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 allowing more patient transfers, and crucially, capturing more patients through the emergency department. The hospitals also avoid births while managing shorter, less treatment-intensive stays for non-pregnancy-related admissions. 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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The authors are grateful to Beth Munnich for generously sharing data on ambulatory surgery center ownership structures. The authors also thank the Florida Agency for Healthcare Administration (AHCA) for providing valuable data resources. AHCA was not responsible for any data analyses or interpretations. Funding provided by NIA K01AG061274 (Whaley). The authors also thank Jonathan Seward for helpful research assistance. All opinions and remaining errors belong solely to the authors.

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; Bernstein *et al*. 2017; Olsson and Tag 2017; Antoni *et al*. 2019; Davis *et al*. 2019).

A specific sector of the US economy that has been a prominent and growing 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

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 2020a, 2020b; 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; Bruch *et al*. 2023).[3] 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).[4] 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

here: https://www.wsj.com/articles/california-bill-to-rein-in-private-equity-health-care-buyouts-dies-11599250052.

[3] Some very recent research has explored private equity involvement in ambulatory surgery centers (ASCs) as well—see Bruch *et al*. (2022) and Lin *et al*. (2022).

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

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 million) and generated a return of over 200% for the remaining investors (Dowd 2017).[5] 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 indirectly 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.[6] 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

[5] 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.

[6] 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.

(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 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 that detail ownership structures for the universe of ambulatory surgery centers (ASCs) operating across the US. ASCs historically rivaled hospitals for profitable business lines, but the two industries are becoming more financially integrated over time.[7] These novel data assets consequently allow us to 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. And neither hospital marketing or outside investment responses to private equity has been examined in the literature to date. 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 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

[7] The ASC ownership information was also obtained through a Freedom of Information Act (FOIA) request to the Center for Medicare and Medicaid Services (CMS).

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 (i.e., 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, during private ownership and the return to public markets, HCA focuses on increasing inpatient throughput—but not evenly across patient types. The hospital chain decreases its share of pregnancy-related admissions by 13-19%, which indicates a strategic shift to avoid less profitable, and perhaps even loss-making, hospitalizations. Conversely, the number of non-pregnancy-related admissions steadily rises, peaking at an approximately 25% increase over baseline levels. Higher inpatient volumes are in part due to a sharp doubling of the rate of transfer patients in the lead up to the 2011 IPO; however, the primary driver of greater hospitalizations throughout the ownership transitions is drawing more patients through the hospitals' emergency departments. The share of hospital stays originating in the emergency department is more than doubled for pregnancy-related admissions and as much as 10% higher for non-pregnancy-related admissions compared to the baseline (pre-private equity) rate. Moreover, the increase in hospitalizations via the emergency department channel is strongly due to a nearly immediate and then persistent change in the propensity to admit a patient arriving to an HCA emergency department after the chain has been taken private. The quantity of patients presenting to HCA emergency departments is largely stable, however, except for the commercially insured market where

visit volumes are approximately 15% above baseline (via diversion, rather than market expansion). The affected emergency department physicians appear to lower their clinical thresholds for admitting across all patient-payer combinations, with the relative changes ranging between 10-50%, depending on the payer market.

While HCA inpatient volumes are growing, hospital stays are simultaneously becoming shorter and less treatment intensive. Non-pregnancy-related patients spend 3-12% less time in the hospital overall and are as much as 10% less likely to have any procedure performed during the stay after the private equity ownership transition. The hospitals also lower their utilization of intensive care units and less frequently discharge patients with home health services. Despite the reduction in treatment intensity per stay, the inpatient case mix is unchanged, and the mortality rates are, if anything, slightly lower. Additionally, these hospital behavior changes are generally evident across payer markets and extend beyond the period of private equity control. They are also not explained by changes in hospitalized patients' health risk status during the private equity investment or divestment periods. Finally, following the introduction of private equity ownership and direction, Florida HCA hospitals dial back their volume of outpatient surgery cases by 18-21%—with remaining cases focused on higher complexity procedures.

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. Many of these strategic shifts continued even after HCA reemerged as a public company, suggesting that private equity ownership drives corporate-wide changes that shareholders expect to be profitable over the long-run. While the ownership transitions did not obviously erode HCA hospital quality, affected patients were potentially burdened with higher out-of-pocket spending due to clinically questionable hospitalizations. Impacted insurers presumably faced higher medical spending as well but appeared unable or unwilling to stem the sharp increase in HCA emergency department visits converted into an inpatient stay—even years later. The hospital chain's new strategy of driving greater inpatient throughput may have generated adverse financial consequences for patients and payers, but the effects we

document are more suggestive of managed care failures, as opposed to market failures in need of 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.

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:

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

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). During the second year of private equity ownership, 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 (in nominal terms) 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 further 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. We do note that the standard errors on the estimates are quite small for the differential change in outdoor advertising (panel (a), Figure 3); however, as we demonstrate in the following section (Section ID), this is a consequence of the extraordinarily large increase in advertising spending by HCA compared to all other hospital systems and medical centers in the analytic sample.

D. *Robustness*

To examine the robustness of our inferences from Figure 3, we implement an empirical exercise that leverages a standard (i.e., "2x2") DD estimation and cycles through 182 sequential estimations of the DD model for outdoor advertising spending, which ultimately allows each unique advertiser from the analytic sample to serve as the treated unit during a single run. One run will include the true treatment unit (i.e., HCA), and the other 181 runs will each include a different placebo treatment unit. The estimating equation is as follows:

$$Y_{at} = \delta_1 PEOwnership_{at} + \delta_2 PEDivestment_{at} + \lambda_a + \gamma_t + \varepsilon_{at} \quad (2)$$

In Equation (2), *PEOwnership* turns on for the treated unit belonging to a given estimation during HCA's private equity ownership period (Q4 2006 through Q1 2011), with *PEDivestment* turning on immediately after (Q2 2011) when HCA has returned to public markets. We then plot in Figure 4 the resulting investment period and divestment period DD coefficients (δ_1, δ_2) from all 182 estimations to show where the "true" DD estimates (i.e., those from using HCA as the treated unit) fall among the full distribution. Panel (a) and panel (b) of Figure 4 show that the DD estimates with HCA as the treated unit are the largest in the resulting distributions. During the ownership period, most of the estimates fall between –$100,000 and +$100,000 in outdoor advertising while the HCA estimate is nearly +$300,000. Moving to the second post-period, the gap between the HCA-specific estimate (nearly +$1,000,000) and the rest of the distribution is more pronounced. Even the farthest non-HCA outliers have DD estimates that are only around half of the HCA-specific estimate. Taken together, the DD distribution patterns in Figure 4 support the interpretations from Figure 2 and Figure 3.

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.[8] 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 2022; Geruso and Richards 2022). 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).[9]

[8] 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.

[9] 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).

B. *Empirical Strategy and Estimation*

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.[10]

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:

$$Y_{it} = \sum_{\substack{j=-7 \\ j\neq -1}}^{7} \delta_j \mathbf{1}\left[Treated_i \times (Time = j)\right] + \theta_i + \gamma_t + \varepsilon_{at} \qquad (3)$$

The specification in Equation (3) 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

[10] 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.

coefficients (δ_j) to examine differential trends in the outcome for HCA before, during, after its private equity takeover. The standard errors are clustered at the ASC owner entity level—125 in total.

C. *Results*

Figure 5 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.[11] 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 (3) and our wider set of control comparison ASC investors described above. The event study DD estimates are presented in Figure 6 and reaffirm what is seen in the raw data trends belonging to Figure 5. 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.

D. *Robustness*

To examine the robustness of our inferences from Figure 6, we closely follow the exercise described in Section ID, relying on a standard (i.e., "2x2") DD estimation that cycles through 126 sequential estimations to allow each unique ASC investor from the analytic sample to serve as the treated unit during a single run. The estimating equation is identical to Equation (2), with the exception of the unit fixed effects (θ_i):

[11] 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.

$$Y_{it} = \delta_1 PEOwnership_{it} + \delta_2 PEDivestment_{it} + \theta_i + \gamma_t + \varepsilon_{it} \quad (4)$$

The definitions of *PEOwnerhip* and *PEDivestment* in Equation (4) also reflect the annualized data for ASC ownership so that they capture the 2007-2011 and 2012-2014 periods, respectively.

The resulting distributions of DD estimates are displayed in Figure 7. The "true" DD estimates from considering HCA as the treated unit are not the stark outliers they were in Figure 4 (i.e., for outdoor advertising expenditures), which somewhat tempers the conclusions that can be drawn from Figures 5 and 6. However, the estimate from the private equity ownership period is at the 95th percentile of the distribution in panel (a), and the estimate for the divestment (i.e., public ownership) period is at the 99th percentile in panel (b). We also note the largest differential changes belonging to the two distributions in Figure 7 (i.e., the coefficients that are larger than those belonging to HCA) are not from a common ASC investor, so in this regard, HCA is seemingly unique in demonstrating a large differential change during 2007-2011 as well as 2012-2014.

III. Hospital Inpatient 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 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.[12] 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 103 control hospitals observed in the analytic data.[13]Across all discharge data sets, we collapse the data to the hospital-quarter-year level for our DD analyses (described next).

We implement two versions of a DD estimation. The first is the more standard 2x2 setup, with a slight modification to give us two distinct post-periods in the specification (i.e., one for during and one for after private equity ownership). We then translate the DD analyses into a full, flexible event study spanning the 11-year analytic

[12] 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. Even 10 years later, Florida remained the most HCA hospital dense state in the US. Authors' calculations from the 2006 and 2016 AHA data.

[13] 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 (Section V).

period (44 quarter-years in total). Equation (5) and Equation (6) 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*).

$$Y_{ht} = \delta_1 PEOwnership_{ht} + \delta_2 PEDivestment_{ht} + \eta_h + \gamma_t + \varepsilon_{ht} \quad (5)$$

$$Y_{ht} = \sum_{\substack{j=-15 \\ j\neq -3}}^{28} \delta_j \mathbf{1}\left[Treated_h \times (Time = j)\right] + \eta_h + \gamma_t + \varepsilon_{ht} \quad (6)$$

In Equation (5), the binary *PEOwnership* variable is equal to one for the 35 treatment group HCA hospitals during HCA's private equity ownership (Q4 2006 through Q1 2011), and the binary *PEDivestment* variable is equal to one for these same 35 hospitals during the remainder of the analytic window (Q2 2011 through Q4 2013) when HCA has returned to public markets. Equation (6) has an identical interpretation as our previous event study models from Sections I and II.

C. *Results for All Admissions*

When looking across all inpatient stays, we measure the total volume of admissions as well as the share of admissions devoted to pregnancy-related patients (i.e., newborn births and expecting mothers) for each hospital in each quarter-year.[14] The "2x2" DD estimates (Equation (5)) are shown in Table 2, with the corresponding event study estimates (Equation (6)) in Figure 8.

During the 2003-2005 period, HCA hospitals only averaged 80% of the aggregate inpatient volume per quarter-year as the average hospital in our control group. However, the gap narrows over time, and by the time HCA returns to public markets, their average inpatient admission volumes are up by 12% over baseline levels. The estimates in column 2 (Table 2) indicate that these additional admissions are less likely to be coming from

[14] Newborns are clearly identified in the discharge records using the AHCA admission type classification. All other pregnancy-related admissions are identified when the primary International Classification of Disease (ICD) 9 diagnosis code listed for the patient (i.e., the principal reason for being hospitalized) falls in the range of 630 to 679 (including associated decimal point values).

births—a service line that is typically unprofitable for hospitals (Cerullo *et al*. 2021). Once HCA is privately held, the share of inpatient stays for a newborn birth falls by approximately 13%, with the effect larger (19% decline) after private equity liquidates its ownership position. We next further restrict the treatment and control hospitals to those having at least one birth in every quarter-year during our 11-year period in order to explore what could be thought of us a pure intensive margin effect (column 3, Table 2). Among HCA hospitals consistently providing newborn delivery care for all quarter-years, their share of admissions tied to pregnancy also fall by 11% and 20% during the private equity investment and divestment phases, respectively. The event study results in Figure 8 align with the inferences drawn from Table 2. Additionally, across all three panels of Figure 8, the effects on hospital admissions following the private equity take-over demonstrate increasing magnitudes over time. For example, the gain in inpatient volumes is approximately 16-19% over HCA baseline levels (Table 2) by the final year of our study period (panel (a) Figure 8).

In light of the findings from Table 2 and Figure 8, we separately subset to pregnancy-related and non-pregnancy-related admissions in Sections IIID and IIIE, respectively, to then examine any changes in treatment intensity as well as payer mix tied to these specific subgroups of hospitalizations.

D. *Results for Pregnancy-Related Admissions*

After restricting to pregnancy-related admissions and hospitals caring for these patients throughout our study period, we measure the length of stay (LOS), share of stays involving a c-section surgery, and share of stays involving at least one procedure (any type) to capture treatment intensity during these specific hospital stays. We likewise calculate the share of these admissions originating in the hospital's emergency department, the share that are transfer patients, the share admitted over the weekend, the average distance traveled by the patient, and the in-hospital mortality rate.[15] We also

[15] Admissions involving a c-section are identified using the ICD-9 procedure codes listed on each discharge record, and more specifically, those in the 74 ICD-9 procedural code range. Distance is the calculated (great circle) distance between the hospital's zip code and the patient's zip code of residence (using the ZIP Code Distance Database provided by the National Bureau of Economic Research) and then averaged over all admissions belonging to the quarter-year.

examine any shifts in payer mix using a mutually exclusive and exhaustive set of payer-specific variables (i.e., bad debt/charity care, commercial (non-Medicare), Medicaid, Medicare Advantage, traditional Medicare fee-for-service (FFS), self-insured, and an 'all others' composite group).[16]

Table 3 reveals that the average HCA hospital approaches inpatient pregnancy-related care similar to the average non-HCA hospital in Florida at baseline (i.e., the LOS and likelihood of receiving a procedure while hospitalized are nearly identical over the 2003-2005 period). Patients also travel comparable distances and are almost equally likely to be hospitalized over the weekend. The clear departures are the much greater share (roughly double) of HCA pregnancy-related hospital stays originating from the hospital's emergency department and inpatient mortality rates for pregnancy-related admissions are exceptionally low for HCA hospitals at baseline. The DD estimates in Table 3 do not indicate that the arrival or departure of private equity induces HCA hospitals to engage in more aggressive treatment behavior. LOS is unchanged, and rates of c-sections as well as receiving any procedure at all are both falling over these two post-periods (columns 1-3). There are no other statistically significant changes in Table 3, with the exception of further (and large) increases in the share of pregnancy-related admissions originating from the hospital's emergency department.[17]

The event study results in Figure 9 suggest that the declines in c-sections and the extensive margin procedure rates are, at most, subtle over time—and perhaps began before the private equity takeover. A more conservative interpretation is that private equity ownership simply does not encourage *more* procedural or surgical care for pregnant patients. Panel (c) of Figure 9 demonstrates the growing rate of pregnant patients

[16] The final group is a combination of individually small payers (e.g., TRICARE, workers' compensation, etc.). Even aggregated together, they typically only represent 2-4% of admissions, irrespective of hospitalization type or treatment/control group status (e.g., see Table 4 and Table 7 baseline summary statistics).

[17] 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 unreliable reporting across hospitals, time, and discharge records). The exclusion of these variable transition quarters is the reason for the drop in observations in column 4 of Table 3 and the four missing event time plotted estimates in panel (c) of Figure 9.

coming from the hospital's emergency department. There is some upward trend in the pre-private equity period—though the differential between HCA and non-HCA hospitals is reasonably constant during the eight quarters immediately preceding HCA's private equity ownership transition. After about 2-2.5 years of private equity ownership, the rate appears to stabilize at a higher rate, and relative to baseline (column 4 of Table 3), the effect magnitudes imply that more than half of all pregnant patients are entering HCA hospitals via their emergency departments going forward. One interpretation consistent with these data patters is that the binding federal EMTALA regulations that require all emergency department patients to be seen and stabilized irrespective of ability to pay consequently limit the degree to which HCA hospitals can eschew pregnancy-related stays. The hospitals may be able to suppress scheduled pregnancy-related admissions (e.g., inductions) but cannot turn away those presenting to the emergency department in need of labor and delivery care.[18]

In terms of payer mix, the estimates in Table 4 do not show a financially favorable change when HCA is privately held. Moreover, HCA hospitals' payer mix experiences further relative increases in Medicaid as well as uncompensated care (i.e., bad debt and charity care) after private equity divests. The event study results in Appendix Figure A3 are not strongly compelling, however, which suggests that the payer mix is largely unaffected by these ownership transitions for the hospital chain. More broadly, the collection of findings for pregnancy-related admissions shows no evidence of a selective retention of patients (e.g., higher paying) or changes in treatment intensity. HCA appears to merely restrain the growth of its hospital services devoted to labor and delivery—likely through limiting the number of planned admissions for these patients—while under private control and beyond.

E. *Results for Non-Pregnancy-Related Admissions*

[18] Appendix Figure A2 presents additional event study results for the number of pregnancy admissions, number of unique OBGYN physicians treating patients at the hospital, and the in-hospital mortality rate. Aggregate pregnancy-related admission volumes do decline a modest amount—though the declining share of all admissions (Figure 8) is predominantly driven by increasing all other hospitalization types. HCA hospitals do not obviously reduce their stock of OBGYNs, and there is little to suggest that mortality risk has appreciably increased for these patients during or after private equity ownership.

We next exclude pregnancy-related hospitalizations to assess HCA hospital behavior changes for all other admission types among our balanced panel of Florida hospitals. We also extend our previous set of treatment intensity measures to include whether the hospital stay includes surgical suite (i.e., operating room) or intensive care unit (ICU) utilization, whether the patient is discharged with post-acute care home health services, the average total charges per stay (i.e., "list prices" in nominal thousands of dollars terms), and the inpatient case mix. To capture changes in case mix (across all payers), we apply the publicly available 2006 Medicare FFS diagnosis related group (DRG) weights to the principal medical reason for the hospitalization as reported on the discharge record. Medicare bases its hospital reimbursements through its inpatient prospective payment system (IPPS) on DRGs and their associated weights, which reflect severity of illness and expected costs of care. After applying the DRG weights to each discharge record, we average the weights across all relevant admissions for each quarter-year belonging to a given hospital. Of note, we also rely on the DRG weights from a single year so that changes in the outcome can be solely attributed to changes in the actual hospitalization case mix (i.e., not confounded with changes in the administratively set DRG weights over time).

We begin by examining changes in the volume of non-pregnancy-related admissions and sources of those admissions in Table 5. Across these margins, the average HCA hospital looks similar to the average non-HCA hospital in Florida during the baseline (2003-2005) period. However, during and after HCA's private equity ownership, HCA demonstrates a 5% and 16% increase in hospitalizations, respectively, with more of those admissions originating from the hospital's emergency department.[19] There is also an uptick in the receipt of transfer patients and weekend admissions (columns 3 and 4, Table 5). Yet, HCA's geographic catchment area appears unchanged (column 5, Table 5), with HCA patients still traveling just over 10 miles from their zip code of residence, on average.

[19] Recall, AHCA implemented a discharge record variable transition in late 2010 for capturing inpatient stays originating from the hospital's emergency department, which accounts for the drop in observations belonging to column 2 of Table 5 due to the exclusion of four quarters of data for all hospitals in the analytic sample (see footnote 17 for complete details).

The corresponding event study estimates in Figure 10 reveal important dynamics across the changes noted in Table 5. Specifically, the increase in inpatient admissions for the hospital chain begins and grows while it is privately held and continues after its return to public ownership. By the end of our study period, average hospitalization volumes are up approximately 23% over HCA's pre-period level, and the share originating from the emergency department is more than 10% higher (panels (a) and (b) in Figure 10). Interestingly, HCA hospitals' willingness to accept more transfer patients does not occur until one year prior to the IPO. The sharp, 100% increase over baseline (2003-2005) in the share of admissions transferred from other hospitals then stably persists for the reemerged public company.

Table 6 displays our DD estimates for the intensity of care belonging to a hospital stay, the inpatient case mix, and the in-hospital mortality rate. The first thing to note from Table 6 is that over the 2003-2005 period hospitals belonging to the HCA chain tend to manage their hospitalized patients in a manner that closely aligns with non-HCA Florida hospitals, on average. The second salient feature of Table 6 is that the DD estimates are negatively signed across all care intensity outcomes. The average length of stay falls by 3% and 10% for the private equity investment and divestment periods, respectively. By the time HCA is a public company again, its hospital stays are 10% less likely to involve the use of an operating room and 8% less likely to involve any medical procedure at all. Likewise, ICU utilization and the rate of patients being discharged with home health services are each down almost 20% over their pre-period rates following the 2011 IPO event. At the same time, the mix of health problems belonging to HCA patients is unchanged over this entire period (column 6), and the in-hospital mortality rate declines by 5-10% in comparison to the baseline rate (column 8).

The accompanying event study estimates in Figure 11 are uniformly well-behaved during the pre-period years and then show differential changes after HCA is taken over by private equity. LOS, in particular, begins to sharply decrease roughly one year after the private equity ownership transition and then continues to fall even beyond HCA's return to public markets. By the conclusion of our study period, the average HCA hospitalization is more than half a day (12%) shorter than the pre-period (2003-2005) mean. The likelihood of utilizing an operating room decreases more gradually; however,

the decline in the probability of receiving any inpatient medical procedure (i.e., an extensive margin effect) closely tracks with the sharp fall in the LOS outcome (panels (a) and (c) in Figure 11). Drops in ICU utilization as well as home health coordination do not clearly materialize until the immediate lead up to the IPO but then persist after HCA's return to public ownership. The risk of in-hospital mortality declines soon after the private equity arrival and remains stably lower throughout our study period (panel (f) in Figure 11).

The DD results for payer mix changes in Table 7 are generally unremarkable. There are no detectable changes for commercially insured, self-insured, or 'all other' payer shares, and the patterns of findings for Medicare as well as Medicare Advantage groups are not clearly consistent over time—Medicaid event study estimates in Figure 12 (panel (b)) additionally provide equivocal findings. The only two compelling results are for bad debt/charity care and Medicare FFS payer groups. The former increases for HCA hospitals during and after private equity's involvement while the latter claims a shrinking relative share of the average HCA hospital payer mix over time. The corresponding event study patterns in panels (a) and (d) of Figure 12 reinforce these interpretations. HCA hospitals witness the share of their payer mix devoted to uncompensated care multiply by 2-4 times their pre-period levels following the private equity ownership transition. And approximately a year after being privately held, the share of patients belonging to traditional Medicare begins to steadily fall—culminating in a roughly 10% decline relative to HCA's baseline levels (column (5), Table 7).[20]

F. *Heterogeneity for Non-Pregnancy-Related Admissions*

While the increase in hospital inpatient volumes, coupled with shorter and less intensive hospital stays, is consistent with a strategy for increasing hospital throughput, the observed changes in inpatient treatment behavior (Table 6 and Figure 11) could also be explained, at least in part, by other dynamic factors. Specifically, as HCA expands its

[20] We return to the somewhat surprising finding for uncompensated care in Section IV where we demonstrate a plausible underlying driver of this result. We also wish to note that the decline in traditional Medicare's share of the payer mix (i.e., a relative change) is not the consequence of the payer's HCA inpatient volumes declining over time (i.e., there is no evidence of Medicare patients being turned away or avoided).

inpatient volumes, the payer(s) associated with the marginal patients and/or the relative health status of the marginal patients could shape subsequent treatment decisions. In other words, if HCA hospitals are disproportionately attracting more business from lower reimbursing payer groups and/or patients with less severe illness, then there would be less incentive and/or need to engage in more aggressive care delivery. We should reiterate that we only observe limited changes in payer mix composition (Table 7), and the case mix (i.e., medical reasons) for non-pregnancy-related hospitalizations is unchanged during the time of private equity investment as well as divestment (Table 6). Nevertheless, for completeness, we further explore these potential mediating factors by re-examining the treatment intensity outcomes as well as investigating each hospital's aggregate patient health risk profile *within payer* and over time.

We specifically focus on commercially insured, Medicaid, Medicare Advantage, and Medicare FFS payer groups to best preserve adequate cell sizes and hospital panel lengths in the subsequent estimations since payer-specific outcome measures are incalculable for quarter-years when a given hospital lacks an inpatient stay for a particular (and usually small) payer. These four payer groups also account for 91% of all non-pregnancy-related admissions to HCA hospitals and 89% of all such admissions among our control group hospitals on average during the pre-period years (see Table 7). Our health risk outcomes of interest include average patient age, share female, share identifying as white race, average Charlson Comorbidity Index, and average Elixhauser Score for each payer-specific inpatient population.[21]

In Table 8, we can see that admitting more patients through the hospital's emergency department is a common behavior across payer groups. Only Medicare advantage (Panel C) fails to have either DD estimate reach statistical significance at conventional levels. The effect magnitude is particularly large for the commercially insured group where hospitalized patients are as much as 15% more likely to have arrived through the hospital's emergency department. The same cannot be said for the patient transfer channel. The increase observed in panel (c) of Figure 10 appears almost

[21] The Charlson Comorbidity Index and the Elixhauser Score are established data-driven algorithms that generate a summary measure of a patient's health status based on the patient's reported existing diagnoses (i.e., the other medical conditions listed on the discharge record that are not necessarily responsible for the current hospitalization).

exclusively driven by Medicare FFS patients—with only a modest contribution from Medicare Advantage enrollees (Panels C and D). Additionally, the relative change in the likelihood of a Medicare beneficiary being a transfer patient around the timing of the IPO is 147% over the baseline rate for HCA hospitals. This is unsurprising since traditional Medicare patients are unencumbered by provider networks and allowing more of them to be transferred into HCA hospitals immediately preceding the IPO is a plausible means to inflate admission volumes/revenues to bolster HCA's public market valuation—and hence stock price. The corresponding event study findings in Figure 13 also align with the interpretations from Table 8 and demonstrate that the effect on the probability of a hospitalization originating from the emergency department actually grows in magnitude throughout our study period (e.g., panels (a) and (c) in Figure 13). Commercially insured hospital stays, for instance, are a full 20% more likely to have been admitted to the inpatient unit via the hospital's emergency department by our final year of data (2013).

The inpatient treatment intensity outcomes in Table 9 provide a similar pattern of findings. The DD estimates are uniformly negative across each payer subgroup and typically substantive in magnitude. The results also indicate that the estimates from Table 6 and Figure 11 (i.e., the effects across all non-pregnancy-related hospitalizations) are not a consequence of shifting payer mix. Shorter, less intensive hospital stays are evident *within payer* as HCA comes under private equity control and then reemerges as a public company. The lone exception in Table 9 is in-hospital mortality where the DD estimates only reach statistical significance at conventional levels for the commercially insured patient population (column 6, Panel A). This cautions against inferring that private equity involvement improved hospital quality (and thereby lowered the inpatient mortality risk), but at the same time, the mortality results in Table 9 offer no indication that quality worsened for any payer subgroup.

The DD estimates for patients' health risk profile are generally lacking a compelling pattern in Table 10. The coefficients are typically small and lack statistical significance approximately half of the time. They are also inconsistently signed, with some results (e.g., Charlson Comorobidity Index and Elixhauser Score for Medicare Advantage and Medicare FFS patients) implying a less favorable health risk profile, on average, as opposed to a healthier patient population. The most compelling changes are

for the average age outcome for each payer subgroup, but even then, the findings are not sharp (see event study results in Figure 14) or large in magnitude (often 1-5% relative changes in comparison to the pre-period means).

Taken together, the results from Sections IIIE and IIIF imply a new company-wide strategy that prioritizes hospital throughout (i.e., more (non-pregnancy) admissions but shorter stays) instead of maximizing service intensity/complexity for a given admission once private equity becomes involved. The declines in treatment intensity are not easily explained by shifts in payer mix or HCA newly attracting a healthier patient population. We also provide additional supporting evidence in Section V that reinforces an interpretation of strategic behavior change focused on inpatient throughput.

IV. Hospital Outpatient Care

A. *Data and Estimation*

When moving to the quarterly outpatient procedural discharge records (i.e., the hospital outpatient departments, or HOPDs) for 2003 through 2013, 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 (i.e., extensive margin), and the average total charges per case in nominal thousands of dollars for a given hospital in a given quarter-year.[22] Our analytic data and empirical setup parallel Section III; however, two control group hospitals do not have a HOPD for surgical and procedural services and are consequently absent from the ambulatory surgery discharge database. Otherwise, the

[22] 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.

composition of treatment group and control group Florida hospitals is identical to Section III. Estimating Equations (5) and (6) are again used throughout, and all standard errors remain clustered at the hospital level.

B. *Results*

When examining the outpatient surgery side of hospital care delivery (i.e., the HOPDs) in Table 11, 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 pre-period average output and fairly stable during both the private equity ownership phase and the chain's re-emergence as a public company (panel (a) Figure 15). 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 11). The investment and divestment periods demonstrate relative effects sizes of 22-37%, respectively, and the behavior change is immediate and growing as evidenced by the event study results in panel (b) of Figure 15. Importantly, the differential shift toward higher complexity cases is present even when restricting to the two dominant payers within this space (Figure 16)—i.e., the commercially insured and traditional (FFS) Medicare markets (Hall *et al*. 2017). This strategic shift is perhaps unsurprising as well. Devoting more of their outpatient service delivery to higher complexity cases is a plausible means to better leverage the hospital's comparative advantages in care production and insulate themselves against business stealing by rivals. It also could reflect, at least in part, growing expectations of lower complexity procedures being referred to non-hospital HCA joint ventures, such as ASC settings (Section II).

Despite the greater emphasis on higher complexity outpatient procedures, the volume of surgeries utilizing laparoscopic technology decreases by 17-32% over these same periods—indicating that the more complex 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 much of this time span, HCA hospitals do seem to differentially adopt the technology—and hence make costly capital investments— as robotic surgery gains popularity toward the end of our study period (column 5 in Table 11 and panel (d) in

Figure 15). Doing so at least aligns with 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 11; panel (e) in Figure 15).

We next assess any payer mix changes for HCA outpatient surgeries in Table 12 and Figure 16. 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 12). There also seems to be greater avoidance of Medicaid outpatient procedures, at least over the short-run. The share of outpatient procedures devoted to Medicaid patients declines by roughly 30% after the private equity acquisition (column 3 of Table 12); the share also does not rebound until the private equity divesture occurs in early 2011 (panel (a) in Figure 17). Not unlike what was evident for inpatient care in Section IIIE, there is a modest and gradual decline in traditional (FFS) Medicare's relative shar of the hospital chain's HOPD payer mix, with a largely offsetting increase in exposure to the Medicare Advantage market. The greater relative tilt toward Medicare Advantage outpatient surgery cases, specifically, is sharp and increasing to some degree over time (panel (b) in Figure 17). The DD estimates in column 4 of Table 12 indicate that the relative changes are as much as an 80% 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 17 lack sufficient precision to draw strong conclusions.

V. Emergency Department Channel

A. *Data and Estimation*

We conclude our empirics by turning our attention to emergency department medical decision-making for HCA hospitals during and after its transition to private equity ownership. Recall from Sections IIID, IIIE, and IIIF, we observe stark increases in the share of inpatient stays originating from the hospital's own emergency department. This

result is evident across hospitalization types as well as payers and informs us about the relative contribution of the hospital's emergency department compared to all other channels that can lead to an inpatient admission. But it does not reveal the underlying cause of the increasing flow of patients from the emergency department. For instance, this pattern could materialize by attracting more patients to HCA emergency departments (e.g., via advertising campaigns) and admitting the same fraction of patients as before—i.e., no change in clinical behavior among emergency department physicians. Alternatively, the increase could be driven by increasing the share admitted among a stable quantity of emergency department visits. The former would be a more innocuous change of circumstances, while the latter (i.e., inappropriately admitting emergency department patients for inpatient care) could be a behavior change that harms consumer welfare by inducing higher medical spending and raising patients' exposure to iatrogenic risks. Relatedly, wide dispersion in admission rates has long been documented (Sabbatini, Nallamothu, and Kocher 2014; Venkatesh *et al*. 2015), with many questioning whether meaningful health benefits accrue from these marginal admissions (Sabbatini, Nallamothu, and Kocher 2014; Currie and Slusky 2020). Empirical findings further suggest that excessive admitting behavior is perhaps more common among for-profit hospital chains (e.g., see Pines, Mutter, and Zocchi (2013); Howard and David (2021)), and HCA has been specifically accused of such perverse activity in recent years by consumer-centric groups as well as federal legislators.[23]

To disentangle these two (though not mutually exclusive) possibilities and shed further light on HCA behavior change when under private equity ownership, we supplement our previous data with a third Florida AHCA discharge database that captures the universe of emergency department visits that *do not* result in the patient being admitted to the presenting hospital. We can then match these records to our universe of

[23] A recent trade press article highlights a formal Securities and Exchange Commission (SEC) filing by the Strategic Organizing Center Investment Group as well as a report released by Service Employees International Union (SEIU) that claim inappropriate hospitalizations by HCA. See here: https://www.fiercehealthcare.com/providers/sec-complaint-filed-against-hca-over-emergency-department-admissions-practices-investor. Additionally, a subcommittee from the US House Committee on Ways and Means has formally brought such accusations against HCA to the attention of the Department of Health and Human Services as well. See here: https://pascrell.house.gov/uploadedfiles/2022.09.13_bp_to_hhs_re_hca.pdf.

inpatient records reporting the hospital's emergency department as the admission source to construct a hospital by quarter-year measure of total emergency department visit volume (by payer) as well as the fraction of those visits that ultimately resulted in an inpatient admission. One drawback for this empirical exercise is that the emergency department discharge database does not begin until the first quarter of 2005, so we necessarily sacrifice two years of pre-period data.[24] However, we still benefit from seven quarters of pre-period observations per hospital and can credibly estimate the following event study specification that spans 2005-2013 for our two emergency department outcomes of interest:

$$Y_{ht} = \sum_{\substack{j=-7 \\ j\neq -3}}^{28} \delta_j \mathbf{1}\left[Treated_h \times (Time = j)\right] + \eta_h + \gamma_t + \varepsilon_{ht} \qquad (7)$$

Equation (7) has the same analytic setup and interpretations as Equation (6) from Section III. All that is different is the modest truncation of the pre-period quarter-years available.

B. *Results*

In Table 13, we first summarize the 2005 hospital-level emergency department visit volumes and the propensity to admit patients within payer market for our treatment and control group hospitals. HCA hospitals attract fewer commercially insured and Medicaid patients to their emergency departments than non-HCA hospitals, on average, but also tend to have a greater volume of Medicare Advantage patients. Interestingly, within each of the four key payer groups in Table 13, HCA admits a *lower* share of patients to its inpatient units prior to becoming a privately held company. Put differently, the emergency medicine physicians staffing HCA emergency departments have a weaker propensity to admit patients from a given payer, at least according to the unadjusted rates (i.e., ignoring patient population risk profiles within an insurance subgroup).

[24] We also exclude the four post-period quarters with unreliable reporting of the emergency department as the admission source within the inpatient discharge database (see footnote 17 for full details).

Figure 18 presents the event study results for total emergency department visits for each payer market. Only one of the four payer groups demonstrates an increase in emergency department visit volumes. During the latter half of HCA's private equity ownership, the commercially insured visit volumes increase by as much as 18% over the 2005 levels reported in Table 13 and maintain the elevated levels following HCA's early 2011 IPO. Visit volumes are relatively stable for HCA Florida hospitals among the Medicaid, Medicare Advantage, and Medicare FFS patient populations. Of note, the increase in commercially insured patients coincides with HCA launching a more robust advertising campaign in Florida media markets, specifically (Appendix Figure A4). A supplementary analysis (Appendix Figure A5) also shows that the increase in commercially insured visits by HCA is via diversion, rather than market expansion (i.e., an intensive, instead of extensive, margin effect). There are no differential changes in the aggregate quantity of commercially insured patients seeking emergency department care in areas where HCA has a market presence in comparison to other Florida markets where HCA is absent. Thus, HCA appears to steal business from surrounding competitors.

Where we see clear and immediate behavior change across each patient-payer population is the share of emergency department patients being admitted to the hospital's inpatient unit (Figure 19). Trends in admitting behavior by HCA emergency department physicians are stable during the nearly two years prior to HCA's ownership transition, but once under private equity control, the admission rate sharply increases and remains at an elevated level indefinitely. The effects are also large. Commercially insured, Medicaid, and Medicare FFS patients are each as much as 5-percentage points more likely to be admitted (36%, 50%, and 11% in relative terms, respectively). And Medicare Advantage patients have roughly a 10-percentage point higher likelihood of being admitted when arriving to an HCA emergency department (25% relative increase). The magnitude of the change in physician behavior among HCA emergency departments eclipses what has been found when hospitals strategically contract with physician staffing companies (Cooper, Scott Morton, Shekita 2020) and eliminates the previous gaps in admitting behavior between HCA and non-HCA hospitals across payers (Table 13). The immediate increase in admitting to the inpatient unit is even evident among the much smaller bad debt/charity care patient population (Appendix Figure A6), which will

ultimately generate uncompensated care costs for the hospital.[25] Thus, HCA owners and managers appear unable to exert sufficient control over emergency department physicians to generate selective admissions of profitable patients; instead, the physicians respond to external pressure by indiscriminately lowering their clinical criteria for inpatient admission across all patients.

The dramatic behavior change displayed in Figure 19 also cannot easily be explained by a sudden change in the types of patients arriving to the emergency department or an under-provision of inpatient care prior to private equity ownership. Recall from Section III, the mix of underlying medical problems associated with the inpatient hospitalizations is unchanged and the patient risk profiles show, at most, small and gradual changes toward a healthier patient population over this time period. Additionally, HCA hospitals are sharply providing *less* intensive care for their hospitalized patients over this period, rather than more—suggesting the marginal patients affected by the strategic change tied to private equity ownership may be receiving medically unnecessary hospital stays.

VI. Conclusions

Risks of 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) are currently known; however, the organizational structures and implicit incentives within the hospital industry are continuously evolving. Private equity, specifically, is playing a growing role within

[25] The top panel of Appendix Figure A6 also suggests that uninsured patients, with limited financial means, may have also become more likely to present to an HCA emergency department as it rolls out a more aggressive advertising campaign (Appendix Figure A4). Recall, the share of hospital stays written off as bad debt or charity care (i.e., uncompensated care) jumps by 100% once HCA is taken private and is more than triple the baseline level after HCA returns to public markets (Table 7). 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): 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.

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 examine hospital behavior over the full life cycle of private equity ownership by leveraging 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 findings 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 capital to permanently shift the HCA hospital chain into a better financially performing state. Inpatient volumes are elevated by increasing the flows of transfer patients as well as patients from the hospitals' emergency departments. At the same time, there is no evidence of quality care erosion, as in-hospital mortality rates are, if anything, slightly lower. HCA also seems to restrain its exposure to (likely unprofitable) pregnancy-related care, and 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 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 campaign, which leads to much greater advertising expenditures in aggregate and plausibly more patients presenting to HCA emergency departments, at least among certain payer groups. 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.

That said, the striking and immediate increase in the propensity to admit patients that present to HCA emergency departments following the transition to private equity ownership raises concerns about a perverse behavior change that would financially

benefit HCA at the expense of consumer welfare. The data do not offer any evidence that the mix of patients, in terms of health problems or health status, would necessitate the sharp and indiscriminate shift in HCA emergency department physicians' clinical judgment around the admission decision. Instead, it seems plausible that external pressure from the new hospital chain owners drives the physicians' medical decision-making change. Within just the last few years, regulators and legislators have been made aware of consumer group concerns that HCA is persistently too aggressive when it comes to admitting patients through its hospital emergency departments (see footnote 23 for examples). Importantly, our evidence points to the likely *origin* of this perverse behavior among HCA hospitals as well as its staying power after private equity relinquishes its full control.[26] The admitting behavior change also appears too quick for capital investments and/or care delivery efficiency enhancements to have plausibly alleviated pre-existing capacity constraints—and hence facilitated inpatient care that was previously infeasible. Our collection of findings is therefore most consistent with a private equity-generated corporate strategy that focuses on hospital throughput by getting more patients into the inpatient side and then discharged more quickly to free up space for the next (potentially low-value) admission.

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 market failures that would be remedied by regulatory intervention. While the effects we document indicate that private equity investors worked to make HCA a more financially successful and better positioned company, the consequences for consumer welfare are less clear. Non-pregnancy-related HCA patients are receiving shorter, less intensive hospitalizations, which may not be harmful but are also not obviously helpful or cost-effective. In fact, it is striking that HCA seems to have been able to increase its inpatient admissions sharply and irreversibly for emergency department patients with little or no pushback by insurers (public or private). The behavior change implies the corporate chain decided to improve inpatient revenue streams by ratcheting up the quantity of hospital stays—despite the marginal

[26] Of note, the behavior changes we quantify also predate HCA's prominent and controversial financial tie up with the EmCare physician staffing company, which occurred in 2011.

hospitalizations having questionable medical necessity. Insurers would presumably have a salient financial interest in curtailing such a strategy but failed to do so—even years later. Taken together, the contemporary influx of private equity funds into US healthcare may continue to raise concerns, but the evidence from a record-setting buyout indicates a role for stronger managed care and/or better alignment between provider incentives and efficient care delivery.

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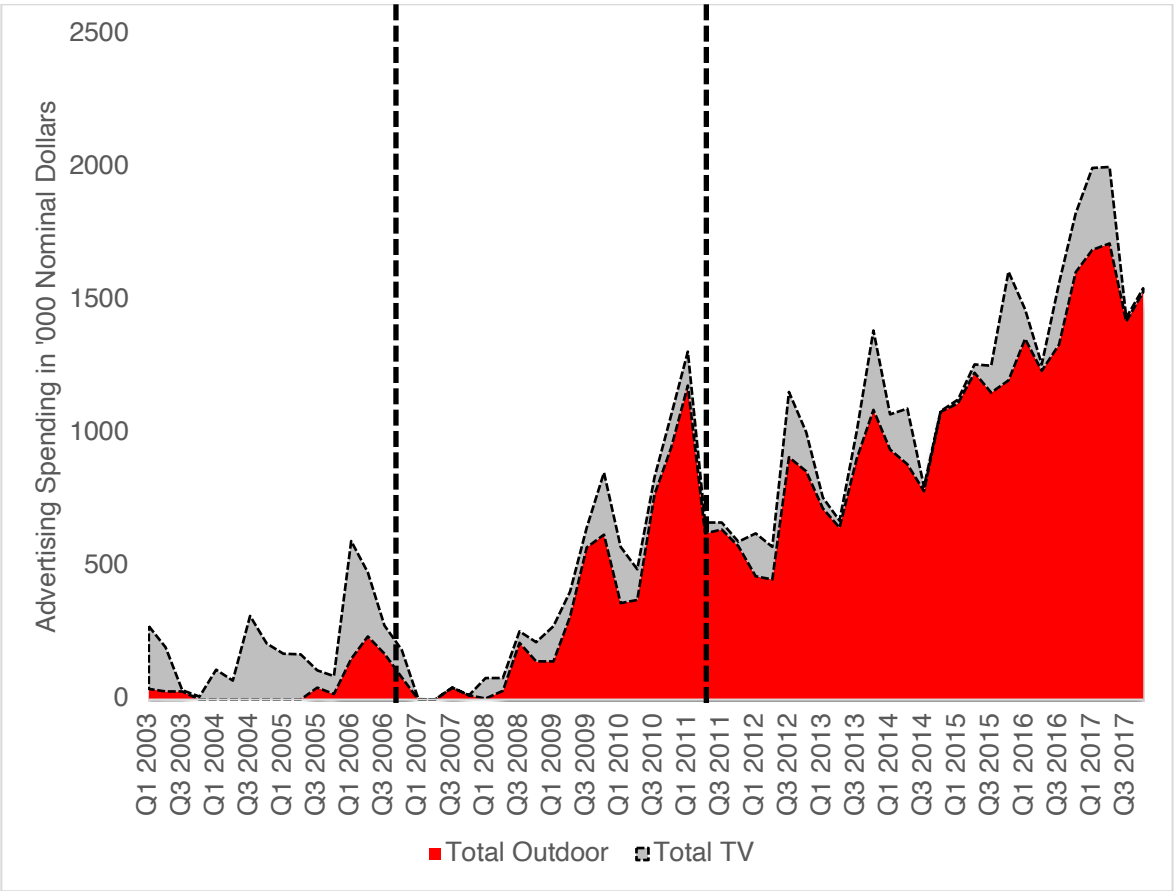


FIG 1. NATIONAL HCA ADVERTISING SPENDING OVER TIME BY MEDIUM

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 dashed lines indicate the beginning and end of private equity ownership of the HCA hospital chain.

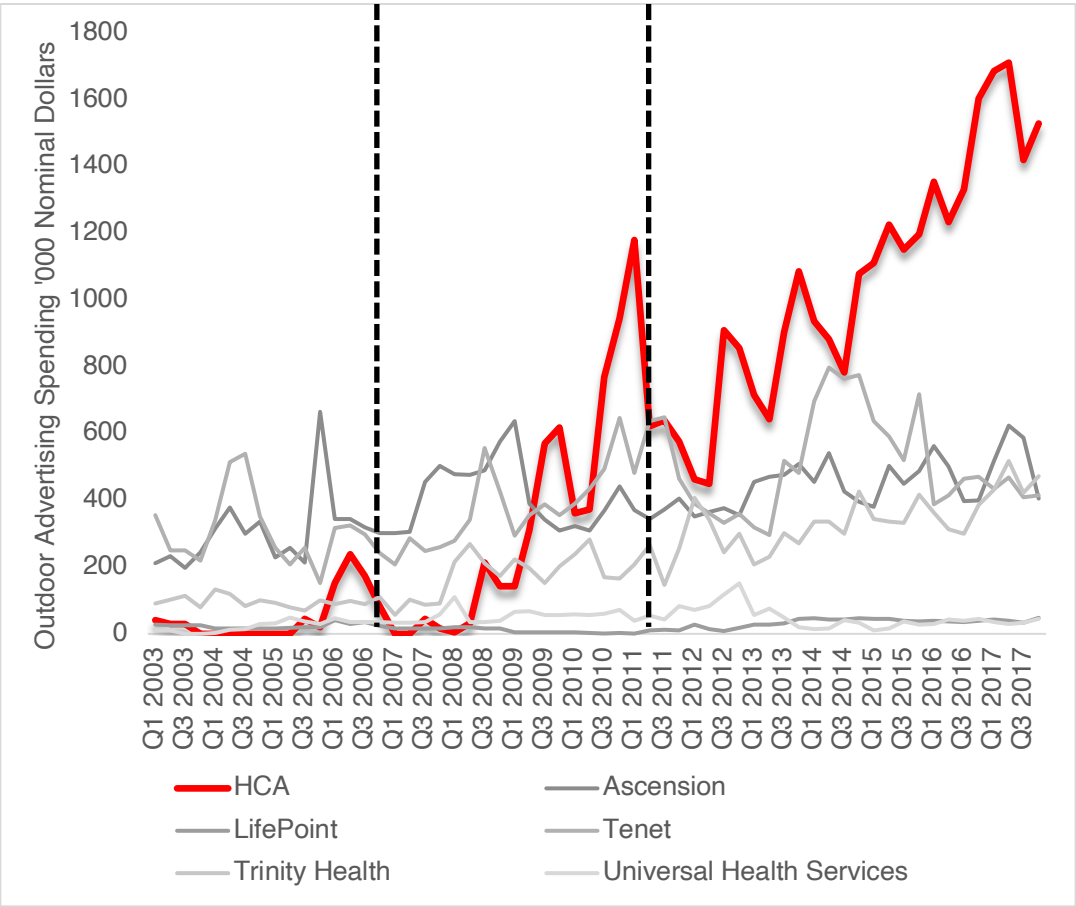
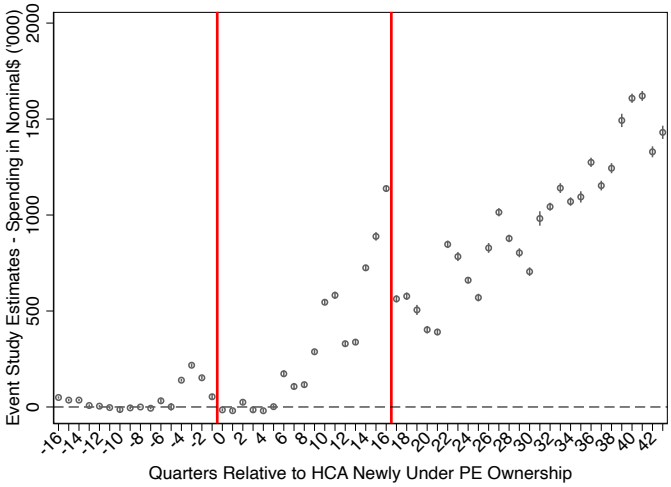
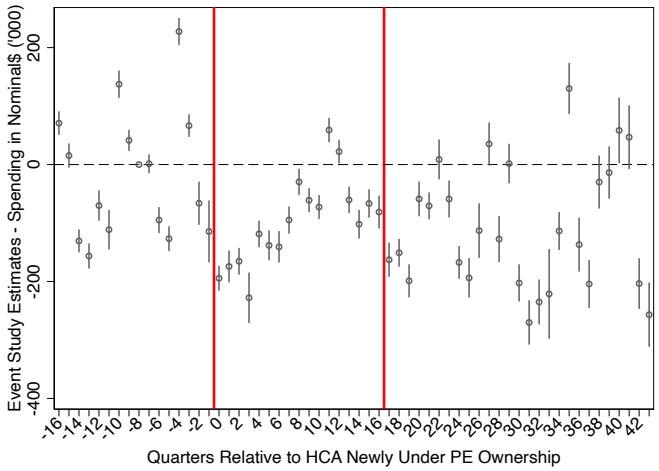


FIG 2. COMPARING HCA OUTDOOR ADVERTISING TO OTHER PROMINENT HEALTH SYSTMES 2003-2017

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 dashed lines indicate the beginning and end of private equity ownership of the HCA hospital chain.



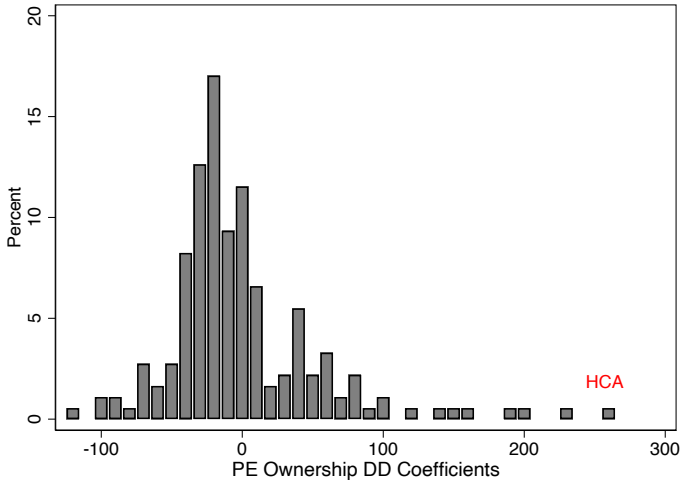
(a) Outdoor Advertising



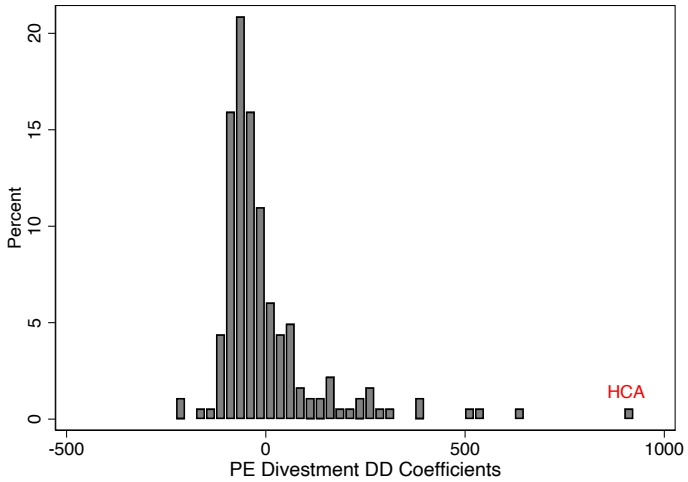
(b) TV Advertising

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.



(a) Period of Private Equity Ownership for HCA



(b) Period after Private Equity Divests from HCA

FIG 4. DISTRIBUTIONS OF DIFF-IN-DIFF 2X2 ESTIMATES FOR OUTDOOR ADVERTISING WHEN ALLOWING EACH OBSERVATIONAL UNIT TO BE "TREATED"

Notes: Estimates are from estimating Equation (2) 182 times, with each estimation using a different hospital chain/health system as the treatment group. One estimation pertains to the "true" treatment group (i.e., HCA), and 181 estimations rely on a placebo treatment group. Panel (a) corresponds to the first "post period" (i.e., when HCA is under private equity ownership). Panel (b) corresponds to the second "post period" (i.e., when HCA has returned to being a public company). Coefficients are in '000 nominal dollar terms.

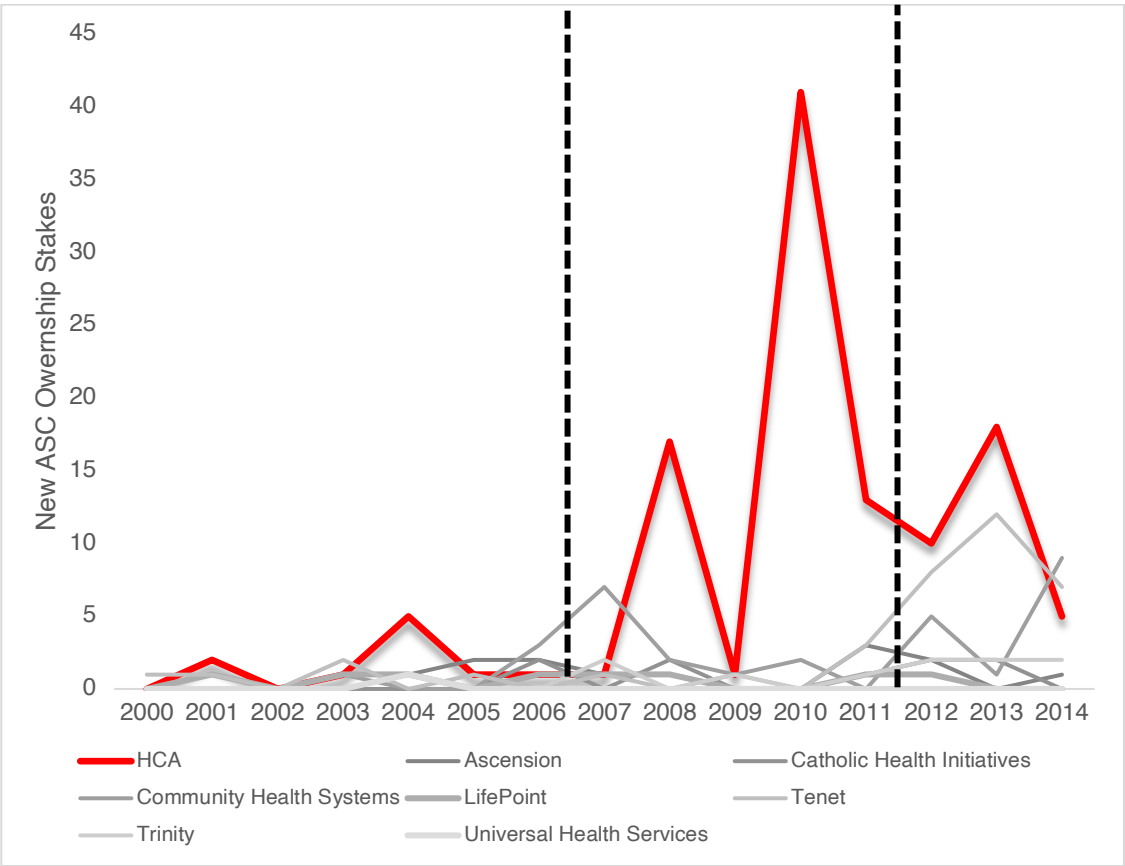


FIG 5. COMPARING HCA OWNERSHIP STAKES IN AMBULATORY SURGERY CENTERS TO OTHER PROMINENT HEALTH SYSTEMS 2000 – 2014

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 dashed lines demarcate the years of private equity ownership for HCA.

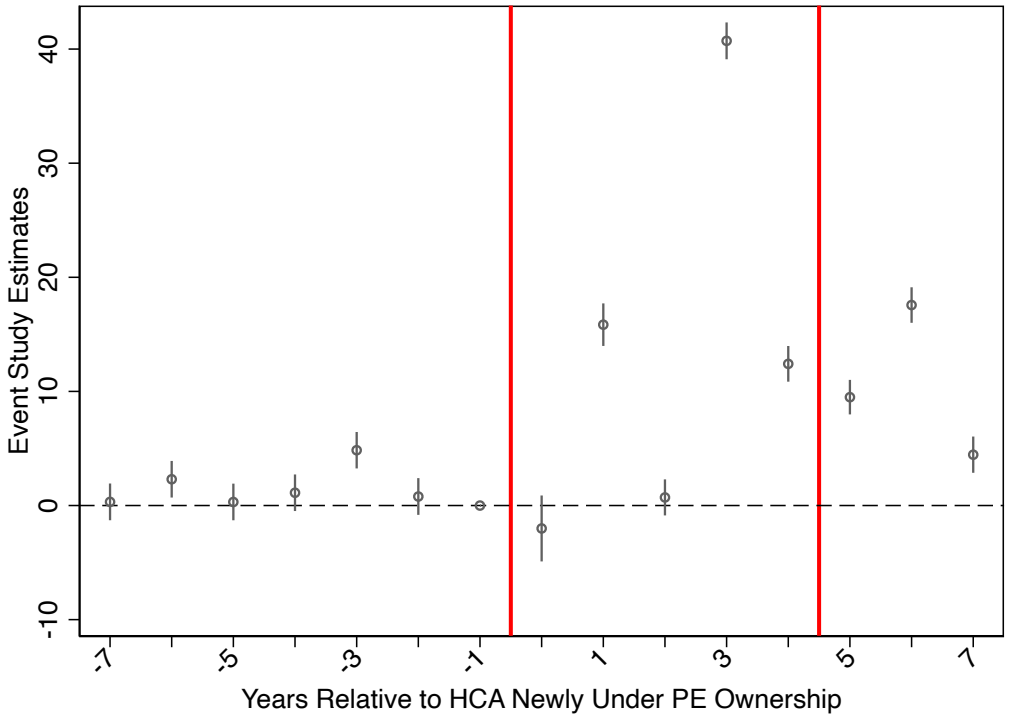
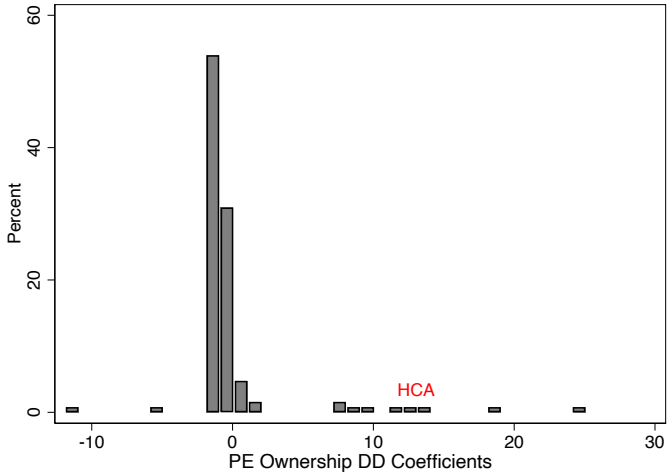
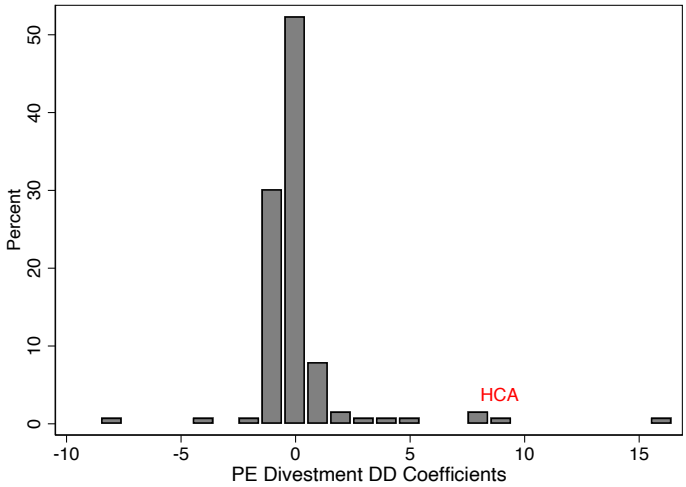


FIG 6. DIFF-IN-DIFF EVENT STUDY ESTIMATES FOR PRIVATE EQUITY OWNERSHIP EFFECTS ON HCA ASC OWNERSHIP STAKES

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.



(a) Period of Private Equity Ownership for HCA



(b) Period after Private Equity Divests from HCA

FIG 7. DISTRIBUTIONS OF DIFF-IN-DIFF 2X2 ESTIMATES FOR ASC OWNERSHIP STAKES WHEN ALLOWING EACH OBSERVATIONAL UNIT TO BE "TREATED"

Notes: Estimates are from estimating Equation (4) 126 times, with each estimation using a different hospital chain/health system as the treatment group. One estimation pertains to the "true" treatment group (i.e., HCA), and 125 estimations rely on a placebo treatment group. Panel (a) corresponds to the first "post period" (i.e., when HCA is under private equity ownership). Panel (b) corresponds to the second "post period" (i.e., when HCA has returned to being a public company).

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

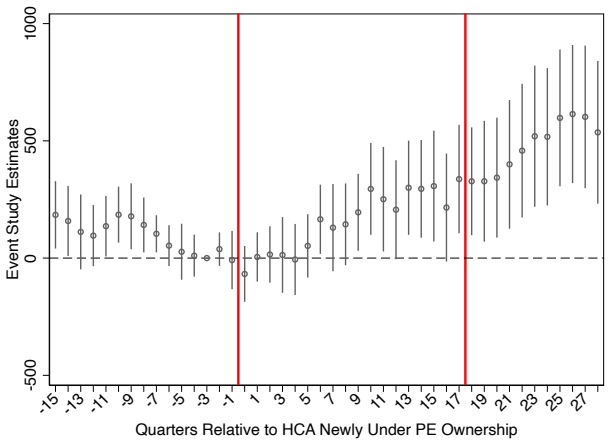
Notes: Data are from the American Hospital Association (AHA) 2006 annual survey and Cost Reports (HCRIS). Six non-Florida hospitals could not be matched to the Cost Reports data. In 2006, Florida contains the most HCA hospitals of any state and represents 24% of HCA hospitals. These same Florida HCA 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

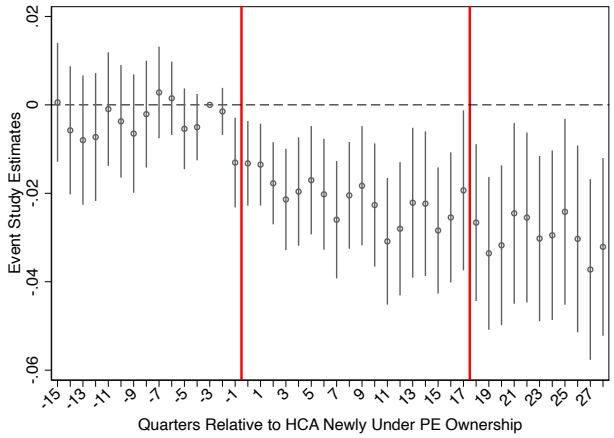
	Number of Admissions	Share of Admissions Pregnancy Related	Share of Admissions Pregnancy Related among Hospitals Consistently Having Nonzero Births
	(1)	(2)	(3)
1[PE Ownership]	64.2	–0.018***	–0.028***
	(75.5)	(0.006)	(0.009)
1[PE Divestment]	382.4***	–0.026***	–0.052***
	(137.8)	(0.010)	(0.013)
Hospital Fixed Effects	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes
Unique Hospitals	138	138	88
Observations (N)	6,072	6,072	3,872
HCA 2003-2005 Outcome Mean	3,134	0.14	0.26
Controls 2003-2005 Outcome Mean	3,914	0.18	0.25

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 only includes hospitals with nonzero births in all quarters over the 11-year period. Standard errors clustered at the hospital level

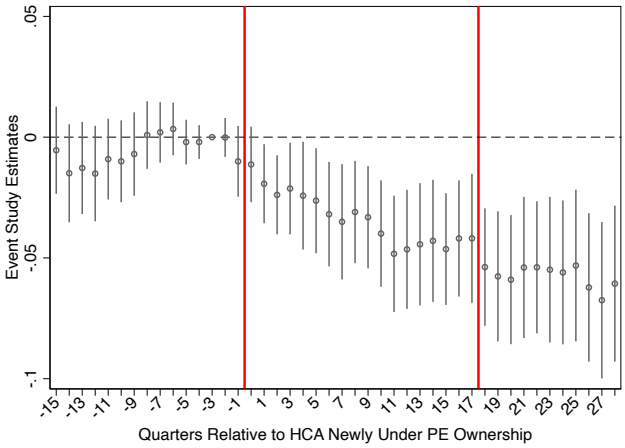
*** P value at 0.01 ** P value at 0.05



(a) Number of Admissions



(b) Share of Admissions Pregnancy Related



(c) Share of Admissions Pregnancy Related among Hospitals Consistently Having Nonzero Births

FIG 8. DIFF-IN-DIFF EVENT STUDY ESTIMATES CORRESPONDING TO TABLE 2

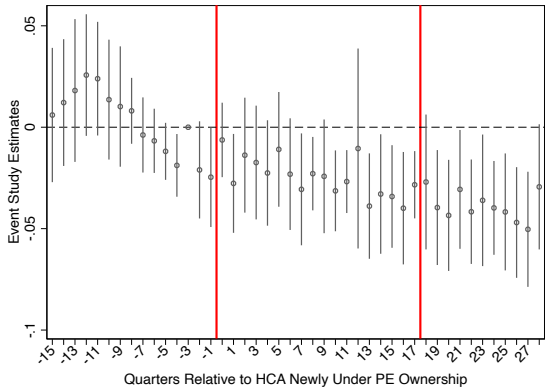
Notes: Outcome definitions and analytic samples are identical to those reported in Table 2. Vertical bars bookend private equity ownership of HCA. Four consecutive quarters are unusable for the outcome in panel (c) due to a data recording transition that was phased in over a year.

TABLE 3—DIFF-IN-DIFF ESTIMATES FOR PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON INPATIENT PREGNANT PATIENT CARE

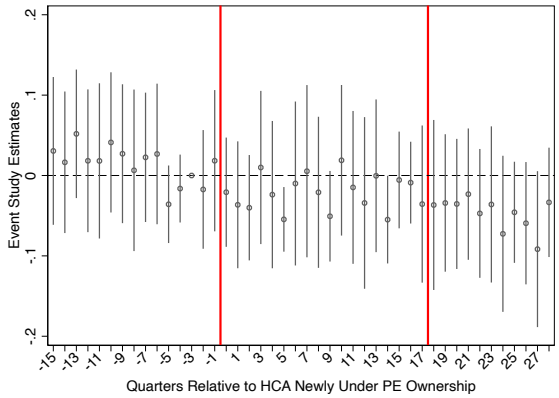
	LOS	C-Section	Any Procedure	Admitted Through ED	Transfer Patient	Weekend Admission	Distance Traveled (miles)	Mortality
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1[PE Ownership]	–0.016	–0.027**	–0.035**	0.233***	0.003	0.006	–0.337	0.0005
	(0.060)	(0.010)	(0.015)	(0.040)	(0.004)	(0.008)	(0.338)	(0.0004)
1[PE Divestment]	–0.029	–0.041***	–0.061***	0.353***	–0.004	0.002	–0.229	0.0009
	(0.058)	(0.012)	(0.020)	(0.050)	(0.004)	(0.011)	(0.384)	(0.0005)
Hospital Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unique Hospitals	105	105	105	105	105	105	105	105
Observations (N)	4,620	4,620	4,620	4,200	4,620	4,620	4,620	4,620
HCA 2003-2005 Outcome Mean	2.5	0.24	0.85	0.24	0.005	0.20	10.7	0.00006
Controls 2003-2005 Outcome Mean	2.7	0.26	0.89	0.13	0.008	0.19	10.3	0.00065

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 with pregnancy-related inpatient admissions from Q1 2003 through Q4 2013. There are 24 unique hospitals in the HCA treated group. "PE" stands for private equity. "LOS" stands for length of stay. "ED" stands for emergency department. Four quarters are unusable for the outcome in column 4 due to a variable definition and reporting requirement transition; thus, those quarters are dropped from the analyses. Column 7 measures the zip centroid-to-zip centroid distance from the patient's zip code to the hospital's zip code. Standard errors clustered at the hospital level

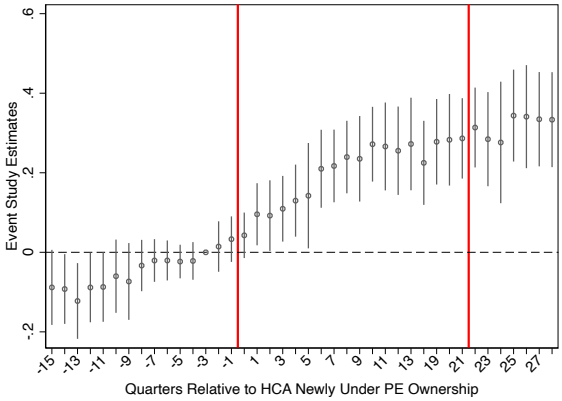
*** P value at 0.01 ** P value at 0.05



(a) Share of Pregnancy Admissions Involving C-Section



(b) Share of Pregnancy Admissions Involving Any Procedure



(c) Share of Pregnancy Patients Admitted Through ED

FIG 9. 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.

TABLE 4—DIFF-IN-DIFF ESTIMATES FOR PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON INPATIENT PREGNANT PATIENT PAYER MIX

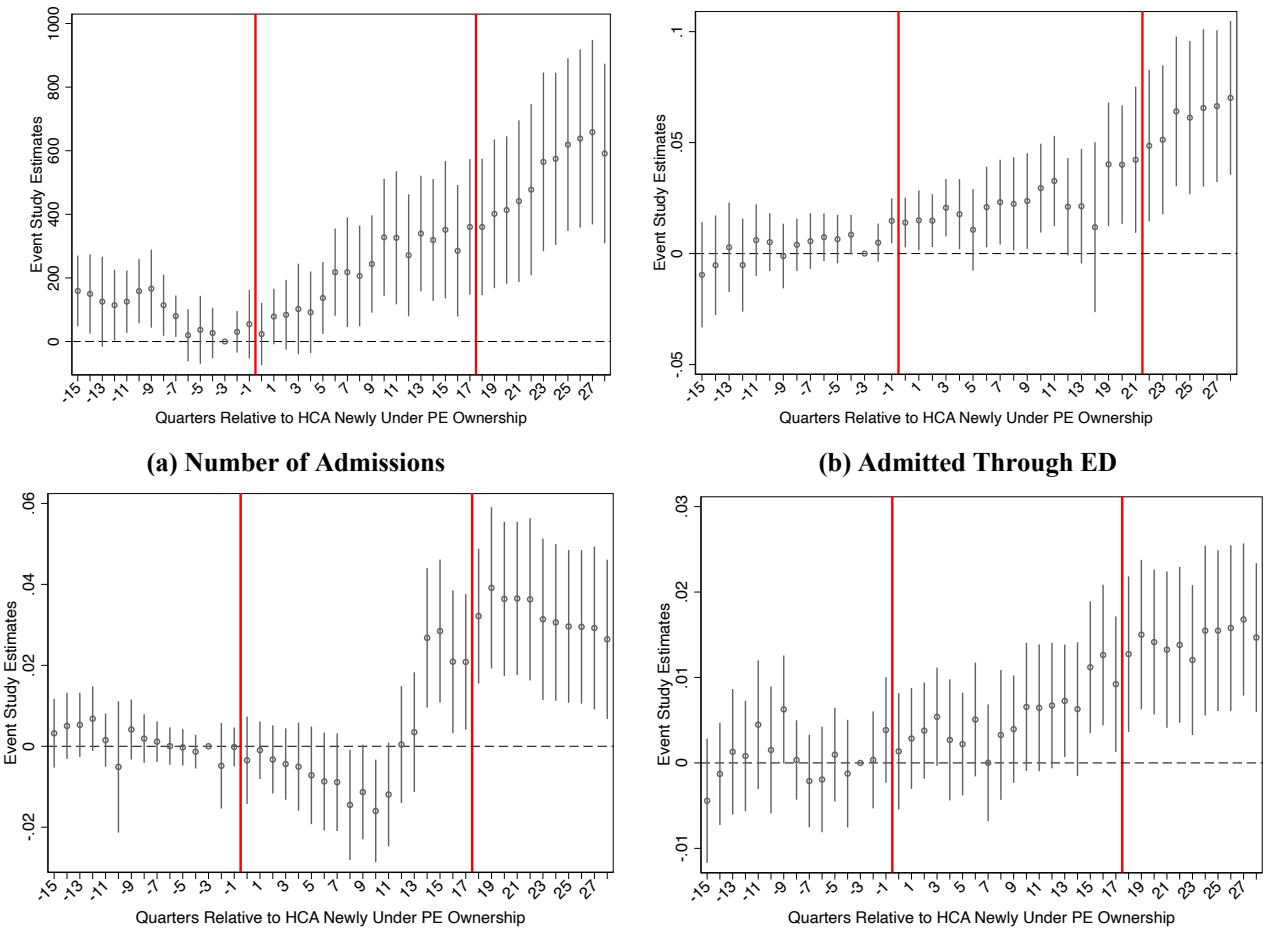
	Bad Debt/Charity	Commercial	Medicaid	Medicare FFS	Self-Insured	All Others
	(1)	(2)	(3)	(4)	(5)	(6)
1[PE Ownership]	0.011**	–0.035	0.002	0.001	0.029	–0.008
	(0.005)	(0.020)	(0.024)	(0.002)	(0.017)	(0.006)
1[PE Divestment]	0.010**	–0.039**	0.041**	0.001	0.0004	–0.013
	(0.005)	(0.019)	(0.020)	(0.002)	(0.014)	(0.008)
Hospital Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Unique Hospitals	105	105	105	105	105	105
Observations (N)	4,620	4,620	4,620	4,620	4,620	4,620
HCA 2003-2005 Outcome Mean	0.004	0.41	0.46	0.005	0.09	0.03
Controls 2003-2005 Outcome Mean	0.016	0.43	0.47	0.004	0.06	0.02

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 with pregnancy-related inpatient admissions from Q1 2003 through Q4 2013. There are 24 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

TABLE 5—DIFF-IN-DIFF ESTIMATES FOR PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON HOSPITAL NON-BIRTH/NON-PRGENGANCY RELATED ADMISSIONS

	Number of Admissions	Admitted Through ED	Transfer Patient	Weekend Admission	Distance Traveled (miles)
	(1)	(2)	(3)	(4)	(5)
1[PE Ownership]	130.6**	0.017**	–0.001	0.005**	0.025
	(66.8)	(0.008)	(0.005)	(0.002)	(0.163)
1[PE Divestment]	431.2***	0.052***	0.031***	0.014***	0.115
	(126.9)	(0.016)	(0.009)	(0.004)	(0.256)
Hospital Fixed Effects	Yes	Yes	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes
Unique Hospitals	138	138	138	138	138
Observations (N)	6,072	5,520	6,072	6,072	6,068
HCA 2003-2005 Outcome Mean	2,626	0.66	0.03	0.19	10.5
Controls 2003-2005 Outcome Mean	3,068	0.66	0.02	0.19	10.6

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. All admissions for birth or pregnancy-related issues are excluded from these analyses. "ED" stands for emergency department. Four quarters are unusable for the outcome in column 3 due to a variable definition and reporting requirement transition; thus, those quarters are dropped from the analyses. Column 5 measures the zip centroid-to-zip centroid distance from the patient's zip code to the hospital's zip code. Standard errors clustered at the hospital level
*** P value at 0.01 ** P value at 0.05



(a) Number of Admissions

(b) Admitted Through ED

(c) Transfer Patient

(d) Weekend Admissions

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.

TABLE 6—DIFF-IN-DIFF ESTIMATES FOR PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON HOSPITAL TREATMENT INTENSITY AND CASE MIX FOR NON-BIRTH/NON-PRGENGANCY RELATED ADMISSIONS

	LOS	OR Use	Any Procedure	ICU Use	Discharged with Home Health	Avg. DRG Weight	Avg. Total Charges '000 nominal dollars (in logs)	Mortality
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1[PE Ownership]	–0.143**	–0.012	–0.020***	–0.014	–0.007	–0.004	0.031	–0.0018**
	(0.056)	(0.007)	(0.007)	(0.015)	(0.004)	(0.024)	(0.019)	(0.0009)
1[PE Divestment]	–0.516***	–0.036***	–0.043***	–0.064**	–0.023***	–0.002	0.014	–0.0029**
	(0.078)	(0.011)	(0.011)	(0.028)	(0.006)	(0.034)	(0.028)	(0.0012)
Hospital Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unique Hospitals	138	138	138	138	138	138	138	138
Observations (N)	6,072	6,072	6,072	6,072	6,072	6,044	6,072	6,072
HCA 2003-2005 Outcome Mean	4.96	0.33	0.54	0.33	0.12	1.13	34.5	0.03
Controls 2003-2005 Outcome Mean	4.90	0.31	0.52	0.30	0.10	1.14	26.0	0.03

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. All admissions for birth or pregnancy-related issues are excluded from these analyses. "LOS" stands for length of stay. "OR" stands for operating room. "ICU" stands for intensive care unit. Pre-period means in column (7) are reported in levels (not log transformed). Standard errors clustered at the hospital level

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

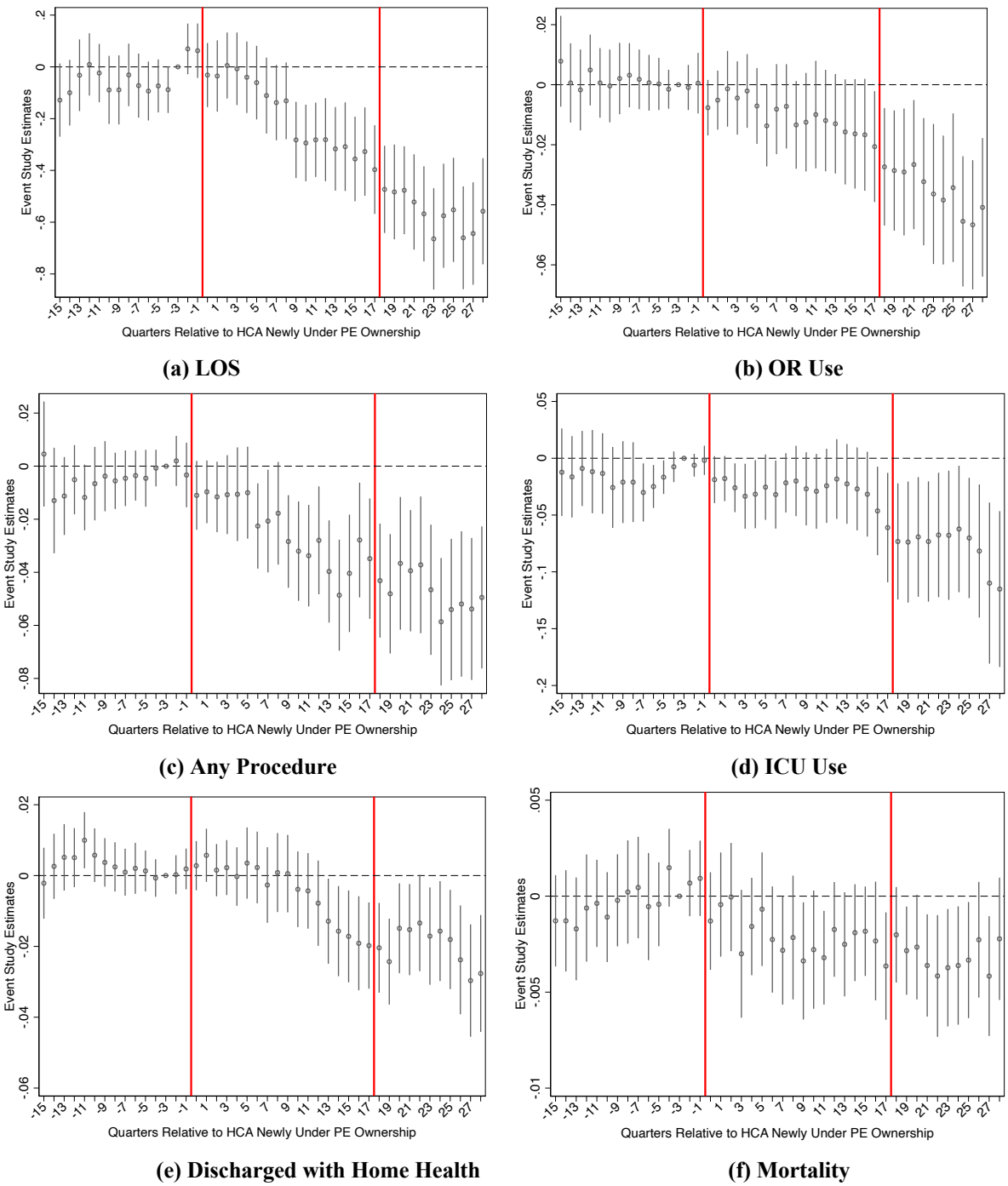


FIG 11. DIFF-IN-DIFF EVENT STUDY ESTIMATES CORRESPONDING TO TABLE 6

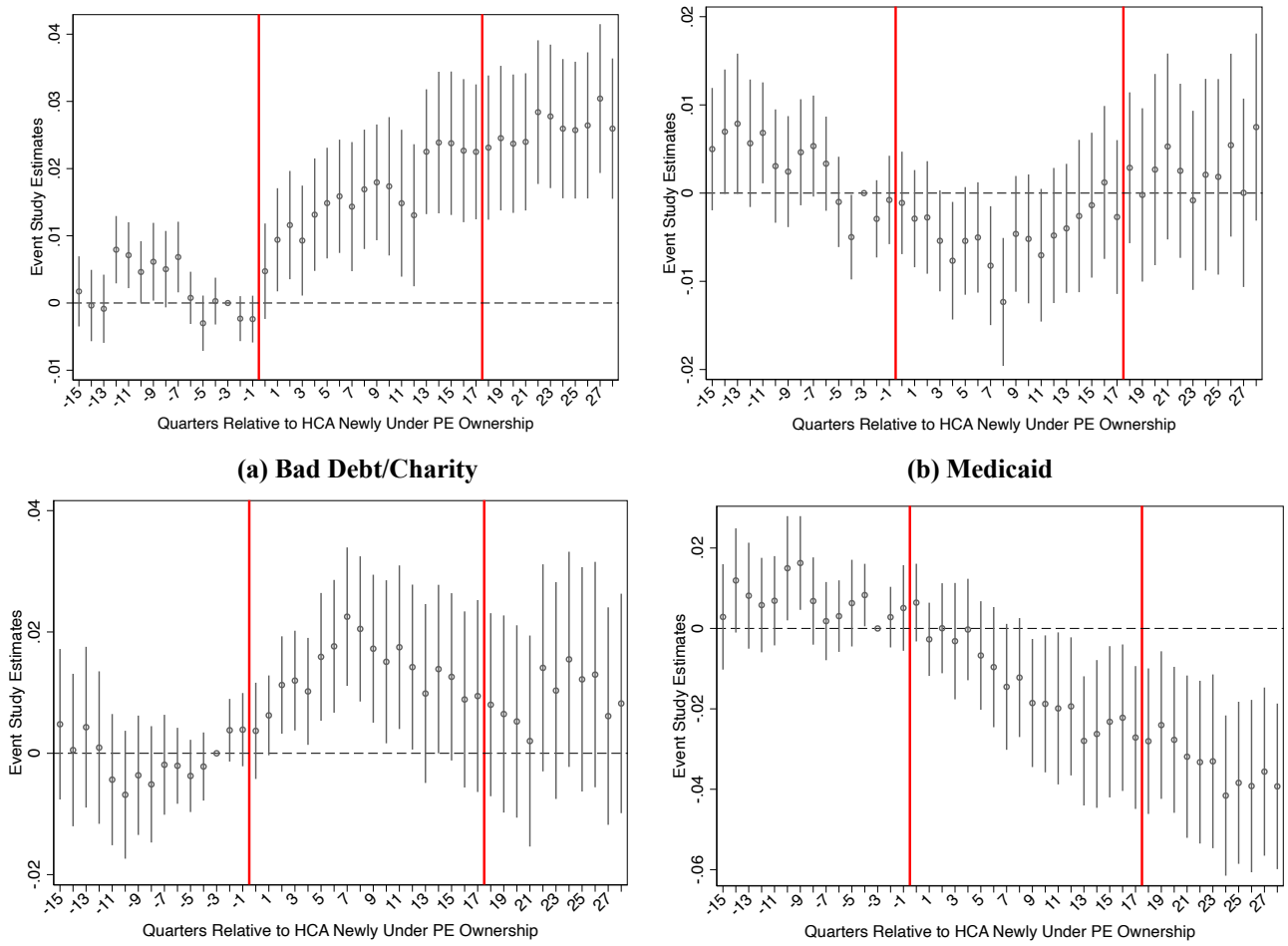
Notes: Outcome definitions and analytic samples are identical to those reported in Table 6. Vertical bars bookend private equity ownership of HCA.

TABLE 7—DIFF-IN-DIFF ESTIMATES FOR PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON HOSPITAL INPATIENT CARE PAYER MIX FOR NON-BIRTH/NON-PRGENGANCY RELATED ADMISSIONS

	Bad Debt/Charity	Commercial	Medicaid	Medicare Advantage	Medicare FFS	Self-Insured	All Others
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1[PE Ownership]	0.014***	0.003	–0.0073***	0.014**	–0.020***	–0.0015	–0.002
	(0.004)	(0.004)	(0.0025)	(0.007)	(0.007)	(0.0039)	(0.002)
1[PE Divestment]	0.024***	0.010	–0.0001	0.010	–0.041***	0.0006	–0.004
	(0.005)	(0.007)	(0.0043)	(0.010)	(0.010)	(0.0050)	(0.004)
Hospital Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Qtr-Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Unique Hospitals	138	138	138	138	138	138	138
Observations (N)	6,072	6,072	6,072	6,072	6,072	6,072	6,072
HCA 2003-2005 Outcome Mean	0.007	0.24	0.08	0.09	0.50	0.05	0.04
Controls 2003-2005 Outcome Mean	0.026	0.27	0.10	0.07	0.45	0.05	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. All admissions for birth or pregnancy-related issues are excluded from these analyses. "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



(a) Bad Debt/Charity

(b) Medicaid

(c) Medicare Advantage

(d) Medicare FFS

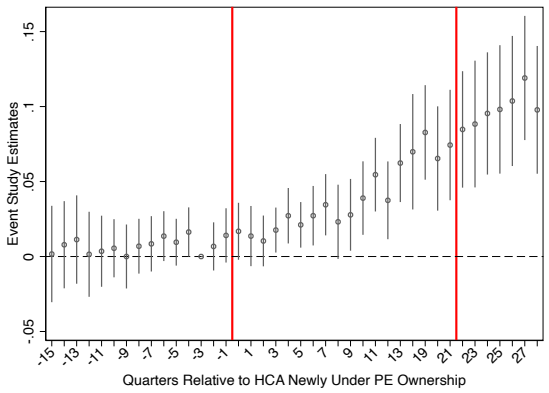
FIG 12. DIFF-IN-DIFF EVENT STUDY ESTIMATES CORRESPONDING TO TABLE 7

Notes: Outcome definitions and analytic samples are identical to those reported in Table 7. Vertical bars bookend private equity ownership of HCA.

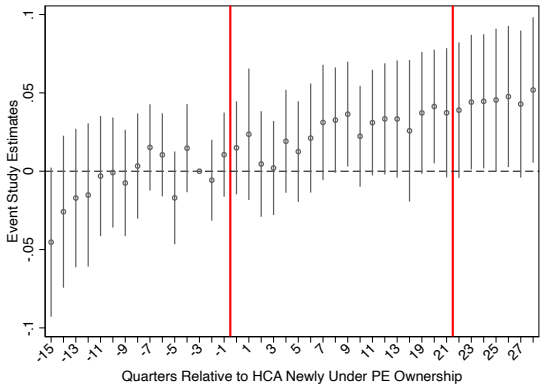
TABLE 8—HETEROGENEITY IN DIFF-IN-DIFF ESTIMATES FOR PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON HOSPITAL NON-BIRTH/NON-PRGENGANCY RELATED ADMISSION SOURCE

	Admitted Through ED	Transfer Patient
PANEL A: Commercial	(1)	(2)
1[PE Ownership]	0.025***	–0.004
	(0.009)	(0.004)
1[PE Divestment]	0.084***	–0.014
	(0.019)	(0.008)
HCA 2003-2005 Mean	0.56	0.03
PANEL B: Medicaid	(1)	(2)
1[PE Ownership]	0.028***	–0.001
	(0.011)	(0.006)
1[PE Divestment]	0.049***	0.008
	(0.018)	(0.008)
HCA 2003-2005 Mean	0.76	0.03
PANEL C: Medicare Advantage	(1)	(2)
1[PE Ownership]	0.001	–0.001
	(0.014)	(0.005)
1[PE Divestment]	0.034	0.020**
	(0.019)	(0.008)
HCA 2003-2005 Mean	0.77	0.03
PANEL D: Medicare FFS	(1)	(2)
1[PE Ownership]	0.015	0.005
	(0.008)	(0.006)
1[PE Divestment]	0.054***	0.074***
	(0.016)	(0.014)
HCA 2003-2005 Mean	0.68	0.03

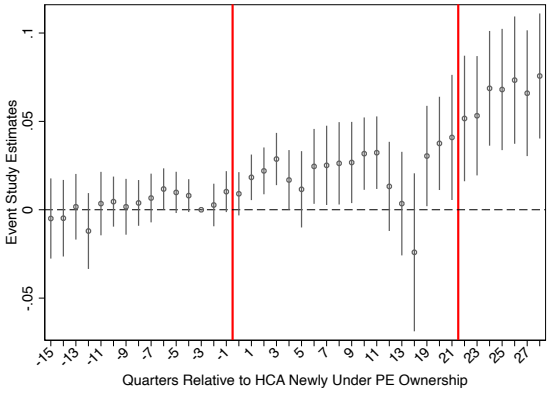
Notes: Analytic data are from the universe of Florida inpatient discharge records collapsed to the hospital-quarter-year-level. Analyses are restricted to general, short-term acute care hospitals consistently observed from Q1 2003 through Q4 2013. There are 35 unique hospitals in the HCA treated group. "PE" stands for private equity. All admissions for birth or pregnancy-related issues are excluded from these analyses. "ED" stands for emergency department. Four quarters are unusable for the outcome in column 1 due to a variable definition and reporting requirement transition; thus, those quarters are dropped from the analyses. Number of observations fluctuates (mostly for smaller payer groups) due to a given hospital not having a relevant admission in a given quarter-year. Standard errors clustered at the hospital level. *** P value at 0.01 ** P value at 0.05



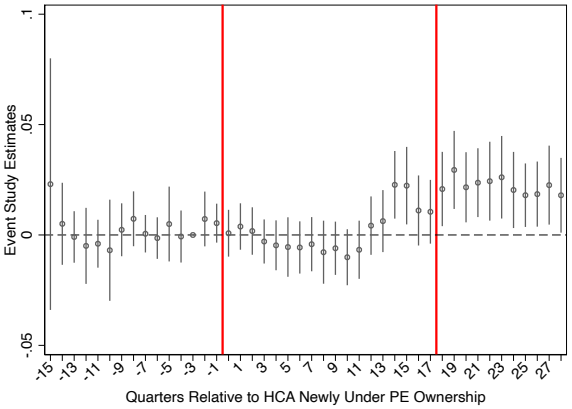
(a) Admitted Through ED - Commercial



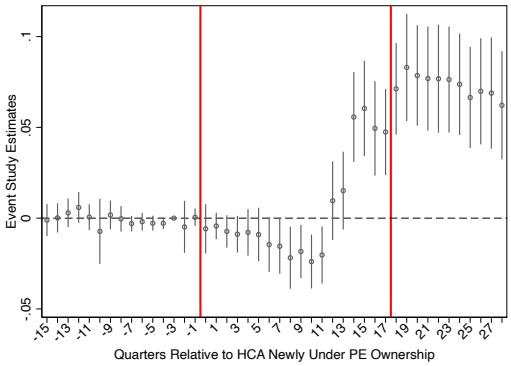
(b) Admitted Through ED – Medicaid



(c) Admitted Through ED – Medicare FFS



(d) Transfer Patient – Medicare Advantage



(e) Transfer Patient – Medicare FFS

FIG 13. DIFF-IN-DIFF EVENT STUDY ESTIMATES CORRESPONDING TO TABLE 8

Notes: Outcome definitions and analytic samples are identical to those reported in Table 8. Vertical bars bookend private equity ownership of HCA.

TABLE 9—HETEROGENEITY IN DIFF-IN-DIFF ESTIMATES FOR PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON HOSPITAL TREATMENT INTENSITY FOR NON-BIRTH/NON-PRGENGANCY RELATED ADMISSIONS BY PAYER

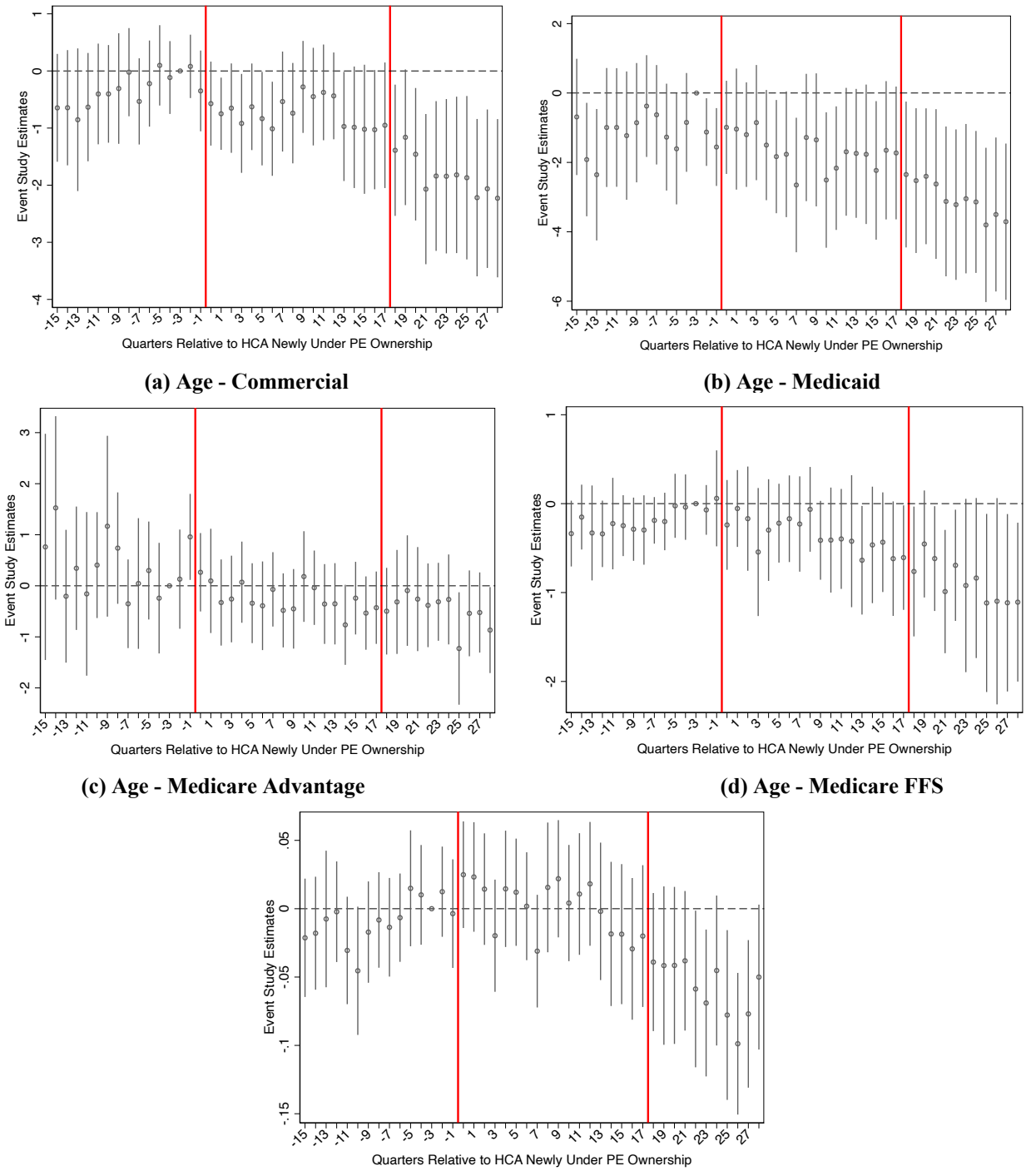
	LOS	OR Use	Any Procedure	ICU Use	Discharged w/ Home Health	Mortality
PANEL A: Commercial	(1)	(2)	(3)	(4)	(5)	(6)
1[PE Ownership]	–0.117**	–0.013	–0.024***	–0.009	–0.005	–0.005**
	(0.047)	(0.008)	(0.009)	(0.013)	(0.004)	(0.002)
1[PE Divestment]	–0.248***	–0.040***	–0.045***	–0.038	–0.013**	–0.009**
	(0.078)	(0.014)	(0.015)	(0.025)	(0.006)	(0.004)
HCA 2003-2005 Mean	3.8	0.40	0.59	0.26	0.08	0.021
PANEL B: Medicaid	(1)	(2)	(3)	(4)	(5)	(6)
1[PE Ownership]	–0.342***	–0.013	–0.033***	–0.022	–0.0019	–0.002
	(0.120)	(0.010)	(0.010)	(0.014)	(0.0013)	(0.001)
1[PE Divestment]	–0.808***	–0.035***	–0.062***	–0.074***	–0.0023	–0.002
	(0.141)	(0.014)	(0.014)	(0.026)	(0.0013)	(0.001)
HCA 2003-2005 Mean	5.3	0.26	0.45	0.29	0.06	0.016
PANEL C: Medicare Adv.	(1)	(2)	(3)	(4)	(5)	(6)
1[PE Ownership]	–0.085	–0.011	–0.010	–0.013	–0.014	0.001
	(0.105)	(0.010)	(0.014)	(0.018)	(0.008)	(0.003)
1[PE Divestment]	–0.439***	–0.034***	–0.027	–0.079**	–0.023**	–0.003
	(0.124)	(0.013)	(0.016)	(0.033)	(0.011)	(0.003)
HCA 2003-2005 Mean	5.0	0.31	0.52	0.40	0.14	0.036
PANEL D: Medicare FFS	(1)	(2)	(3)	(4)	(5)	(6)
1[PE Ownership]	–0.088	–0.013	–0.015**	–0.013	–0.008	–0.001
	(0.070)	(0.007)	(0.008)	(0.017)	(0.005)	(0.001)
1[PE Divestment]	–0.485***	–0.038***	–0.037***	–0.067**	–0.030***	–0.001
	(0.105)	(0.010)	(0.011)	(0.032)	(0.008)	(0.001)
HCA 2003-2005 Mean	5.8	0.32	0.54	0.37	0.16	0.036

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. All admissions for birth or pregnancy-related issues are excluded from these analyses. "LOS" stands for length of stay. "ICU" stands for intensive care unit. Each outcome is specific to the relevant payer group listed in Panels A-D. Estimations are otherwise identical to those from Table 6. Number of observations can fluctuate slightly due to a given hospital not having a relevant admission in a given quarter-year. Standard errors clustered at the hospital level. *** P value at 0.01 ** P value at 0.05

TABLE 10— DIFF-IN-DIFF ESTIMATES FOR PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON PATIENT CHARACTERISTICS FOR NON-BIRTH/NON-PRGENGANCY RELATED ADMISSIONS BY PAYER

	Age	Female	White	Charlson Comorbidity Index	Elixhauser Score
PANEL A: Commercial	(1)	(2)	(3)	(4)	(5)
1[PE Ownership]	–0.40	0.006	–0.014**	0.010	0.015
	(0.30)	(0.004)	(0.006)	(0.014)	(0.020)
1[PE Divestment]	–1.48***	0.0001	0.004	–0.049**	–0.033
	(0.51)	(0.0053)	(0.008)	(0.020)	(0.029)
HCA 2003-2005 Mean	48.8	0.55	0.78	0.50	1.0
PANEL B: Medicaid	(1)	(2)	(3)	(4)	(5)
1[PE Ownership]	–0.57	0.012**	–0.024***	0.019	0.045
	(0.58)	(0.005)	(0.008)	(0.022)	(0.028)
1[PE Divestment]	–1.94**	0.005	–0.019	–0.049	–0.020
	(0.87)	(0.006)	(0.010)	(0.030)	(0.045)
HCA 2003-2005 Mean	39.5	0.59	0.59	0.66	1.1
PANEL C: Medicare Adv.	(1)	(2)	(3)	(4)	(5)
1[PE Ownership]	–0.61	–0.003	–0.006	0.039	0.059**
	(0.33)	(0.008)	(0.010)	(0.024)	(0.028)
1[PE Divestment]	–0.84**	0.003	0.006	0.009	0.016
	(0.41)	(0.008)	(0.013)	(0.033)	(0.043)
HCA 2003-2005 Mean	74.9	0.53	0.81	0.90	1.7
PANEL D: Medicare FFS	(1)	(2)	(3)	(4)	(5)
1[PE Ownership]	–0.10	0.004	–0.015**	0.067***	0.080***
	(0.21)	(0.003)	(0.007)	(0.023)	(0.027)
1[PE Divestment]	–0.70	0.007	0.003	0.032	0.035
	(0.37)	(0.004)	(0.008)	(0.028)	(0.040)
HCA 2003-2005 Mean	74.3	0.56	0.82	0.99	1.8

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. All admissions for birth or pregnancy-related issues are excluded from these analyses. Each outcome is specific to the relevant payer group listed in Panels A-D. Number of observations can fluctuate slightly due to a given hospital not having a relevant admission in a given quarter-year. Standard errors clustered at the hospital level.
*** P value at 0.01 ** P value at 0.05



(a) Age - Commercial

(b) Age - Medicaid

(c) Age - Medicare Advantage

(d) Age - Medicare FFS

(e) Charlson Comorbidity Index - Commercial

FIG 14. DIFF-IN-DIFF EVENT STUDY ESTIMATES CORRESPONDING TO TABLE 10

Notes: Outcome definitions and analytic samples are identical to those reported in Table 10. Vertical bars bookend private equity ownership of HCA.

TABLE 11—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]	–375.6***	–8.6	159.2***	–10.6**	0.018	0.131***
	(95.5)	(5.3)	(41.6)	(4.4)	(0.024)	(0.033)
1[PE Divestment]	–330.9**	3.8	259.7***	–19.8***	0.218***	0.208***
	(132.7)	(6.9)	(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	136	136	136	136	136	136
Observations (N)	5,984	5,984	5,984	5,984	5,984	5,984
HCA 2003-2005 Outcome Mean	1,791	116.6	708.0	61.5	--	8,257
Controls 2003-2005 Outcome Mean	2,320	143.3	803.3	81.2	--	6,541

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

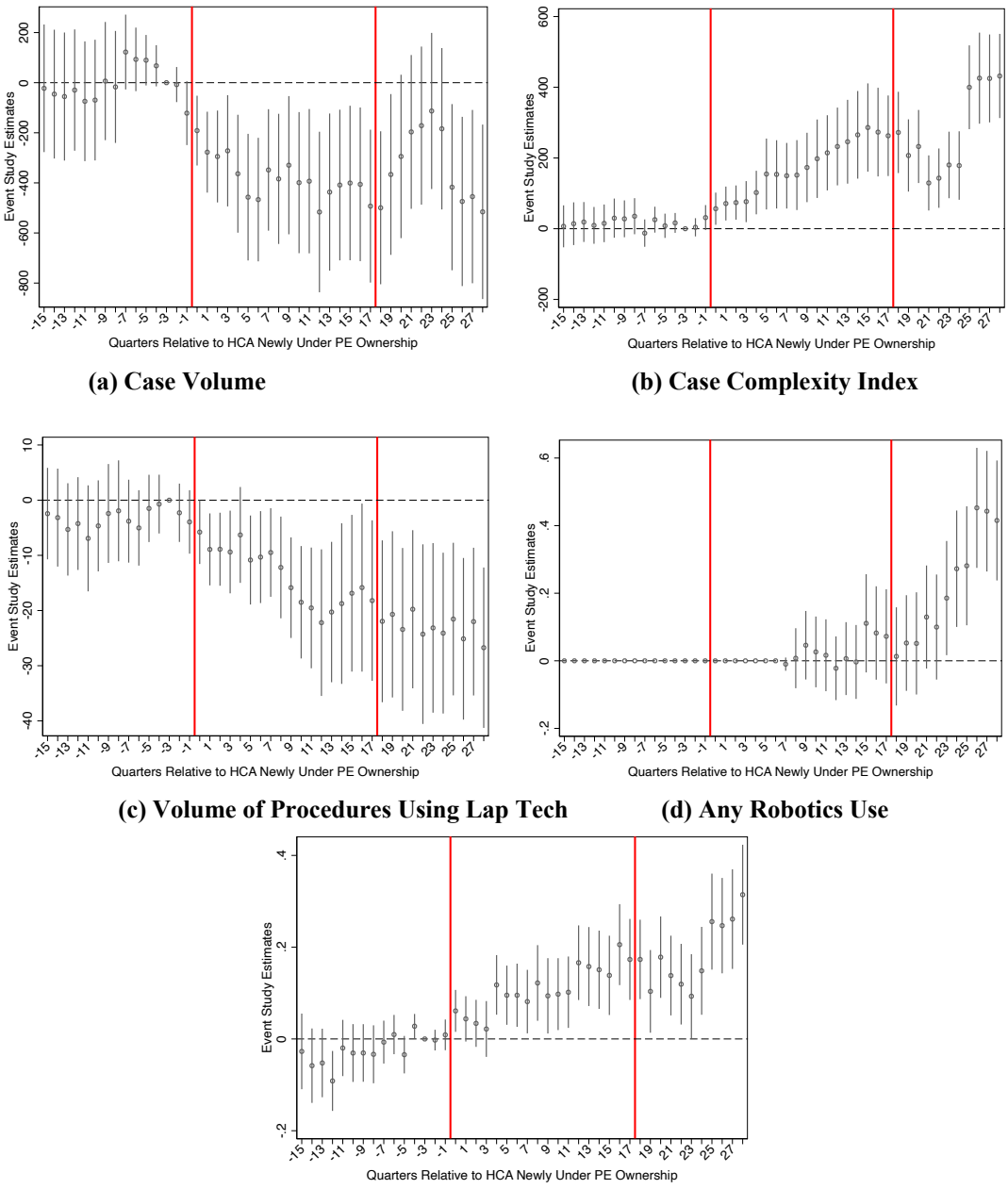
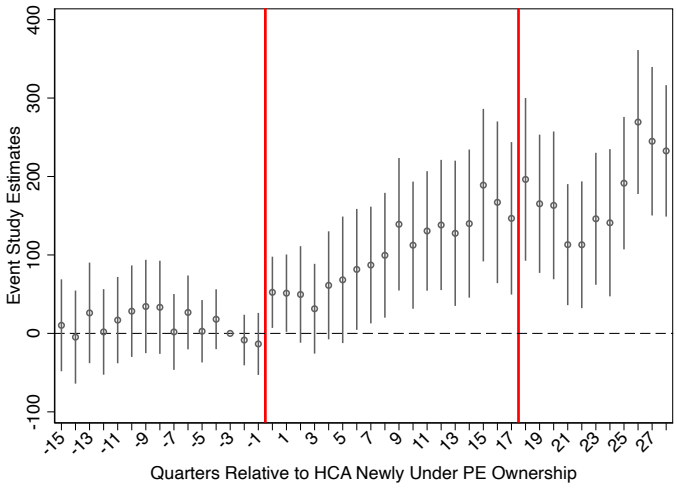
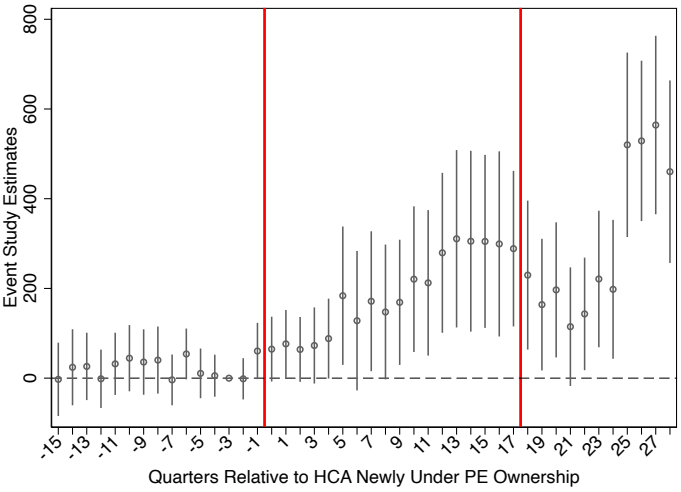


FIG 15. DIFF-IN-DIFF EVENT STUDY ESTIMATES CORRESPONDING TO TABLE 11

Notes: Outcome definitions and analytic samples are identical to those reported in Table 11. Vertical bars bookend private equity ownership of HCA.



(a) Case Complexity Index - Commercially Insured



(b) Case Complexity Index - Medicare FFS

FIG 16. HETEROGENEITY IN PRIVATE EQUITY INVESTMENT AND DIVESTMENT EFFECTS ON HOSPITAL OUTPATIENT CARE CASE COMPLEXITY INDEX BY PAYER

Notes: Outcome definition and estimation parallels Table 11; however, the cases are subset

TABLE 12—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	0.005	–0.022***	0.026***	–0.018**	0.008***	0.002
	(0.002)	(0.009)	(0.006)	(0.006)	(0.008)	(0.003)	(0.004)
1[PE Divestment]	0.004	0.012	–0.008	0.040***	–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	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	0.001	0.39	0.07	0.05	0.42	0.02	0.05
Controls 2003-2005 Outcome Mean	0.014	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

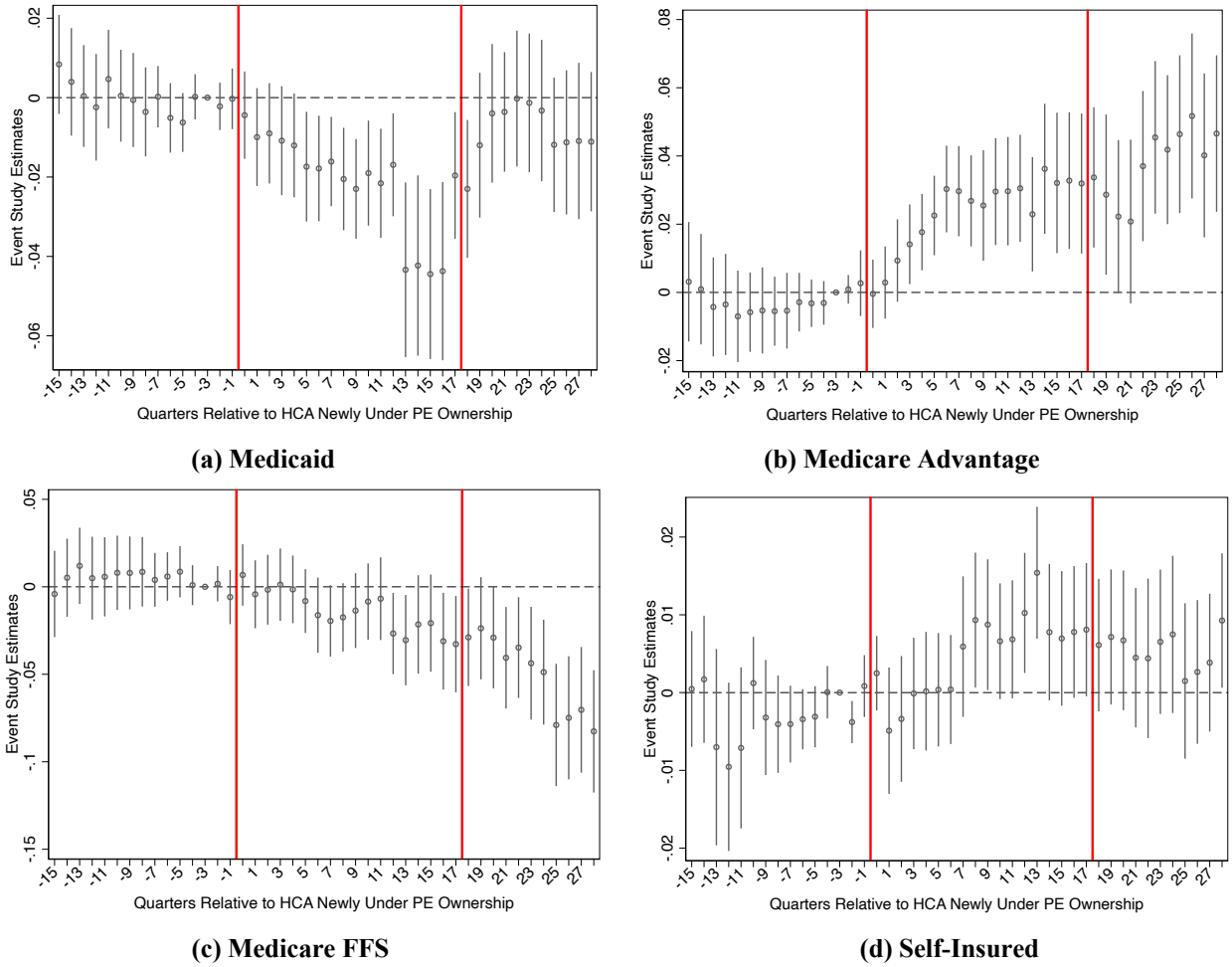


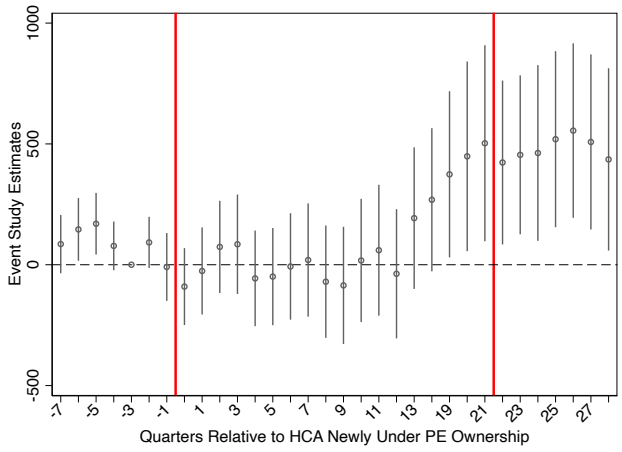
FIG 17. DIFF-IN-DIFF EVENT STUDY ESTIMATES CORRESPONDING TO TABLE 12

Notes: Outcome definitions and analytic samples are identical to those reported in Table 12. Vertical bars bookend private equity ownership of HCA.

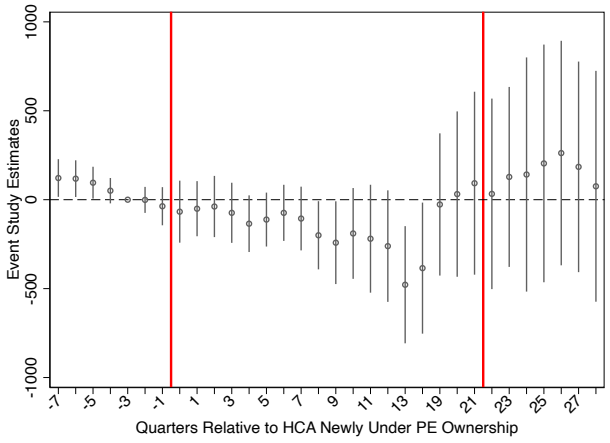
TABLE 13—AVERAGE TOTAL EMERGENCY DEPARTMENT PATIENTS AND SHARE OF EMERGENCY DEPARTMENT PATIENTS ADMITTED TO THE SAME HOSPITAL'S INPATIENT UNIT BY PAYER IN 2005

	HCA Hospitals	Control Group Hospitals
Total ED Encounters		
Commercial	2,768	3,273
Medicaid	1,815	2,133
Medicare Advantage	434	329
Medicare FFS	1,911	1,924
Share Admitted		
Commercial	0.14	0.17
Medicaid	0.10	0.15
Medicare Advantage	0.40	0.46
Medicare FFS	0.45	0.48
Unique Hospitals	35	99

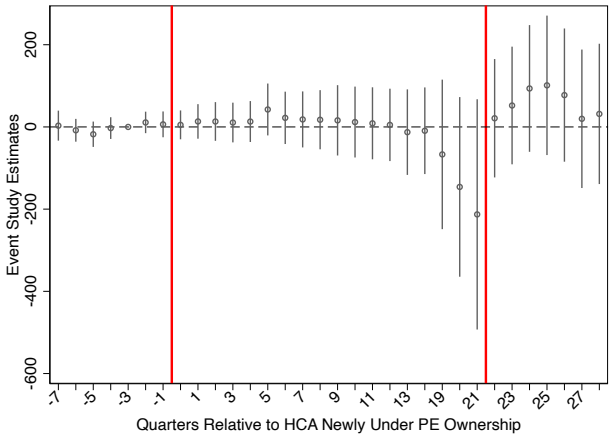
Notes: Restricts to treatment and control group hospitals from main analyses that also have emergency department (ED) encounter data in 2005. Four hospitals do not have relevant inpatient and ED outpatient admissions and are excluded from these empirical exercises. "Total ED Encounters" is the total number of inpatient admissions for the relevant payer that came through the hospital's ED summed with the total number of outpatient ED encounters at the same hospital (i.e., ED visits that did not result in an inpatient admission to the hospital). It then serves as the denominator for calculating the share of relevant ED patients ultimately admitted to the hospital's inpatient unit.



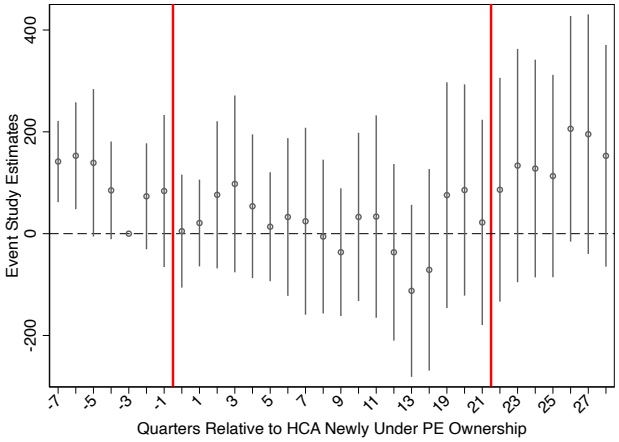
(a) Commercial



(b) Medicaid



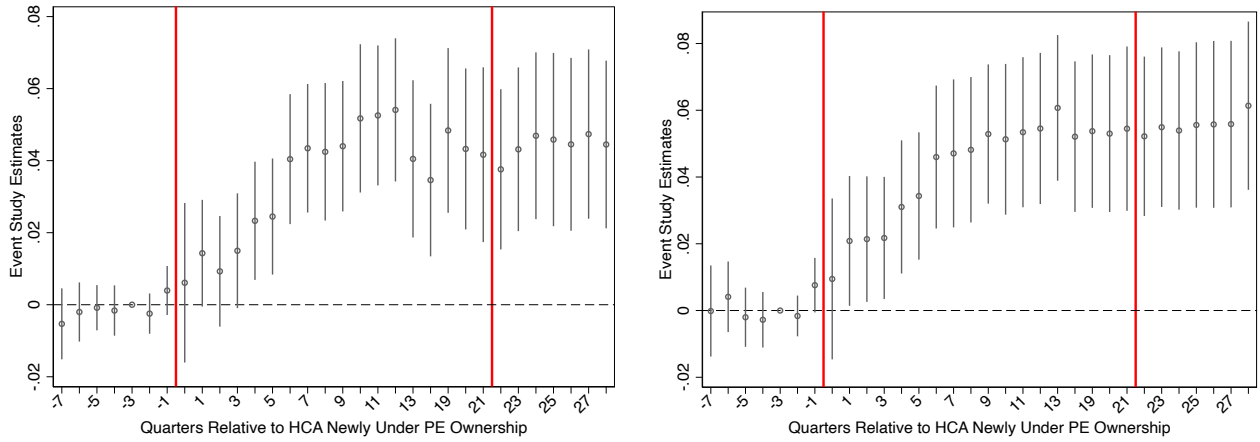
(c) Medicare Advantage



(d) Medicare FFS

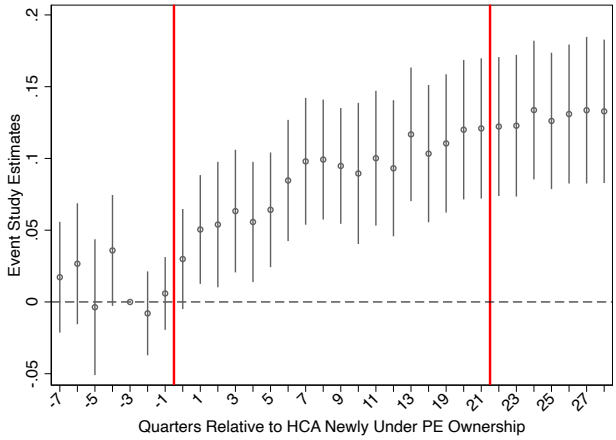
FIG 18. DIFF-IN-DIFF EVENT STUDY ESTIMATES FOR TOTAL EMERGENCY DEPARTMENT ENCOUNTERS BY PAYER

Notes: Outcome definitions and analytic samples are identical to those reported in Table 13. Vertical bars bookend private equity ownership of HCA

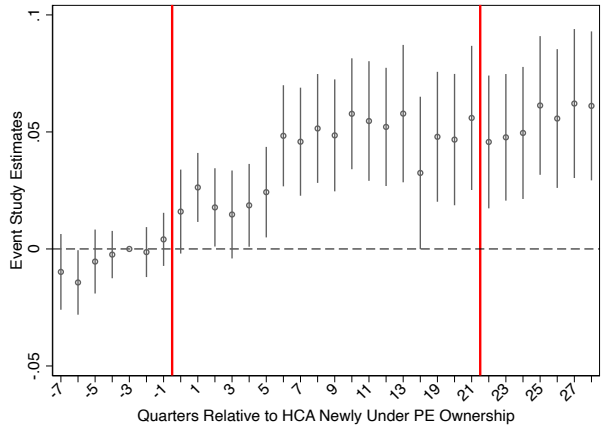


(a) Commercial

(b) Medicaid



(c) Medicare Advantage



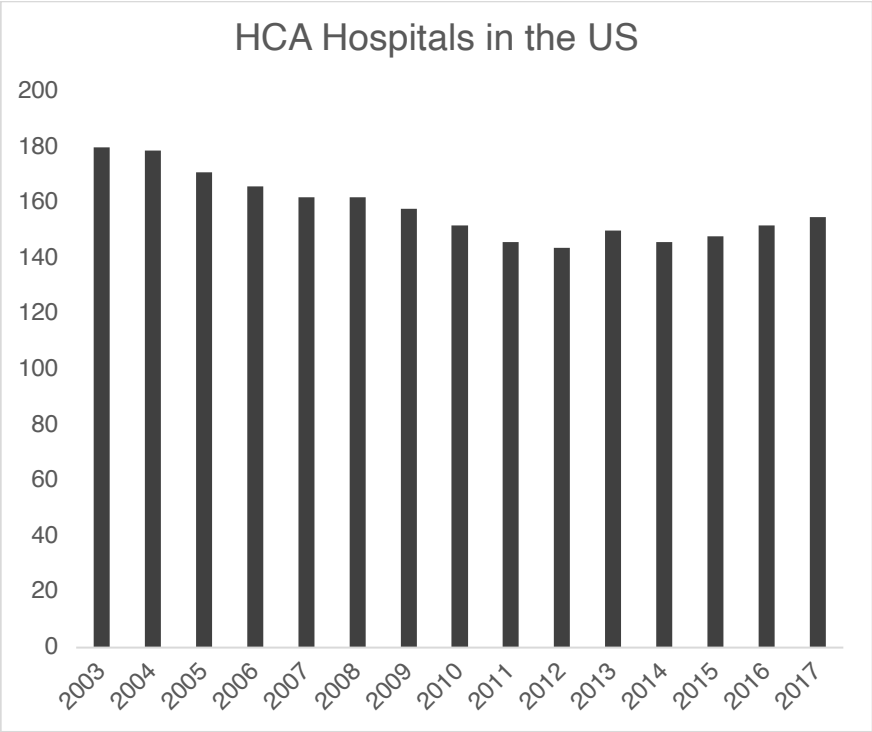
(d) Medicare FFS

FIG 19. DIFF-IN-DIFF EVENT STUDY ESTIMATES FOR SHARE OF EMERGENCY DEPARTMENT ENCOUNTERS RESULTING IN ADMISSION TO INPATIENT UNIT BY PAYER

Notes: Outcome definitions and analytic samples are identical to those reported in Table 13. Recall, four quarters are unusable for the inpatient variable capturing admission through the ED due to a variable definition and reporting requirement transition; thus, those quarters are dropped from the analyses. Vertical bars bookend private equity ownership of HCA.

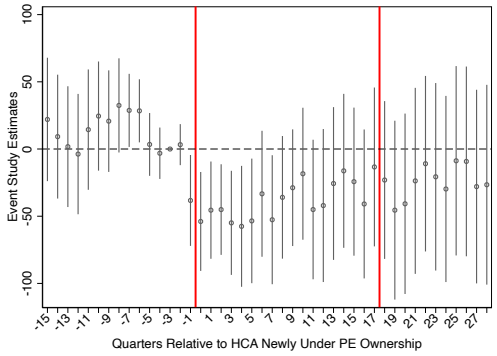
Appendix

Appendix Figure A1: Number of HCA Hospitals Over Time

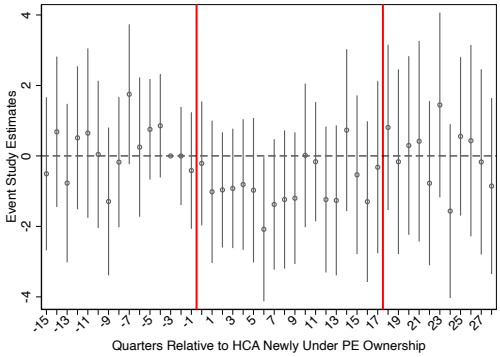


Source: American Hospital Association (AHA) annual survey. Authors' calculations.

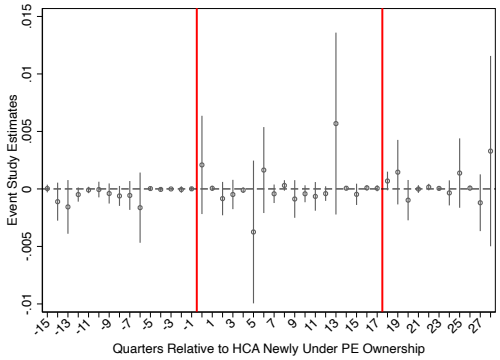
Appendix Figure A2: Effects on Pregnancy Related Total Admissions, Number of Unique OBGYNs, and Mortality



(a) Number of Admissions

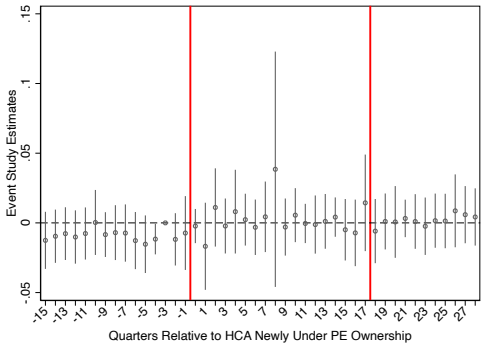


(b) Number of Unique OBGYNs

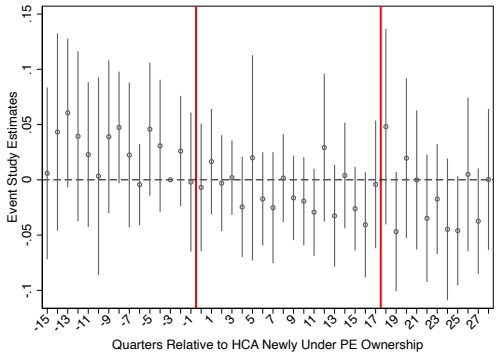


(c) Mortality

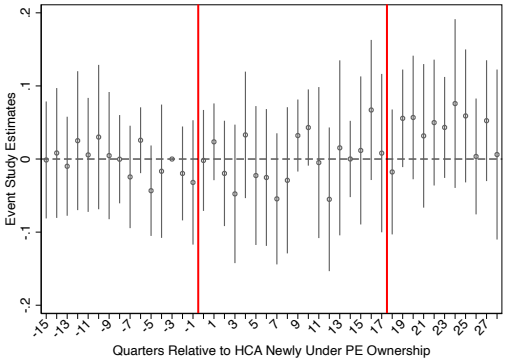
Appendix Figure A3: Effects on Pregnancy-Related Admission Payer Mix



(a) Bad Debt/Charity

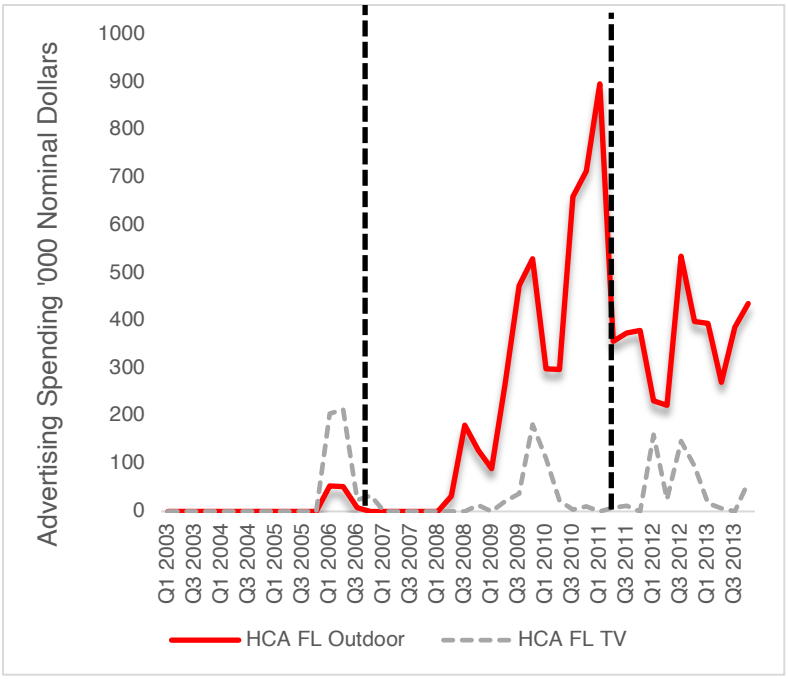


(b) Commercial

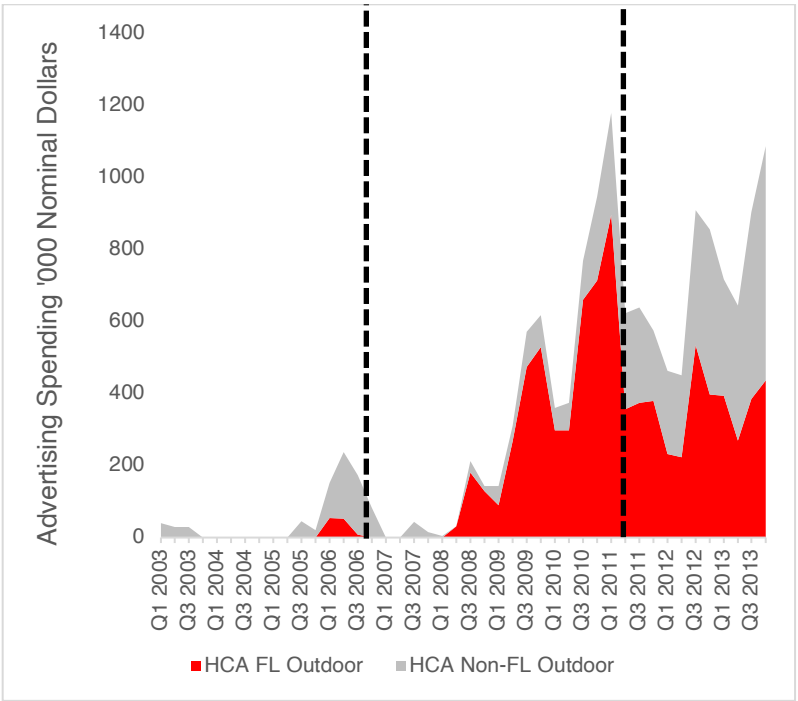


(c) Medicaid

Appendix Figure A4: HCA Advertising in Florida Media Markets and Compared to Non-Florida Media Markets

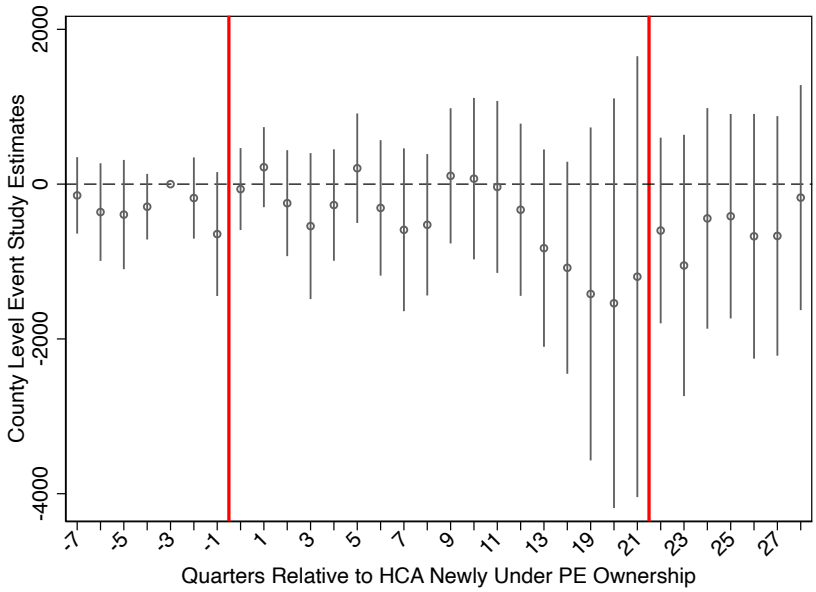


(a) HCA Advertising in Florida Media Markets



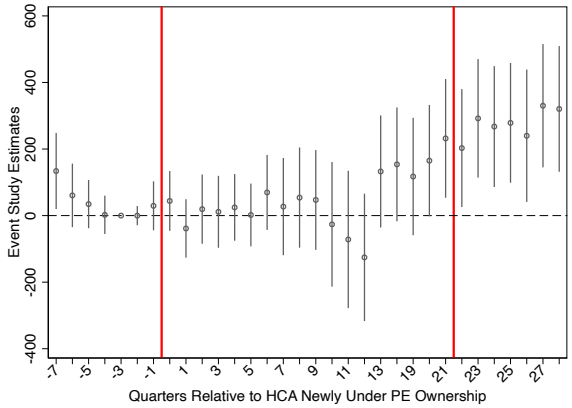
(b) HCA Advertising in Florida and Non-Florida Media Markets

Appendix Figure A5: County Level Effects on Commercial Patient Emergency Department Utilization

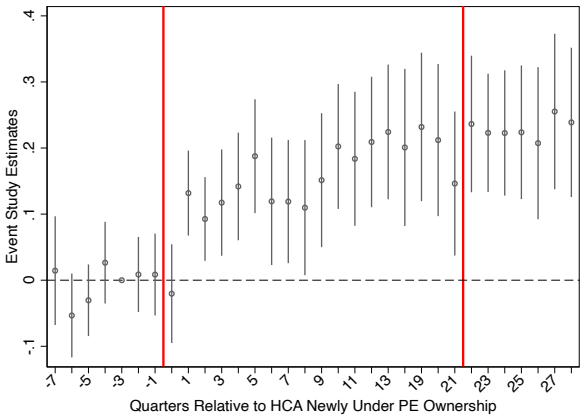


Notes: Outcomes is the county level summation of all inpatient admissions through a hospital ED and all outpatient ED encounters (i.e., ED visits not resulting in an admission). Restricts to counties with non-zero commercial patient ED utilization in all quarter-years, 2005-2013. Counties (23) with at least one HCA hospital always presents are classified as treated. Counties (34) with no HCA hospitals persistently present are classified as controls. 14 treatment group counties have a single HCA hospital; 6 have two; 1 has three; and 2 have four. Treatment group counties averaged 16,000 commercially insured ED encounters per quarter-year in 2005.

Appendix Figure A6: Event Study Effects for Emergency Department Visit Volumes and Share Admitted among the Bad Debt/Charity Care Patient Population



(a) ED Encounters



(b) Share Admitted