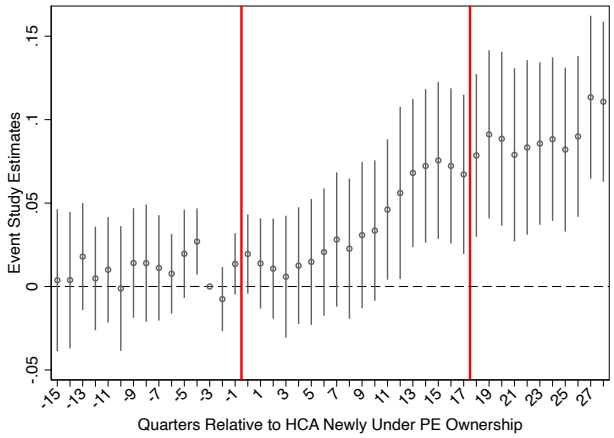
	Number of Admissions	Share of Patients Classified as Emergent	Share Admitted through Hospital Emergency Department
	(1)	(2)	(3)
1[PE Ownership]	62.8	0.028*	0.043***
	(76.1)	(0.016)	(0.010)
1[PE Divestment]	376.7***	0.081***	0.090***
	(138.7)	(0.023)	(0.017)
Hospital Fixed Effects	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes
Unique Hospitals	136	136	136
Observations (N)	5,984	5,984	5,440
HCA 2003-2005 Outcome Mean	3,134	0.56	0.58
Controls 2003-2005 Outcome Mean	3,950	0.52	0.55

Notes: Analytic data are from the universe of Florida inpatient discharge records collapsed to the hospital-quarter-year-level. Analyses are restricted to general, short-term acute care hospitals consistently observed from Q1 2003 through Q4 2013. There are 35 unique hospitals in the HCA treated group. "PE" stands for private equity. Four consecutive quarters are unusable for the outcome in column (3) due to a data recording transition that was phased in over a year. Standard errors clustered at the hospital level

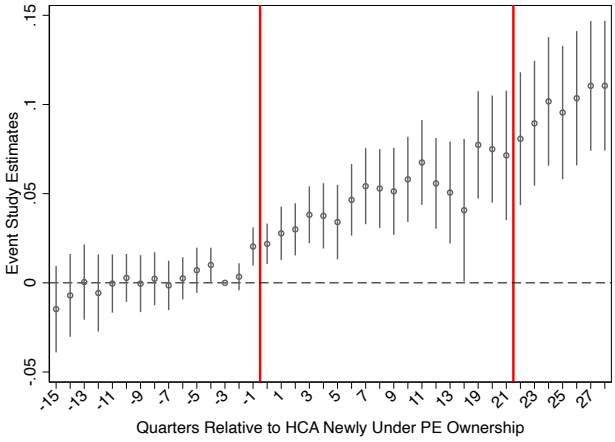
*** P value at 0.01 ** P value at 0.05 * P value at 0.10



(a) Number of Admissions



(b) Share of Patients Classified as Emergent



(c) Share Admitted through Hospital Emergency Department

FIG 6. DIFF-IN-DIFF EVENT STUDY ESTIMATES CORRESPONDING TO TABLE 2

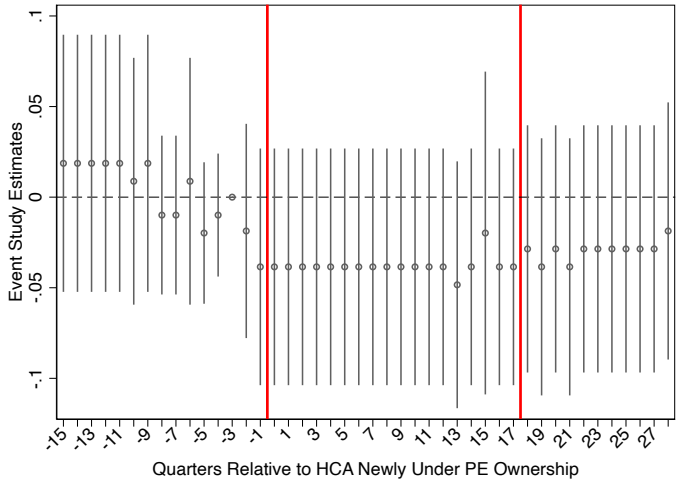
Notes: Outcome definitions and analytic samples are identical to those reported in Table 2. Vertical bars bookend private equity ownership of HCA. Four consecutive quarters are unusable for the outcome in panel (c) due to a data recording transition that was phased in over a year.

TABLE 3—DIFF-IN-DIFF ESTIMATES FOR PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON HOSPITAL LABOR AND DELIVERY

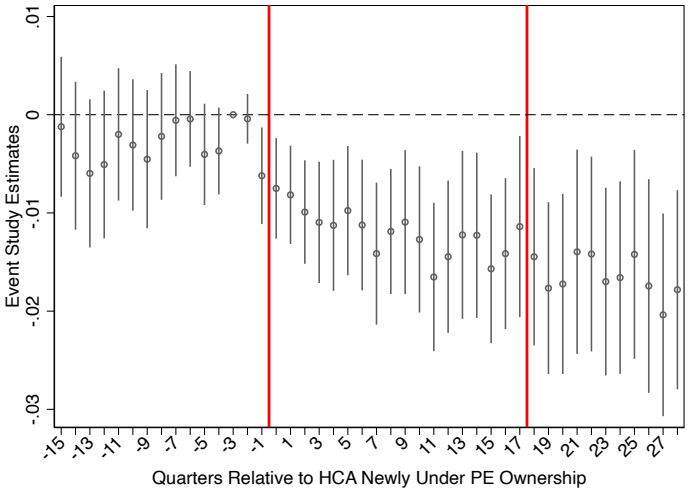
	Presence of Labor and Delivery Unit	Share of Inpatient Stays for Births
	(1)	(2)
1[PE Ownership]	–0.040	–0.009***
	(0.029)	(0.003)
1[PE Divestment]	–0.031	–0.014***
	(0.031)	(0.005)
Hospital Fixed Effects	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes
Unique Hospitals	136	136
Observations (N)	5,984	5,984
HCA 2003-2005 Outcome Mean	0.56	0.07
Controls 2003-2005 Outcome Mean	0.73	0.09

Notes: Analytic data are from the universe of Florida inpatient discharge records collapsed to the hospital-quarter-year-level. Analyses are restricted to general, short-term acute care hospitals consistently observed from Q1 2003 through Q4 2013. There are 35 unique hospitals in the HCA treated group. "PE" stands for private equity. Column (3) restricts to the subgroup of treatment and control hospitals that handle births in all quarter-years between 2003 and 2013. Standard errors clustered at the hospital level

*** P value at 0.01 ** P value at 0.05 * P value at 0.10



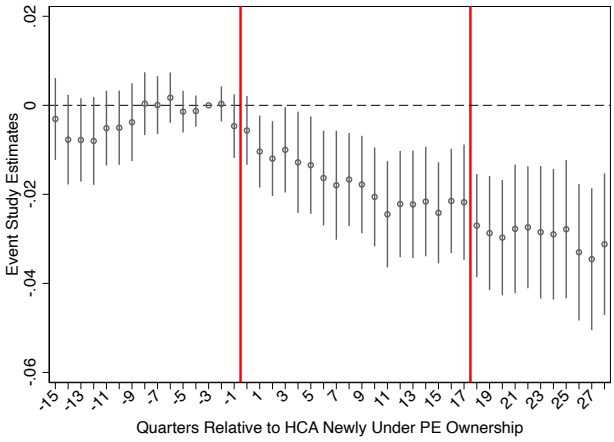
(a) Presence of Labor and Delivery Unit



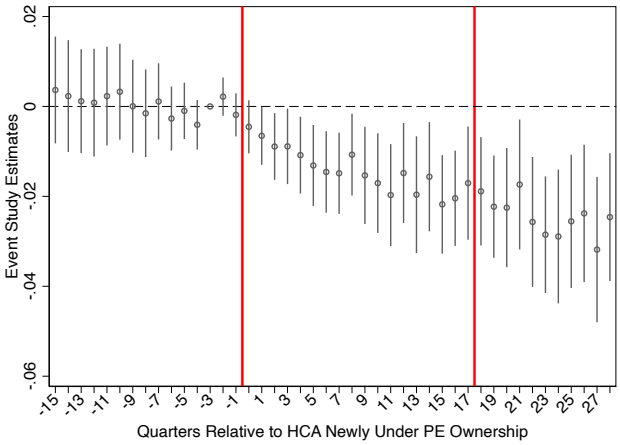
(b) Share of Inpatient Stays for Births

FIG 7. DIFF-IN-DIFF EVENT STUDY ESTIMATES CORRESPONDING TO TABLE 3

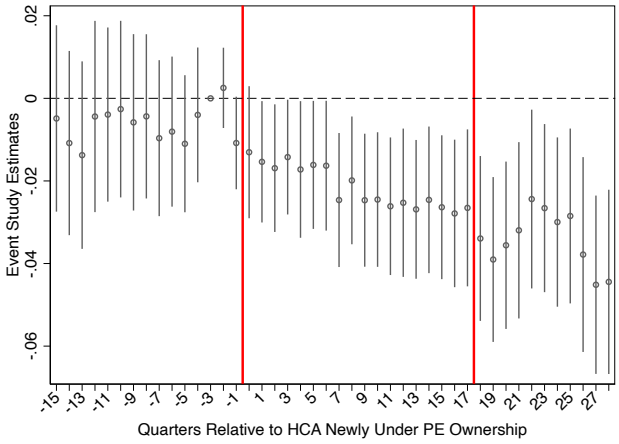
Notes: Outcome definitions and analytic samples are identical to those reported in Table 3. Vertical bars bookend private equity ownership of HCA.



(a) Hospitals Always with Labor and Delivery Unit



(b) Commercially Insured Hospitalizations



(c) Medicaid Hospitalizations

FIG 8. EXPLORING HETEROGENEITY IN THE DECLINE OF ADMISSION RATES FOR BIRTHS

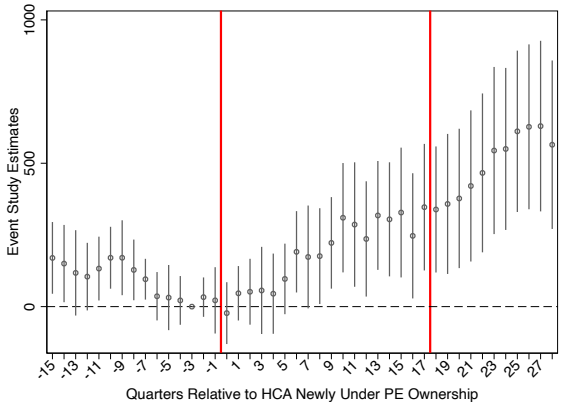
Notes: Each diff-in-diff event study subsets to inpatient hospital stays for the subgroup of hospitals satisfying each condition (i.e., hospitals always having an active labor and delivery unit, commercially insured hospitalizations, and finally Medicaid hospitalizations)

TABLE 4—DIFF-IN-DIFF ESTIMATES FOR PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON HOSPITAL INPATIENT CARE AND TREATMENT INTENSITY

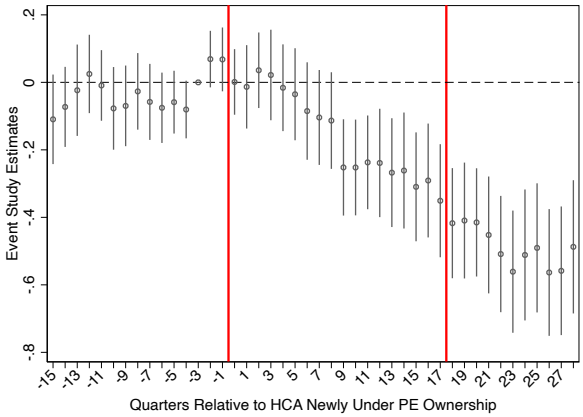
	Number of Admissions	LOS	Any Procedures During Stay	Cardiac Procedures	Surgery	Lab Testing	Radiology Imaging	ICU Use	Mortality	Avg. Total Charges '000 nominal dollars (in logs)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1[PE Ownership]	97.4	–0.121**	–0.023***	–0.001	–0.007	–0.006*	0.004	–0.016	–0.002*	0.040**
	(70.7)	(0.055)	(0.007)	(0.007)	(0.006)	(0.003)	(0.008)	(0.013)	(0.001)	(0.018)
1[PE Divestment]	406.7***	–0.455***	–0.045***	0.004	–0.037***	–0.008	0.006	–0.061**	–0.003**	0.026
	(132.2)	(0.077)	(0.011)	(0.010)	(0.011)	(0.005)	(0.012)	(0.025)	(0.001)	(0.028)
Hospital Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unique Hospitals	136	136	136	136	136	136	136	136	136	136
Observations (N)	5,984	5,984	5,984	5,984	5,984	5,984	5,984	5,984	5,984	5,984
HCA 2003-2005 Outcome Mean	2,895	4.8	0.57	0.28	0.33	0.98	0.74	0.31	0.03	32.3
Controls 2003-2005 Outcome Mean	3,546	4.7	0.56	0.25	0.30	0.97	0.70	0.27	0.02	24.1

Notes: Analytic data are from the universe of Florida inpatient discharge records, excluding discharge records for newborns, collapsed to the hospital-quarter-year-level. Analyses are restricted to general, short-term acute care hospitals consistently observed from Q1 2003 through Q4 2013. There are 35 unique hospitals in the HCA treated group. "PE" stands for private equity. "LOS" stands for length of stay. "ICU" stands for intensive care unit. Pre-period means in column (10) are reported in levels (not log transformed). Standard errors clustered at the hospital level

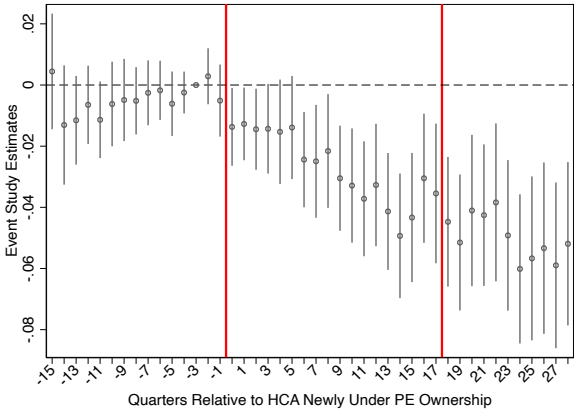
*** P value at 0.01 ** P value at 0.05 * P value at 0.10



(a) Number of Admissions



(b) LOS



(c) Any Procedures During Stay

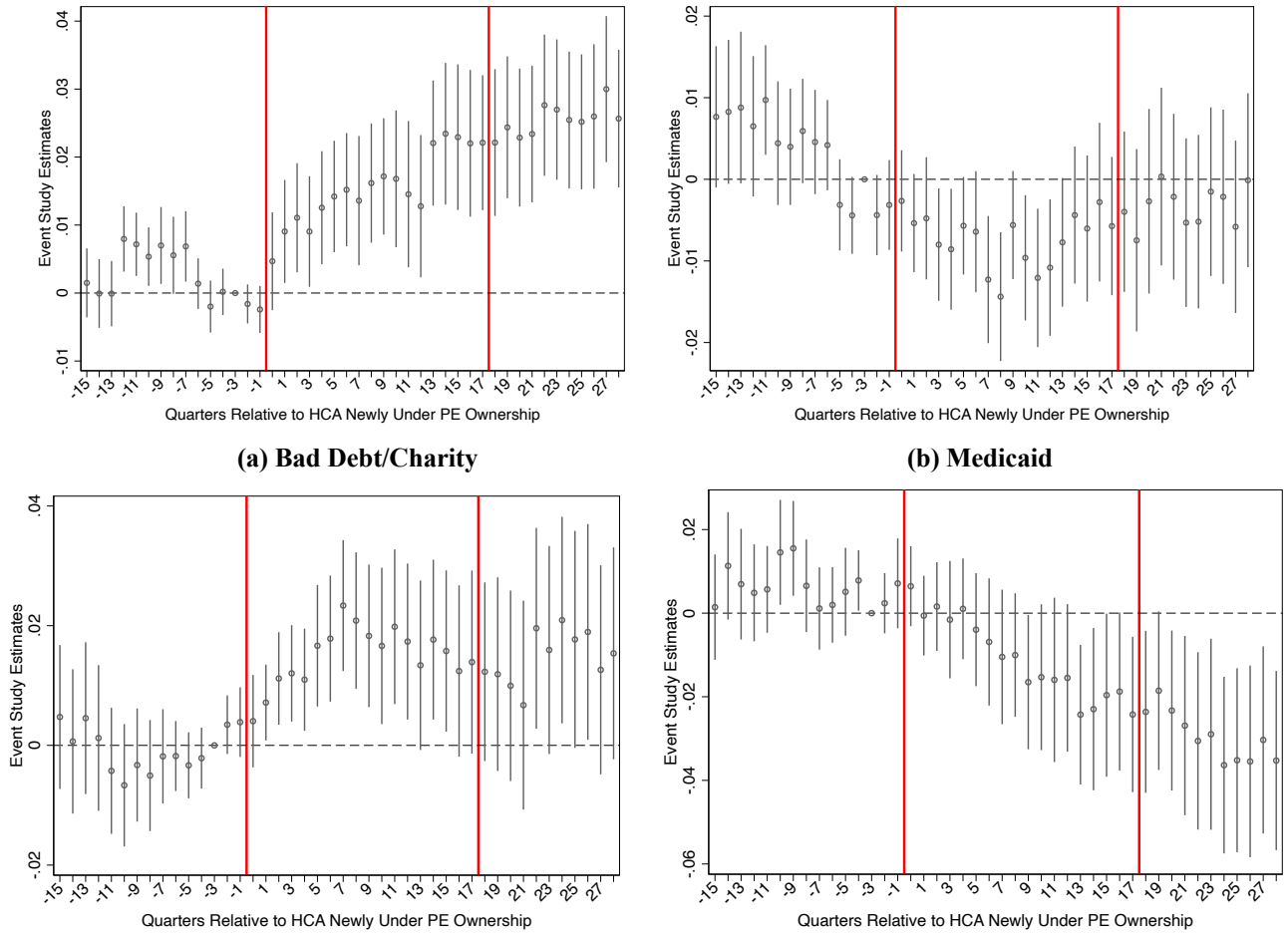
FIG 9. DIFF-IN-DIFF EVENT STUDY ESTIMATES CORRESPONDING TO TABLE 4

Notes: Outcome definitions and analytic samples are identical to those reported in Table 4. Vertical bars bookend private equity ownership of HCA. In the interest of space, key results presented here while the rest are available within the Appendix.

TABLE 5—DIFF-IN-DIFF ESTIMATES FOR PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON HOSPITAL INPATIENT CARE PAYER MIX

	Bad Debt/Charity	Commercial	Medicaid	Medicare Advantage	Medicare FFS	Self-Insured	All Others
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1[PE Ownership]	0.013***	0.001	–0.011***	0.016**	–0.017**	0.0003	–0.003
	(0.004)	(0.005)	(0.003)	(0.007)	(0.007)	(0.004)	(0.002)
1[PE Divestment]	0.023***	0.006	–0.007	0.015	–0.036***	0.002	–0.005
	(0.005)	(0.008)	(0.005)	(0.010)	(0.011)	(0.005)	(0.003)
Hospital Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unique Hospitals	136	136	136	136	136	136	136
Observations (N)	5,984	5,984	5,984	5,984	5,984	5,984	5,984
HCA 2003-2005 Outcome Mean	0.01	0.25	0.11	0.08	0.47	0.05	0.04
Controls 2003-2005 Outcome Mean	0.02	0.28	0.14	0.06	0.41	0.06	0.03

Notes: Analytic data are from the universe of Florida inpatient discharge records, excluding discharge records for newborns, collapsed to the hospital-quarter-year-level. Analyses are restricted to general, short-term acute care hospitals consistently observed from Q1 2003 through Q4 2013. There are 35 unique hospitals in the HCA treated group. "PE" stands for private equity. "FFS" stands for fee-for-service (traditional) Medicare. Standard errors clustered at the hospital level *** P value at 0.01 ** P value at 0.05 * P value at 0.10



(a) Bad Debt/Charity

(b) Medicaid

(c) Medicare Advantage

(d) Medicare FFS

FIG 10. DIFF-IN-DIFF EVENT STUDY ESTIMATES CORRESPONDING TO TABLE 5

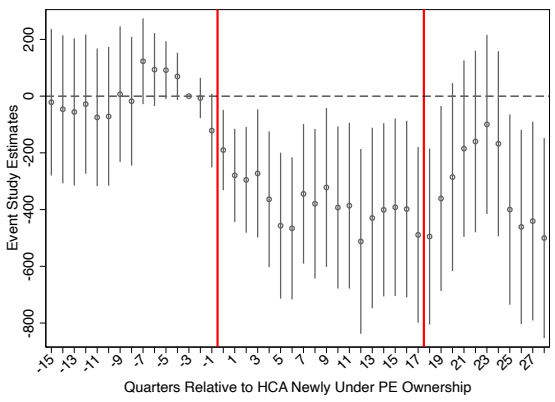
Notes: Outcome definitions and analytic samples are identical to those reported in Table 5. Vertical bars bookend private equity ownership of HCA. In the interest of space, key results presented here while the rest are available within the Appendix.

TABLE 6—DIFF-IN-DIFF ESTIMATES FOR PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON HOSPITAL OUTPATIENT CARE AND TREATMENT INTENSITY

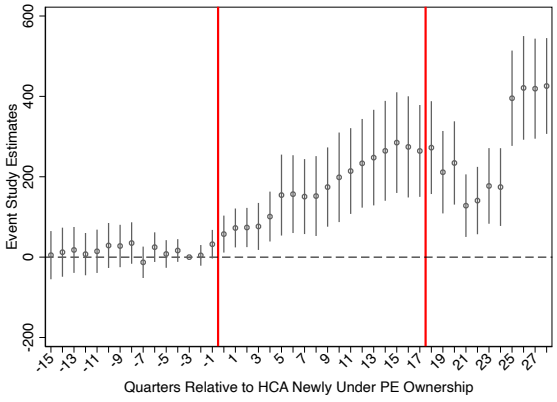
	Case Volume	Number of Unique Physicians Performing Cases at HOPD	Case Complexity Index	Volume of Procedures Using Laparoscopic Tech	Any Robotics Use	Avg. Total Charges '000 Nominal Dollars (in logs)
	(1)	(2)	(3)	(4)	(5)	(6)
1[PE Ownership]	–372.1***	–8.8	160.3***	–10.7**	0.018	0.135***
	(96.8)	(5.4)	(41.7)	(4.5)	(0.024)	(0.033)
1[PE Divestment]	–319.3**	4.1	258.0***	–19.7***	0.215***	0.206***
	(134.3)	(7.0)	(45.8)	(7.0)	(0.063)	(0.041)
Hospital Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Unique Hospitals	134	134	134	134	134	134
Observations (N)	5,896	5,896	5,896	5,896	5,896	5,896
HCA 2003-2005 Outcome Mean	1,791	116.6	708.0	61.5	--	8,256.9
Controls 2003-2005 Outcome Mean	2,346	144.9	802.6	82.1	--	6,527.2

Notes: Analytic data are from the universe of Florida outpatient (ambulatory) discharge records, matched to the hospitals belonging to the inpatient analytic sample and collapsed to the hospital outpatient department (HOPD)-quarter-year-level. There are 35 unique hospitals in the HCA treated group; two hospitals from the control group do not have a HOPD and are consequently not part of these analyses. "PE" stands for private equity. Pre-period means in column (6) are reported in levels (not log transformed). Standard errors clustered at the hospital level

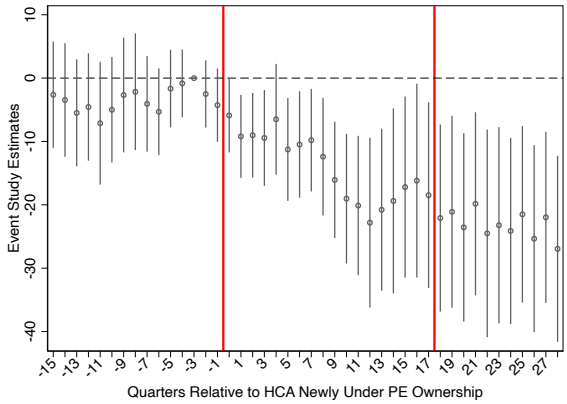
*** P value at 0.01 ** P value at 0.05 * P value at 0.10



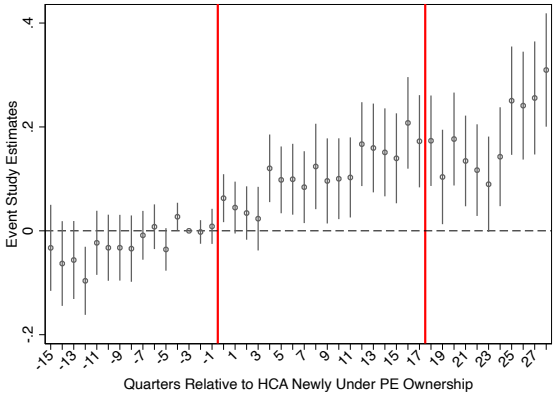
(a) Case Volume



(b) Case Complexity Index



(c) Volume of Procedures Using Lap Tech



(d) Avg. Total Charges '000 (in logs)

FIG 11. DIFF-IN-DIFF EVENT STUDY ESTIMATES CORRESPONDING TO TABLE 6

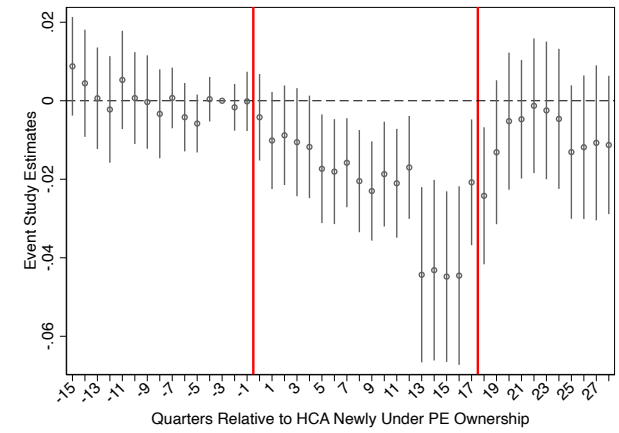
Notes: Outcome definitions and analytic samples are identical to those reported in Table 6. Vertical bars bookend private equity ownership of HCA. In the interest of space, key results presented here while the rest are available within the Appendix

TABLE 7—DIFF-IN-DIFF ESTIMATES FOR PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON HOSPITAL OUTPATIENT CARE PAYER MIX

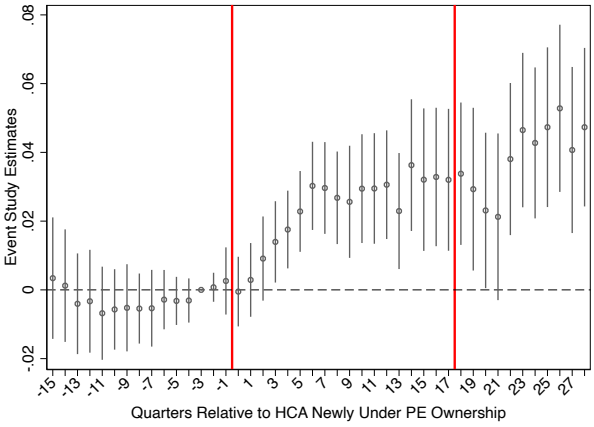
	Bad Debt/Charity	Commercial	Medicaid	Medicare Advantage	Medicare FFS	Self-Insured	All Others
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1[PE Ownership]	–0.001	0.006	–0.022***	0.026***	–0.019**	0.008***	0.002
	(0.002)	(0.009)	(0.006)	(0.006)	(0.008)	(0.003)	(0.004)
1[PE Divestment]	0.004	0.013	–0.010	0.041***	–0.055***	0.008**	–0.002
	(0.003)	(0.013)	(0.008)	(0.010)	(0.013)	(0.004)	(0.005)
Hospital Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unique Hospitals	134	134	134	134	134	134	134
Observations (N)	5,896	5,896	5,896	5,896	5,896	5,896	5,896
HCA 2003-2005 Outcome Mean	0.001	0.39	0.07	0.05	0.42	0.02	0.05
Controls 2003-2005 Outcome Mean	0.015	0.45	0.09	0.04	0.32	0.04	0.05

Notes: Analytic data are from the universe of Florida outpatient (ambulatory) discharge records, matched to the hospitals belonging to the inpatient analytic sample and collapsed to the hospital outpatient department (HOPD)-quarter-year-level. There are 35 unique hospitals in the HCA treated group; two hospitals from the control group do not have a HOPD and are consequently not part of these analyses. "PE" stands for private equity. "FFS" stands for fee-for-service (traditional) Medicare. Standard errors clustered at the hospital level

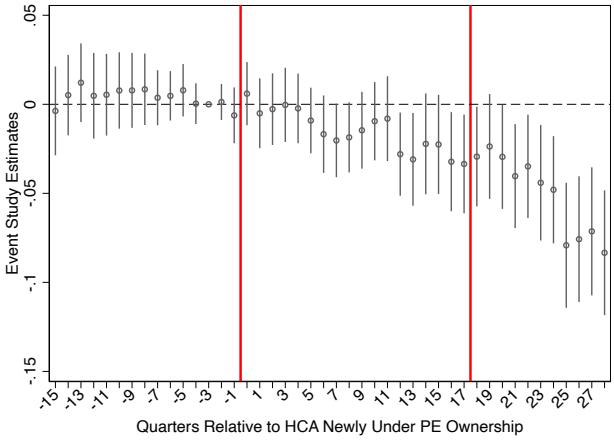
*** P value at 0.01 ** P value at 0.05 * P value at 0.10



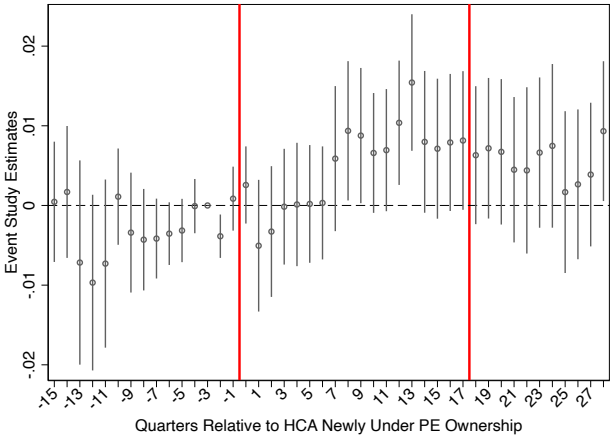
(a) Medicaid



(b) Medicare Advantage



(c) Medicare FFS



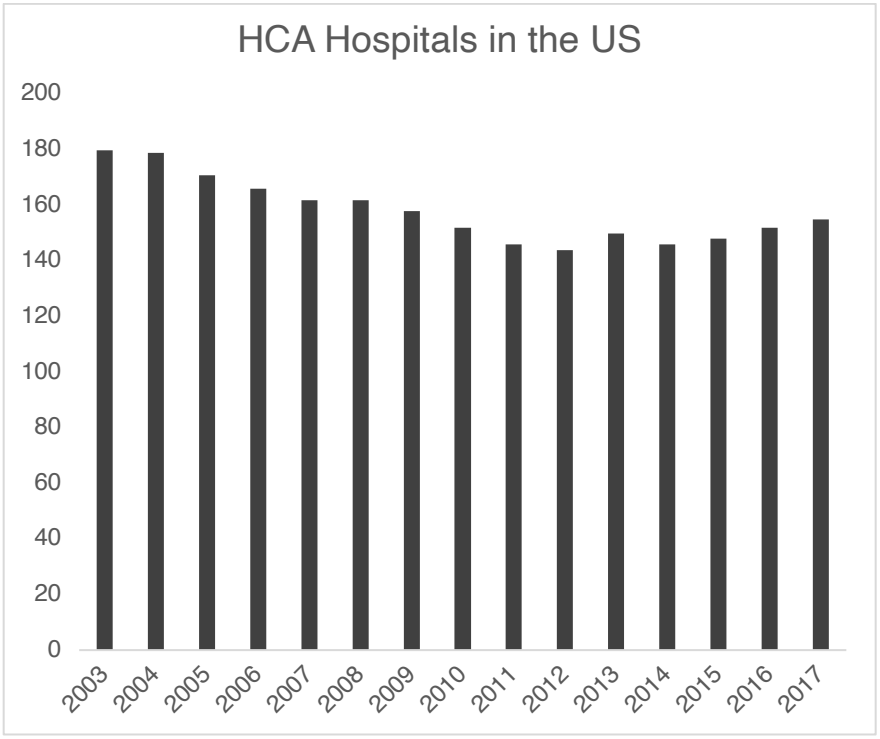
(d) Self-Insured

FIG 12. DIFF-IN-DIFF EVENT STUDY ESTIMATES CORRESPONDING TO TABLE 7

Notes: Outcome definitions and analytic samples are identical to those reported in Table 7. Vertical bars bookend private equity ownership of HCA. In the interest of space, key results presented here while the rest are available within the Appendix

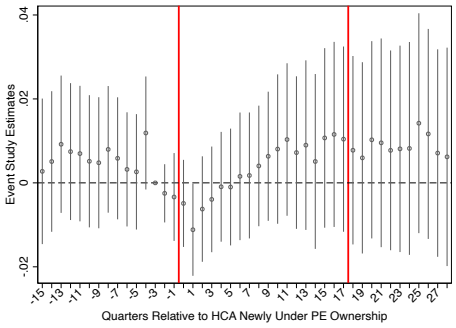
Appendix

Appendix Figure A1: Number of HCA Hospitals Over Time

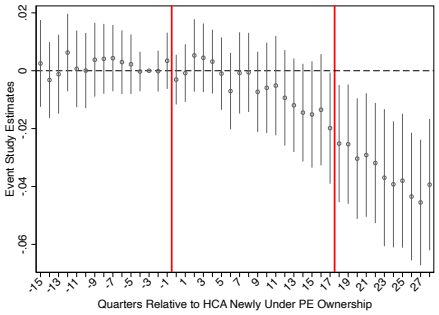


Source: American Hospital Association (AHA) annual survey. Authors' caluclations.

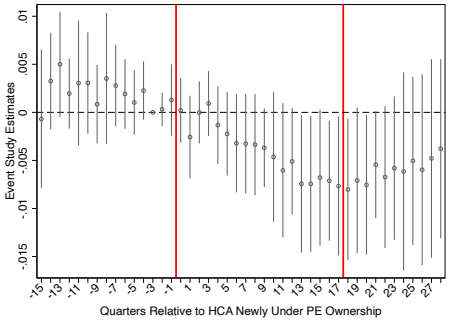
Appendix Figure A2: Additional Event Study Results Corresponding to Table 4



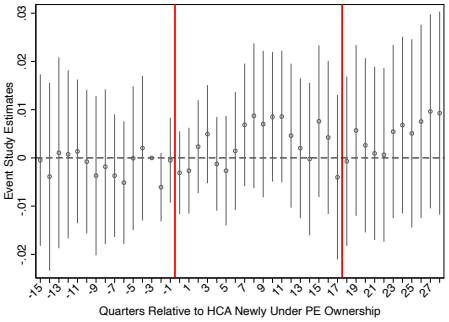
Cardiac Procedures



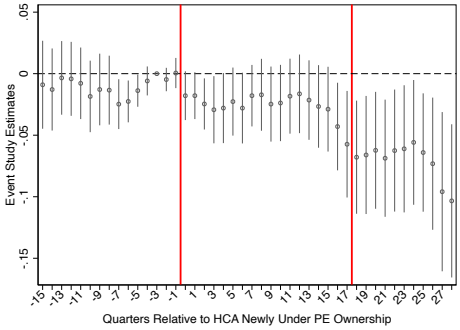
Surgery



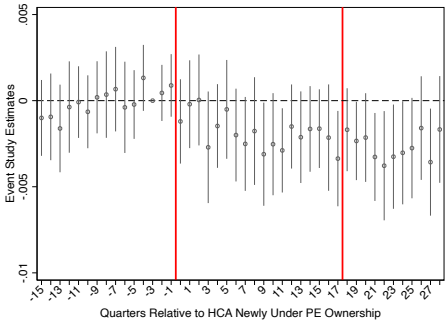
Lab Testing



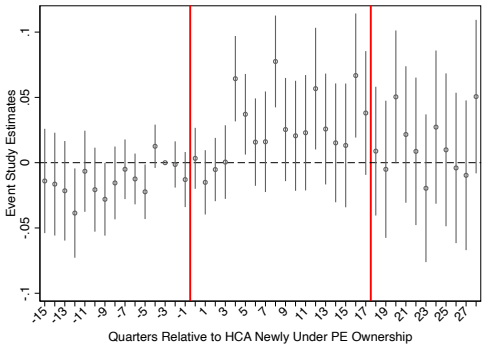
Radiology



ICU Use

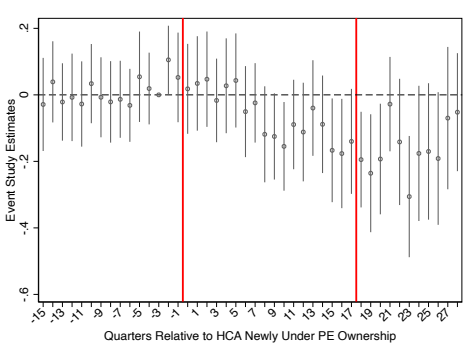


Mortality

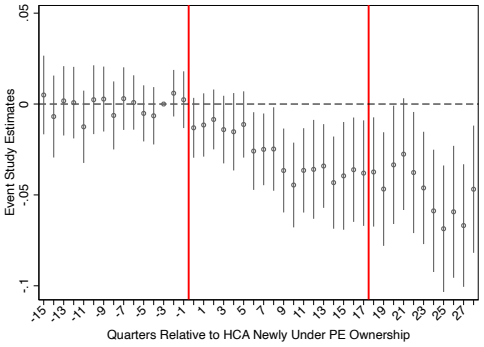


Avg. Total Charges (in logs)

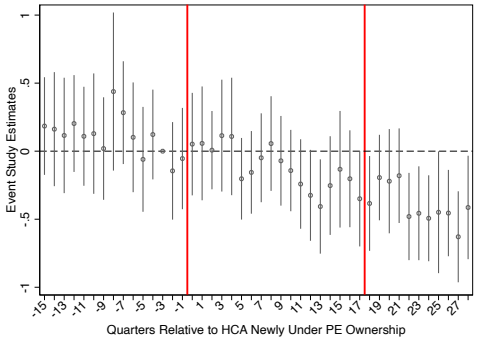
Appendix Figure A3: Heterogeneity in LOS and Any Procedure Effects by Key Payer Groups



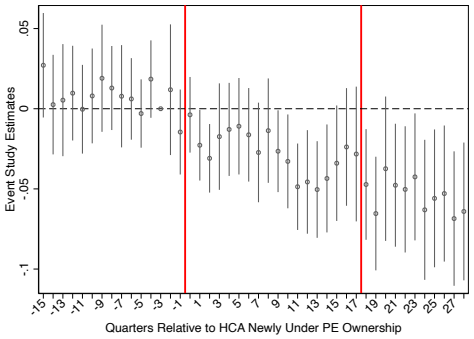
LOS – Comm. Insured



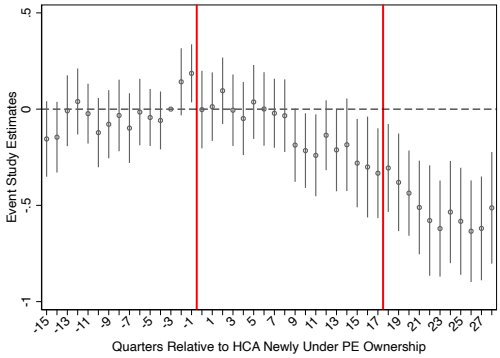
Any Procedures – Comm. Insured



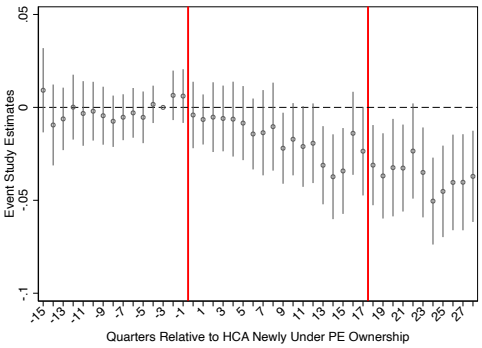
LOS – Medicaid



Any Procedures – Medicaid

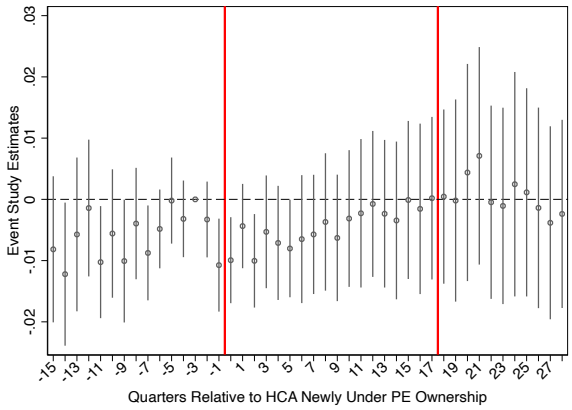


LOS – Medicare

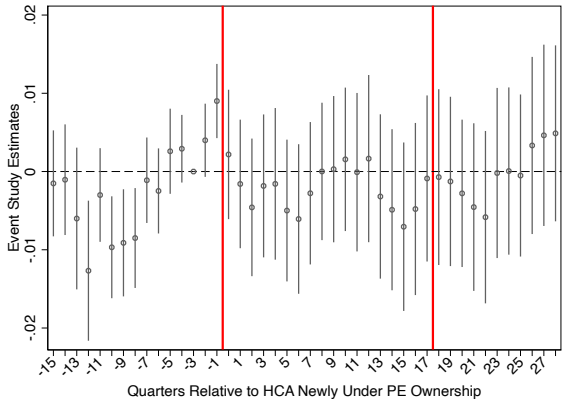


Any Procedures – Medicare

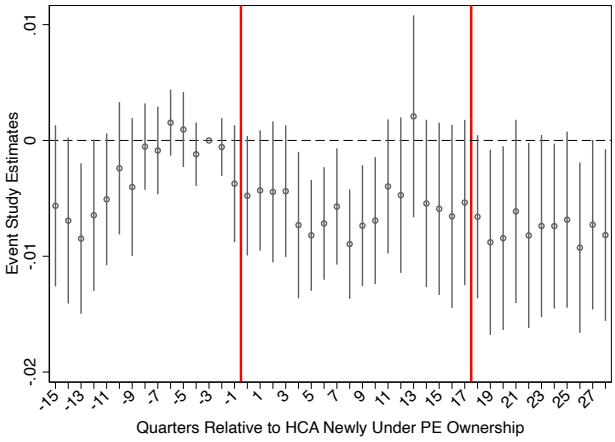
Appendix Figure A4: Effects on Hospital Inpatient Payer Mix



Commercially Insured

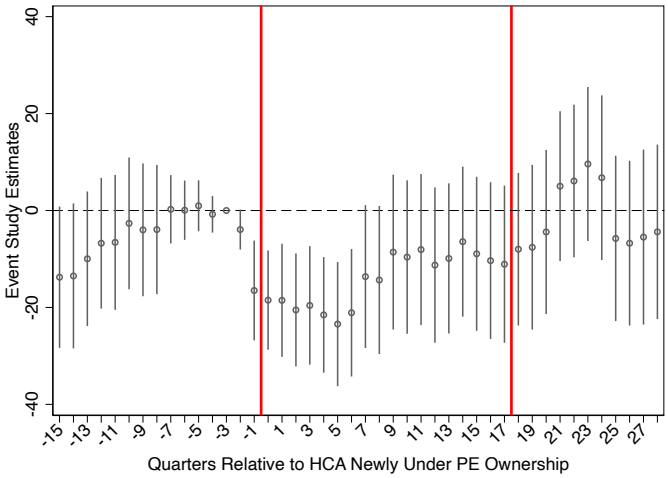


Self-Insured

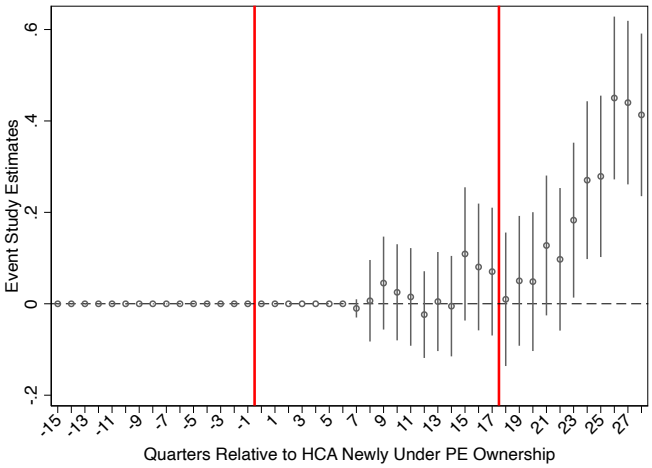


All Others

Appendix Figure A5: Effects on Hospital Outpatient Case Characteristics

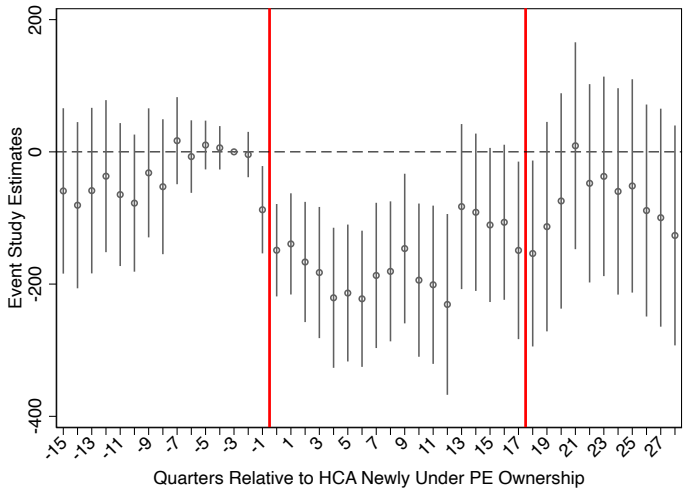


(a) Number of Unique Physicians Performing Cases at HOPD

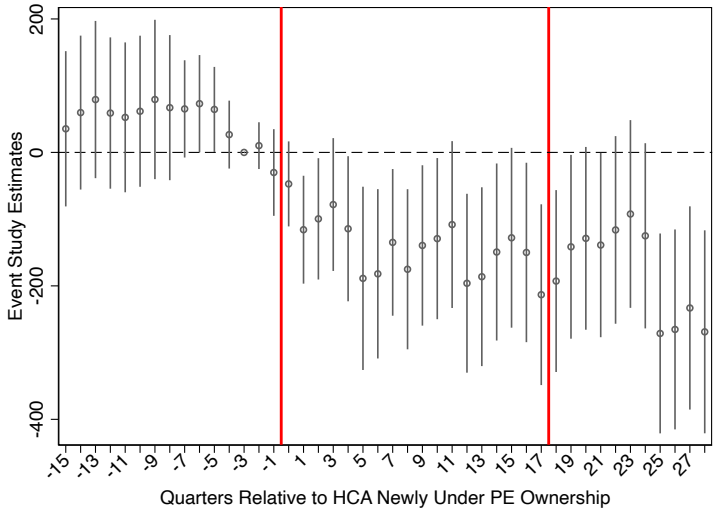


(b) Any Robotics Use

Appendix Figure A6: Decline in HOPD Volumes by Key Payers



(a) Commercially Insured



(b) Medicare FFS