Turbocharging Profits? Contract Gaming and Revenue Allocation in Healthcare*

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Abstract

Firms often exploit loopholes in government contracts to boost revenues. The welfare consequences of this behavior depend on how firms use the marginal windfall dollar. This paper studies how hospitals allocated $3 billion obtained via a Medicare payment loophole. The average gaming hospital increased both Medicare and total revenue by around 10%, implying large spillovers on other payers. Some of these funds flowed to operating costs, a result driven entirely by nonprofits. The rest flowed off hospital balance sheets, mostly due to for-profit hospitals. These funds enriched executives and shareholders. We detect modest reductions in mortality rates at nonprofits but no changes at for-profits. Our results imply the consequences of such engineered windfalls vary substantially by hospital ownership.

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1 Introduction

Governments frequently contract with private firms to deliver goods and services. Design flaws or ambiguities in contracts provide opportunities for firms to exploit loopholes and increase revenue beyond the intention of policymakers. This behavior, in which firms "engineer" windfalls, is estimated to cost the U.S. government hundreds of billions of dollars annually (Government Accountability Office, 2023). Despite the prevalence and significant costs associated with loopholes in government contracts, little research exists on how firms utilize funds obtained from engineered windfalls. The welfare consequences of this behavior depend on how firms allocate the marginal dollar of excess revenue.

These issues are particularly acute in the healthcare sector, which represents one-fifth of the U.S. economy, features an outsized government presence, and is rife with information frictions and agency problems (Arrow, 1963). Medicare and Medicaid account for a quarter of federal outlays but more than half of all estimated improper federal payments (Government Accountability Office, 2023). Payment system design is one common contracting challenge in this setting. Policymakers' efforts to design an efficient system can be frustrated by the actions of providers and insurers to maximize their own revenue through "gaming" (Dafny, 2005; Decarolis, 2015; Duggan, 2000; Geruso and Layton, 2020). If providers direct gaming revenue to patient care, policymakers may have less to fear from payment system weaknesses. However, if excess revenue has limited benefits for patients, it would support devoting greater resources to contract design and payment oversight (Leder-Luis, n.d.; Shi, 2023).

In this paper, we study how hospitals allocate revenue obtained from exploiting a loophole in Medicare's outlier payments program. For most patients, Medicare uses a fixed-price contract (Laffont and Tirole, 1993) that does not pay hospitals for costs of care at the margin. Outlier payments modify that contract to pay hospitals for some of the costs of treating patients who require resource-intensive care. However, due to flawed implementation, hospitals could inflate outlier payments by "turbocharging": rapidly raising their list prices, commonly referred to as charges. We conservatively estimate that hospitals that gamed this program received $3 billion in excess Medicare payments between 1998 and 2003 before the loophole was closed.

Several features of this episode make it an ideal setting to study how hospitals allocate gains from engineered windfalls. First, turbocharging involves a top-down administrative decision by hospital managers to inflate charges across all patients via a simple change in hospital bookkeeping. Second, turbocharging appears to have been driven by geographic coincidence: Some hospitals were subject to large policy-driven payment cuts that may have incentivized gaming and were located near consulting firms that advised hospital managers on this practice (U.S. Department of Justice, 2008). These features allow us to exploit conditionally random variation in gaming behavior. Third, the revenue at stake from this behavior was substantial, with turbocharging hospitals raising their effective Medicare payment rates by 22% at the peak of the episode in 2002. Such a large boost in revenue could meaningfully impact hospital operations.

We first show that hospitals that engaged in turbocharging[1] previously experienced larger Medicare payment cuts under the Balanced Budget Act of 1997 (BBA97), suggesting the cuts may have spurred some hospitals to search for offsetting revenues. We also find that ownership type is highly predictive of turbocharging, consistent with theories of organizational behavior. Government-owned hospitals likely have little incentive to exploit loopholes to increase revenue because they operate under soft budget constraints (Kornai, Maskin and Roland, 2003). In contrast, managers of for-profit hospitals may have more incentive to maximize profits since they can distribute profits to themselves (Hansmann, 1980). In accordance with these theories, we find that for-profit hospitals are heavily over-represented among gamers, while almost no government hospitals engaged in turbocharging.

We use a matched difference-in-differences approach to estimate the causal effect of gaming outlier payments on hospital revenue, the allocation of the windfall gain, and its downstream effects on patients. We match on BBA97 payment cut parameters to compare gamer to non-gamer hospitals that had a similar motive to engage in turbocharging but did not. Our analytic sample includes 120 gamers and 1,396 matched comparator hospitals.

We find that, on average, hospitals that game Medicare by turbocharging obtain nearly $17 million in excess outlier payments, which translates to a 10% increase in total Medicare inpatient revenue between 1998 and 2003. The rapid growth in hospital list prices may also impact other payers because they often benchmark their payment rates to list prices (Bai and Anderson, 2016; Cooper et al., 2019) or piggyback on Medicare's contract design, thus inheriting its flaws (Clemens, Gottlieb and Molnár, 2017; Clemens and Gottlieb, 2017). Indeed, we detect large spillover effects on other insurers: total hospital revenue increases by $67 million, a similar amount as Medicare revenue in percent terms.

What do hospitals do with the engineered windfall? We trace the flow of funds into three mutually exclusive and exhaustive categories. The first is operating costs, and we find nearly half of the revenue obtained from turbocharging flowed there, though the estimate

[1] We define this group as hospitals with extreme growth in charges and simulated outlier payments. From hereon, for brevity we refer to these hospitals as gamers. Our approach, described in detail in Section 5.1, is conservative and identifies hospitals that most egregiously engaged in turbocharging. As a validation exercise, we find substantial overlap between our sample of gamer hospitals and those sued for outlier payments fraud under the False Claims Act.

is imprecise. Second, we study changes in net worth (defined as assets less liabilities) and find minimal effects here, including no detected change in fixed assets that might benefit patients, such as land, buildings, and equipment. The only remaining destination for the revenue to flow is off the hospital's balance sheet, called net balance deductions. These increase by nearly $40 million per hospital, over half of the estimated total revenue obtained from turbocharging. Such flows often represent the movement of funds to a hospital's parent organization, where they could be spent on executive compensation or, at for-profit firms, disbursed to shareholders.

These findings obscure remarkable differences between how nonprofit and for-profit hospitals allocate this revenue. Among nonprofits – but not for-profits – we find that the revenues predominantly flow to operating costs. In particular, nonprofits increase spending on non-labor direct operating costs which could enhance care delivery. Given these differences in behavior, we find modest quality improvements among nonprofit hospitals but no changes at for-profit hospitals. Quality of care was measured using patients hospitalized for non-deferrable health conditions (Card, Dobkin and Maestas, 2009; Doyle et al., 2015).

For-profit hospitals transfer essentially the entirety of the excess revenue off their balance sheets. We, therefore, trace the funds to the hospital's parent organization. Via SEC filing data, we show that Tenet Corporation, whose hospitals account for most of the for-profits engaging in turbocharging, dramatically increased compensation for its highest-paid executives during the gaming period. The system also engaged in stock buybacks, resulting in millions paid to shareholders. Back of the envelope calculations suggest that roughly a billion dollars were funneled toward their executives and shareholders.

This paper contributes to several strands of literature. First, we extend research studying how firms respond to windfall gains. Much of this literature has focused on firm responses to winning lawsuits, grants, or bonuses (Blanchard, Lopez-de Silanes and Shleifer, 1994; Howell and Brown, 2022; Cespedes, Huang and Parra, 2023). Within healthcare, adjacent literature has studied how healthcare providers respond to policy-driven price and wealth shocks (Duggan, 2000; Kaestner and Guardado, 2008; Clemens and Gottlieb, 2014; Cabral, Geruso and Mahoney, 2018; Gross et al., n.d.; Cooper et al., 2017). Some prior studies have examined how firms exploit loopholes, for example, by "upcoding" patient or beneficiary risk to increase their revenue (Dafny, 2005; Sacarny, 2018; Silverman and Skinner, 2004; Cook and Averett, 2020; Geruso and Layton, 2020).

However, little is known about how firms allocate revenue obtained from exploiting loopholes. Managers may view revenue derived from loopholes as less legitimate and less permanent than revenue obtained from intended policy changes (Wang, Stuart and Li, 2021). Such compartmentalization of revenue into separate "mental accounts" may lead managers to spend engineered windfalls differently (Thaler, 1985). For example, while several studies on exogenous windfalls find that the cash is invested into the firm or benefits employees (Saez, Schoefer and Seim, 2019; Howell and Brown, 2022), we find minimal evidence of such behavior. For-profit hospitals invest no revenue in the hospital and instead transfer the majority of funds off the balance sheet. Even among nonprofit hospitals, no excess revenue is spent on long-term commitments such as fixed capital, additional staff, or higher wages; instead, it is spent on more immediate operating needs.

Second, we contribute to the literature on ownership and performance of healthcare organizations. Many studies of US hospitals have found evidence that nonprofits often behave like for-profits (Dranove and Ludwick, 1999; Duggan, 2000; Sloan et al., 2001; Capps, Carlton and David, 2020). However, in theory, nonprofit and government-owned organizations should provide public goods or services that might be under-supplied by purely profit-driven organizations (Weisbrod, 1988; Sloan, 2000). Our results are consistent with these theoretical predictions of distinct responses by government, nonprofit, and for-profit hospitals in their propensity to exploit the loophole and, conditional on gaming, how they allocate the excess revenue. In particular, we find that nonprofit hospitals appeared to increase quality, to the benefit of patients, while we see no such response among for-profits (Newhouse, 1970; Rose-Ackerman, 1996; Glaeser and Shleifer, 2001; Garthwaite, Gross and Notowidigdo, 2018).

Third, our results highlight the potential for large spillover effects of loopholes in government payment contracts onto other payers (Clemens and Gottlieb, 2017; Clemens, Gottlieb and Molnár, 2017; Einav et al., 2020). Benevolent policymakers would internalize these spillovers when considering investments in contract design or provider oversight. The turbocharging scheme also relates to other instances in which providers manipulate charges or costs to increase their revenue. For example, such behavior has been noted in insurer-provider surprise billing disputes (Gordon et al., 2022) and among nursing homes aiming to appear less profitable to raise reimbursements from public payers (Gandhi and Olenski, 2024).

Lastly, we contribute to the growing literature on forensic economics (Zitzewitz, 2012) and the value of improving payment design and investing in disciplinary mechanisms to curb fraud and abuse (Howard and McCarthy, 2021; Leder-Luis, n.d.; Perez and Wing, 2019; Shi, 2023). These studies typically quantify how providers respond to specific mechanisms introduced to curb wasteful or fraudulent behavior, assuming that the targeted behavior is socially undesirable. We complement these studies by showing that the social value of such healthcare spending is not uniformly high or low and varies by provider ownership type.

2 Background

2.1 Medicare and outlier payments

The origins of the outlier payments scandal can be traced to 1983 when Medicare implemented a prospective payment system to reimburse hospitals for inpatient stays. The goal of prospective payment was to curb growing costs by paying hospitals a fixed price per inpatient episode, irrespective of the hospital's realized cost of treatment. This approach aimed to give hospitals a strong incentive to minimize the costs of production (Laffont and Tirole, 1993).

In practice, the system translated a patient's diagnoses and procedures submitted by the hospital on an insurance claim into one of several hundred Diagnosis-Related Groups (DRGs). Each DRG had a relative price attached to it, called a weight. To pay the hospital, the weights were transformed into dollars based on a hospital-specific conversion factor that depended on market and hospital characteristics. Within the broad payment categories represented by DRGs, hospitals incurred the full marginal cost of treatment.

This payment system created two potential problems. First, it gave hospitals an incentive to avoid admitting patients who would be costly to treat within a DRG. For example, hospitals would lose money by treating a patient who was likely to need ventilator support for months. Second, hospitals now had an incentive to shirk on care for patients who were admitted by discharging them earlier than medically appropriate.

To address these issues, the system included an insurance program called outlier payments. The program had the form of an insurance policy in which hospitals paid the full cost of treatment until costs in excess of the DRG payment exceeded a deductible, at which point Medicare paid 80% of further costs. For example, consider a procedure with a DRG payment of \$10,000. If the outlier payments deductible is \$20,000 and the hospital's reported cost to treat a very ill patient is \$100,000, then the hospital receives 80% of the cost beyond \$30,000, or \$56,000 in outlier payments.

However, as in many contracting settings, the federal government agency administering Medicare, the Centers for Medicaid and Medicare Services (CMS), could not observe the true costs of treatment, and so it relied on costs reported by hospitals. These were calculated in a convoluted fashion, where the hospitals reported the list price or "charges" for each patient stay, and CMS deflated this list price using a cost-to-charge ratio to arrive at the expected cost. Hospitals calculate a patient's charges by finely tracking the procedures, supplies, and other services used in their care and then pricing them according to a set of list prices called the chargemaster. Hospitals have wide latitude to set these list prices, untethering them from actual costs (Dobson et al., 2005).[2] While some details have changed over time, the essence of the outlier payment system has remained unchanged since 1983.

2.2 Opportunities to game payments

Medicare's approach to calculating outlier payments gave hospitals the opportunity to game the system by inflating their charges – a practice referred to as 'turbocharging' (CMS, 2016). A hospital's charges rendered in year t were typically deflated by cost-to-charge ratios from year $t-3$ or $t-4$. This lag occurred because the ratios came from hospital cost reports that could take years to finalize. If costs and charges grew at the same rate in the intervening years, the lag would not matter. However, if hospitals grew their charges rapidly, Medicare would not account for that growth for several years. Therefore, a hospital's patients would appear much costlier than they actually were and yield more outlier payments in the interim. Unlike other types of gaming such as upcoding of clinical diagnoses or procedure codes, turbocharging does not depend on participation from clinicians and, instead, involves an administrative decision by hospital executives to inflate charges across all patients with simple changes in hospital bookkeeping.[3]

Figure 1 illustrates this phenomenon by showing the evolution of "costs" at the most extreme gamer hospital in our data, a nonprofit facility in New Jersey. Specifically, it shows histograms of deflated charges, less DRG payments, across patients in each fiscal year. Beyond the deductible (the vertical red line), Medicare paid the hospital 80% of the remaining cost. In the lead-up to the turbocharging period (1997), few patients surpassed the deductible. As turbocharging grew (2000–2003), the cost distribution shifted to the right. CMS concurrently raised the deductible from under $10,000 in 1997 to over $30,000 in 2003, attempting to curtail the growth in outlier payments. After the loopholes were plugged, the cost distribution perceived by CMS shifted back to the left.

In the 1990s, Medicare made two changes that gave hospitals greater reason to consider gaming. First, it ended another form of outlier payment that reimbursed hospitals for unusually long patient stays and reallocated the funds to the outlier program we study. To do so, Medicare lowered the deductible for high-cost outlier payments, increasing the

[2]The cost-to-charge ratio used to deflate charges is taken from a hospital's most recently settled cost report. It represents the sum of all hospital costs divided by the sum of charges across all patients treated in a given reporting year.

[3]Hospitals with particularly extreme turbocharging could also exploit a related loophole. If a hospital's cost-to-charge ratio were more than 3 standard deviations away from the national average, Medicare considered it a data error and instead used the average ratio of other rural or urban hospitals in the state. By rapidly growing charges, hospitals could drive down the ratio to the point that Medicare treated it as an error. Going forward, their heavily marked-up charges would be deflated by the markup of the average hospital, making patients look exceptionally expensive. Medicare closed this loophole alongside the others in 2003.

number of patients triggering these payments and thus raising the return to gaming this system. Second, the Balanced Budget Act of 1997 (BBA97) substantially reduced Medicare DRG payments to hospitals while leaving outlier payments largely unchanged (O'Sullivan et al., 1997). The law froze or cut annual payment updates and reduced special add-ons for teaching and safety net hospitals. The cuts began in fiscal year 1998 and were so substantial that for the first time in its history, Medicare paid hospitals less in one year than it had the previous year (Merck et al., 2001).

Hospital stakeholders suggested that pressures from BBA97 led hospitals to game outlier payments as a new source of revenue. For instance, a New Jersey Hospital Association economist suggested that hospitals in the state gamed because they were disproportionately hit by BBA97 cuts (Jaklevic, 2003). Likewise, the president of the California Nurses Association described the outlier payment gaming as "an end run around" BBA97 and efforts by HMOs to control costs (Rawlings and Aaron, 2005). Some consulting firms also counseled nearby hospitals to exploit the payment loopholes, driving geographic clustering of gaming behavior. For example, a New Jersey consulting firm settled with the US Department of Justice (DOJ) to resolve allegations that it advised hospitals to grow charges and inflate their outlier payments (U.S. Department of Justice, 2008).

As the BBA97 cuts phased in, many hospitals began "turbocharging" by rapidly growing their charges, and they came to reap higher outlier payments. These charge increases also applied to all billing at the hospital, including non-Medicare insurers. Gaming continued for several years with little recognition by CMS. The agency noticed that outlier payments were coming in above target (see Figure 2) but did not connect these developments to excess charge growth (United States Senate, 2003). Their strategy to curb payments was to raise the deductible, tripling it between late 1998 and late 2002, as indicated in Figure 1. Raising the deductible reduces outlier payments all else equal, but hospitals were gaming the system so aggressively that payments still remained above Medicare's target.

2.3 The scandal and aftermath

In October 2002, a financial analyst released a report showing that the for-profit chain Tenet relied much more heavily on outlier payments than was previously known (Galloro, 2002). At roughly the same time, a whistleblower suit was filed in federal court alleging that Tenet and several other hospitals, including many nonprofit facilities, had fraudulently manipulated the outlier payment system (Leder-Luis, n.d.; U.S. v. Tenet et al., 2002). News stories in the ensuing period highlighted that several hospitals and hospital systems were receiving surprisingly high outlier payments, including clusters around Philadelphia and in New Jersey (Stark and Goldstein, 2002; Jaklevic, 2003). See Appendix A for more details on the outlier payments scandal.

Following these events, CMS closed the loopholes with a series of policy changes in August and October 2003. It instructed contractors to use more recent cost reports to calculate the cost-to-charge ratio so that charge growth would be reflected more quickly in payment calculations. It also created a framework to recompute outlier payments later and, if necessary, claw them back. These changes essentially ended this era of gaming. Figure 2 shows the sudden drop in payments in 2004, and the bottom panel of Figure 1 shows that the charge distribution of the most extreme gamer in our data shifted far to the left in 2004.

In the aftermath, federal agencies sued dozens of hospitals and hospital systems for fraudulent billing under the False Claims Act. Tenet, in particular, agreed to pay over $788 million for receiving high outlier payments by "inflating their charges substantially in excess of any increase in the costs associated with patient care" (U.S. Department of Justice, 2006*c*). In practice, federal agencies mainly pursued hospitals and hospital systems in which whistleblowers stepped forward with evidence of payment manipulation. However, in the analysis that follows, we provide the first systematic evidence that the scope of gaming went far beyond just the hospitals that were sued.

3 Theoretical Background

In this section, we draw on economic theory to generate predictions on which types of firms are more likely to exploit loopholes and, conditional on doing so, differences in how firms may use these funds.

3.1 Incentive to Game

A hospital's governance structure varies by whether it is owned by a nonprofit, for-profit, or government organization. Nonprofits may be owned by academic institutions, religious groups, or charitable organizations and are exempt from paying income and property taxes at the federal, state, and local levels. In return for the tax benefit, they must provide some charity care or services to the local community. Nonprofits cannot disburse surplus revenue to private shareholders or individuals, including managers. For-profits are owned by either private investors or public shareholders and pay corporate taxes. Managers at for-profit hospitals can distribute a share of profits to themselves and own shares in the firm. Both nonprofit and for-profit managers have a fiduciary responsibility to act in the best interests of their organization, which in nonprofits is often perceived as fulfilling a charitable mission, and in for-profits, it is often perceived as maximizing shareholder returns. Government-owned hospitals are subsidized by taxpayers and primarily aim to provide services to underserved populations, including low-income and uninsured patients.

These differences in ownership are often used to inform theories of hospital and nonprofit behavior more broadly (see Sloan (2000) and David, Philipson and Malani (2007) for a review). For example, the altruist model views nonprofits and government firms as maximizing social welfare and, therefore, more focused on maximizing quality. These organizations are more likely to attract altruistic decision-makers who prioritize the organization's mission and societal welfare over personal gain (Rose-Ackerman, 1996; Besley and Ghatak, 2005). However, managers of government entities may have less incentive to maximize revenue than nonprofits because they face a "soft" budget constraint: the government subsidizes their losses but also taxes away their surplus (Kornai, Maskin and Roland, 2003; Baicker and Staiger, 2005).

A related model considers how nonprofit status can be a signal of noncontractible quality: since patients cannot easily observe hospital quality, and nonprofits do not face pressure to distribute profits to owners, patients may trust nonprofits more than for-profits to prioritize quality over profits (Arrow, 1963; Hansmann, 1980; Glaeser and Shleifer, 2001; Jones, Propper and Smith, 2017). Nonprofits may commit to the norms and expectations of their institutional environment to maintain their legitimacy. Alternatively, nonprofits may operate as "for-profits in disguise," seeking to maximize profits while disguised as charitable organizations (Weisbrod, 1988). Reconciling these theories, nonprofits are likely neither pure profit nor pure welfare maximizers (Newhouse, 1970).

Drawing on this literature, for-profits may be more likely to engage in potentially improper behavior, such as exploiting loopholes in payment contracts, than nonprofit or government-owned hospitals. In particular, for-profits have more to gain from such behavior since managers can distribute profits to themselves. Nonprofits may have more taste to engage in such profit-maximizing schemes than government hospitals but less taste to do so than for-profits.[4]

3.2 Use of Excess Revenue

These theories of hospital ownership provide insights into how hospitals may allocate excess revenue obtained from a loophole. For example, nonprofits have implicit constraints based on their reputation as providers of charity care and explicit constraints on their use of funds that may motivate them to spend excess revenue on patient care. More altruistic managers may also be more aligned with furthering nonprofit goals, such as expanding access to care

[4] Consistent with this hypothesis, Horwitz (2005) finds that for-profit hospitals are more likely to offer profitable medical services, government hospitals are more likely to offer unprofitable services, and nonprofits fall in the middle.

or improving quality. Bound by their fiduciary responsibilities, for-profits could instead use this as an opportunity to distribute profits to their shareholders, as well as themselves.

Hospitals may also spend profits differently based on the source and permanence of funds. Individuals, for example, often deviate from a standard consumption model and instead tend to compartmentalize their finances into separate "mental accounts", influencing their decisions on spending, saving, and investing (Thaler, 1985). Extending this logic to hospital managers, they may view funds obtained from exploiting loopholes as less legitimate than those obtained from an intended policy change and, therefore, hold them in a separate mental account. Accordingly, hospitals may immediately spend the unearned windfall rather than increase reserves or invest in capital projects (Wang, Stuart and Li, 2021). Managers may also view funds obtained from loopholes as temporary, whereas budgetary and other policy changes can lead hospitals to experience more permanent changes in reimbursement. Hospitals may be reluctant to spend revenue from temporary sources on long-term commitments and instead spend it on more immediate operating needs. Indeed, the loophole studied in this setting proved to be transitory.

A related phenomenon is the flypaper effect, which suggests organizations use government funds in accordance with their intended purpose rather than integrating them into their budget for more optimal use (Hines and Thaler, 1995; Singhal, 2008). The flypaper effect could be interpreted as an application of mental accounts to the use of funds by organizations (Thaler, 1990). In our setting, since hospitals receive outlier payments as reimbursements for care provided during costly inpatient stays, hospitals may deploy the excess revenue toward inpatient care, even though other uses may be more optimal. Such a finding may be more likely to manifest in nonprofits than for-profits, given their non-distribution constraints and the implicit contract to provide community benefits for tax subsidies. To the extent nonprofits view these funds as unearned via gaming, they may also justify this improper behavior by using funds obtained from the outlier payments program for its intended purpose.

4 Data

This study combines a wide array of data sources to identify the set of hospitals eligible for outlier payments, determine which hospitals potentially gamed these payments, and observe their clinical and financial behavior. We observe all data between 1994–2006 and use this period unless otherwise noted. We adjust all monetary outcomes for inflation and display them in real 2000 dollars. Our set of hospitals is essentially the universe of those paid by Medicare under DRGs and thus eligible for outlier payments. We draw this list from a

Dartmouth Institute tracking file.[5] To observe hospital characteristics, we link this file with the CMS Providers of Services data and American Hospital Association survey data.

We directly observe the parameters that CMS contractors used to calculate payments through the CMS Impact file and Provider-Specific File. We use hospital cost report data to track financial information, including revenues and expenses. Because cost reports occasionally contain extreme values that are likely errors, we winsorize all cost report variables 1% on each side within year. For all-payer revenue and operating costs, where transient changes are particularly common, we suppress values that are more than double the average of the previous and next year. To observe patient-level charges and Medicare payments, including outlier payments, we use 100% fee-for-service Medicare hospital claims.

We also use Medicare claims and enrollment data to track hospital clinical performance. We assemble a cohort of Medicare patients hospitalized for non-deferrable conditions via the emergency department (Card, Dobkin and Maestas, 2009; Doyle et al., 2015). The data includes rich patient covariates, including demographics, diagnosis histories, and the diagnosis for which the patient was admitted.[6] As outcomes, we track 30-day risk-adjusted mortality and readmission, the same metrics used by CMS to measure hospital quality. The non-deferrability of these conditions helps to mitigate concerns about the selection of patients into hospitalization (Card, Dobkin and Maestas, 2009). Studies have also validated these observational quality metrics by showing that they are strongly correlated with quality measured from patients who were quasi-randomized to hospitals (Doyle, Graves and Gruber, 2019; Hull, 2020).

Lastly, we use SEC filing data available through Compustat to determine executive compensation and shareholder payouts for publicly traded hospital systems. Specifically, we present the total salary and bonus for the top five highest-paid executives. We also present a measure of total compensation realized by executives in a given year, including the value realized from option exercises (Kaplan and Rauh, 2010). For nonprofit hospitals, we use IRS form 990 data to determine total compensation for top executives, defined as officers, directors, trustees, and other key employees.

[5] We use this file to track hospitals even if they switch Medicare identifiers. To focus on hospitals eligible for outlier payments, we drop hospitals that ever convert to critical access facilities, which are paid using a different system.

[6] The cohort consists of patients admitted for any of 29 principal diagnosis categories described in Doyle et al.. The cohort construction approach is described in Chandra, Kakani and Sacarny (n.d.) and Gaynor et al. (n.d.). The data consists of index admissions, defined as the patient's first admission for a non-deferrable emergency in a year. Patient covariates include demographics, defined as age-race-sex interactions; histories of 23 diagnoses drawn from previous hospitalizations in the prior year; and fixed effects for the principal diagnosis ICD-9 category.

5 Research Design

5.1 Designating hospitals as gamers

The first task is to determine which hospitals likely did and did not game the outlier payment system. We develop an algorithm building on the approaches used by CMS while also addressing their weaknesses. CMS focused on growth in charges per patient and growth in the hospital's share of Medicare inpatient payments from outliers (CMS, 2003*a*,*b*). CMS used only 3-4 years of data, which meant they could inadvertently flag hospitals that experienced transient shocks or began treating sicker patients during the period of interest. Moreover, they used realized outlier payments, which were affected by changes to payment formulas. For example, CMS's efforts to cut payments, like raising the deductible, could blunt a hospital's growth in outlier payments and result in undercounting the true number of gaming hospitals.

In contrast, our algorithm uses a much longer time series and a simulated payments strategy that holds patient mix and payment formulas fixed. This strategy isolates the growth in outlier payments that came from the hospital's pre-existing distribution of charges across its patients and its realized charge growth. Specifically, we use the hospital's fiscal year 1995-1996 patient mix and simulate the payments the hospital would have received for them in fiscal years 1993–2003. The simulation leaves patients' DRGs unchanged, fixes the formula that calculates outlier payments (e.g., the deductible), but scales patients' charges so that they grow according to their actual trajectory during this period.

We then fit a hospital-specific trend break model for two outcomes, the logarithm of observed average charges and the ratio of simulated outlier to non-outlier (DRG) payments:

$$o_{ht} = \alpha_h + \alpha_t + \beta_h^{pre} t + \beta_h^{post} (t - B) \, 1 \left[t \geq B\right] + \delta \ln \left(drgweight_{ht}\right) + \epsilon_{ht}, \tag{1}$$

where h indexes hospitals, t indexes time in quarters, and o_{ht} is the outcome. The model controls for hospital and quarter fixed effects (the α), hospital-specific pre- and post-break trends, and the logarithm of the average DRG weight at the facility. B is the break, defined as the end of fiscal year 1996. This approach uses long periods to estimate the pre- and post-trends to limit the influence of transitory shocks and regression to the mean. It also controls for patient mix through DRG weights to account for growth in charges that might come from selecting sicker patients rather than gaming. We estimate this model using data from fiscal years 1993–2003 and limit to hospitals that treated patients in every quarter during this time.

We define the estimated increase in the outcome, $\hat{d}_h$, as the hospital's fitted value at the end of the sample period less its fitted value at the break, ignoring the effect of DRG weights. We assume that hospitals with large increases in their charge rates and their ratio of outlier payments over this period are the likely gamers. To be conservative, we set a high bar to make this determination: hospitals in the top decile of $\hat{d}_h$ on both dimensions are flagged as gamers. Hospitals below the 85^{th} percentile on both dimensions are assumed to have likely not manipulated their charges. We consider the space between the 85^{th} and 90^{th} percentiles to be indeterminate and exclude hospitals in this range from the analytic sample. Appendix Figure C.2 illustrates the joint distribution of $\hat{d}_h$ and superimposes this classification scheme. We flag 180 hospitals as gamers, 2,530 as non-gamers, and 533 as indeterminate.

As with the approach used by CMS, we cannot say with certainty that every hospital designated as a gamer using this approach manipulated charges to reap excess Medicare outlier payments. Here, we find it reassuring that the set of hospitals designated as gamers overlaps closely with those accused by the DOJ based on whistleblower witness testimony. Note that the DOJ only brought lawsuits against a select set of hospitals. This set does not represent all hospitals that engaged in gaming. Of the 33 accused hospitals we could find using court documents and press releases, 26 (79%) were also flagged under this algorithm, 1 was designated a non-gamer, and the remainder were in the indeterminate range.[7] From hereon, for brevity, we refer to the hospitals tagged by our algorithm as gamers and the remaining hospitals retained in the sample as non-gamers.

5.2 Characteristics of gamer hospitals

Which hospital characteristics are associated with a greater propensity to engage in turbocharging? To shed light on this, we examined the association between turbocharging behavior and various hospital attributes, measured in 1997. Figure 3 presents mean values of select hospital attributes (e.g., % owned by a system) by decile of charge growth over 1998–2003, the period of interest. Panel A shows that hospitals in the top decile of charge growth were disproportionately likely to be for-profit owned. While for-profit hospitals comprise about 15% of all hospitals, they are nearly 40% of hospitals in the top decile. Nonprofit hospitals are represented across all deciles of charge growth in a relatively stable fashion. In contrast, government-owned hospitals are disproportionately likely to be in the bottom two deciles of charge growth. These patterns are consistent with the theoretical predictions discussed in Section 3 about how ownership type will affect manager behavior. Panel B shows that hospitals in the top decile of charge growth are also disproportionately system-owned. Panels C and D examine the association between attributes that determined the size of BBA97 payment cuts and turbocharging behavior. The plots show that hospitals

[7] This omits Tenet hospitals because the Tenet lawsuit was against the entire corporation rather than a specific facility. However, of the 94 hospitals affiliated with Tenet between 1998-2001, we classify 60 (64%) as gamers.

facing greater Medicare cuts, such as those located in markets with a higher wage index, were also disproportionately more likely to increase their charges.

To study these patterns formally, we estimate regression models predicting whether a hospital is in the top decile of charge growth or is flagged by our algorithm as a gamer based on characteristics recorded in 1997. These two outcomes are highly correlated but differ in the case of hospitals with high charge growth that did not experience high growth in their (simulated) outlier share of total Medicare payments. Since results are qualitatively similar regardless of the outcome, we will discuss only the coefficients for the latter outcome for brevity. Appendix Table C.1 presents the corresponding results from these models. Columns 1 and 2 present coefficients from bivariate models, while columns 3 and 4 present coefficients from multivariate regression models.

As seen in the bivariate regression results in Column 2, gaming hospitals are more likely to be for-profit, part of a health system, in an urban area, and have greater bed capacity. They also rely less on Medicare inpatient stays. These patterns are consistent with the trends seen in Figure 3. Column 4 shows that the association between gaming and for-profit ownership remains similar in magnitude even after conditioning on all the other attributes. Hence this association is not simply a reflection of greater likelihood of system membership or large bed capacity of for-profit hospitals. Gaming hospitals also have higher mortality and readmission scores, suggesting they may serve a higher-risk patient population. The payment parameters most impacted by BBA97, which include the wage index and adjustments for safety net and teaching hospitals, are also highly predictive of gaming (discussed in more detail in the following section).

5.3 Construction of sample and matching

Given these differences in the characteristics of gaming and non-gaming hospitals, our goal is to construct a control group that minimizes the risk of bias in our estimates. We begin by restricting to the set of gamer and non-gamer hospitals open from 1994–2006. We next remove non-gamer hospitals located within 5 miles of gamer facilities. This restriction helps to address a potential Stable Unit Treatment Values Assumption (SUTVA) violation from non-gamer hospitals being influenced by their gamer peers. For instance, gamer hospitals might increase patient volume by "stealing" patients from non-gamer hospitals. Similarly, we remove hospitals ever affiliated with Tenet from the non-gamer group since the chain gamed heavily, and the excess revenue may have been diverted to these facilities. Finally, because exceptionally few government-run hospitals gamed payments, we drop all of these facilities from the sample.

An additional concern is the potential endogeneity of gaming. Hospitals may have gamed due to geographic coincidence, like locating near a consulting firm that advocated this strategy, and geographic clustering is apparent when we map flagged facilities (Appendix Figure C.3). This behavior might also reflect an effort to counteract payment reductions from BBA97. This driver of gaming presents a threat to our differences-in-differences research design because the shocks from BBA97 disproportionately affected certain hospitals, like safety net facilities and teaching facilities, and had their own effects on hospital behavior (Kaestner and Guardado, 2008; Azoulay, Heggeness and Kao, 2020).

A standard approach to address this endogeneity due to selection is to match gaming hospitals to non-gaming hospitals based on hospital characteristics before gaming occurred. We match on the payment parameters BBA97 manipulated: the add-on for safety net facilities, the add-on for teaching facilities, and the wage index.[8] We use these parameters at their 1997 values, which were set before BBA97. In addition, we match on the hospital's Medicare share of inpatients in terciles, since the Medicare share determines the hospital's overall shock from Medicare policies. Because we combine matching with differences-in-differences, our approach assumes that the matched comparison group provides a valid counterfactual trajectory for the gamer group.

Our baseline approach uses coarsened exact matching (CEM), though we demonstrate robustness of our key results to a number of alternative methods. CEM coarsens the matching covariates into bins and then matches "treated" units (gamers) to "untreated" units (non-gamers) exactly on those coarsened covariates (Iacus, King and Porro, 2012; King and Nielsen, 2019). We generate weights to target the effect of gaming on the hospitals that gamed, i.e., the treatment on the treated (TOT) estimand. We call the reweighted non-gamer hospitals matched comparators.

After matching, our sample includes 120 gamer hospitals and 1,396 non-gamer hospitals. Table 1 provides summary statistics on the gaming hospitals and matched comparators. Panel A includes the payment parameters we matched on and Panel B includes other key characteristics. As expected, the averages are similar between the groups on the matched variables. Appendix Table C.2 shows the characteristics of the samples step-by-step as we move from the full set of hospitals to the set analyzed in the regressions. This table shows that the matching approach makes the groups much more observably similar on the covariates that both were and were not directly matched upon.

[8] While BBA97 did not change the wage index, it did limit annual payment updates. This policy essentially reduced payments to all hospitals by a common percent amount. We match on the wage index because these reductions impacted high-wage areas harder in absolute terms.

5.4 Empirical strategy

Having assembled the gamer and matched comparator hospitals, we implement a difference-in-differences research design to estimate the causal effect of manipulating the outlier payment program on income, use of funds, and other operational outcomes. The trends for the gaming hospitals over 1994–2006 are compared against those for the matched comparator hospitals. The period 1994–1997 represents the years before hospitals engaged in turbocharging to increase outlier payments. We set 1997 as the last year before gaming because of the important role of BBA97 in triggering this response by hospitals.

The period 1998–2006 has three distinct phases. The early phase, 1998–2000, is the period when hospitals began to game outlier payments, while the late phase, 2001-2003, represents the height of gaming. The after phase, 2004–2006, is immediately after CMS closed the payment loophole. We estimate separate D-D coefficients corresponding to each of these phases using the following model.

$$y_{ht} = \alpha_h + \alpha_t + \beta_1 \cdot D_h \cdot early_t + \beta_2 \cdot D_h \cdot late_t + \beta_3 \cdot D_h \cdot after_t + X_{ht}\Theta + \epsilon_{ht}, \quad (2)$$

where y_{ht} is the outcome of interest for hospital h in year t. D_h is a flag for hospitals tagged as gamers by our algorithm, as described in the previous section. β_1 captures the average difference in outcomes between gamers and non-gamers over the period 1998–2000, relative to the average over the years 1994–1997. Similarly, β_2 captures the average difference in outcomes in the late gaming period, relative to the pre-gaming period. We primarily focus on these coefficients.[9] X_{ht} is a time-varying control for Medicare Advantage penetration in the hospital's market.[10] ϵ_{ht} represents idiosyncratic unobserved factors that may also determine the outcome. We cluster standard errors by hospital, which is the level of treatment in this setting.

To interpret the coefficients β_1 and β_2 as the causal effects of exploiting the loophole, the analysis assumes that outcomes for gamers and comparators would have progressed on similar trends as in the 1994–1997 period, absent the gaming behavior observed over 1998–2003. This "parallel trends" assumption is standard in D-D research designs and is untestable. However, an event study can provide suggestive evidence on the assumption by showing whether the groups were on differential trends prior to the gaming episode. It also assists in the study of effect dynamics. We therefore estimate the following model:

[9] Appendix Tables C.4 and C.5 report β_3, the effect during the post-gaming period.

[10] We define markets as Health Service Areas (HSAs), which are collections of counties in which hospital use is relatively self-contained (Pickle et al., 1996).

$$y_{ht} = \alpha_h + \alpha_t + \sum_{s \neq 1997} \gamma_s \cdot D_h \cdot 1\left[t = s\right] + X_{ht}\Theta + \epsilon_{ht}, \tag{3}$$

A hospital's decision to exploit the loophole is non-random and, as shown in Table C.1, varies based on hospital characteristics. While selection into gaming is an inherent feature of this setting, we mitigate concerns that hospital selection is driving our results in the following ways. First, the matching design enables us to identify comparison hospitals that were similarly impacted by BBA97's changes to Medicare payments. As discussed in Section 2, this gaming episode appears to be prompted in large part due to the payment cuts instituted by BBA97. By comparing gaming hospitals to facilities that also faced observably similar payment cuts, we isolate a valid counterfactual. Second, consistent with our identifying assumption, we reassuringly find little evidence of trend deviations before 1998. Third, we can observe that Medicare revenues at gaming and comparator hospitals re-converge after CMS closes the loophole. While the post-gaming period is complicated by legal uncertainty and settlements, this tendency for convergence suggests the groups would have been on similar trends absent the gaming.

6 Results

This section presents our main results on the excess revenue hospitals generated by exploiting the loophole and how they allocated this revenue. Figures 4 and 5 present event studies using 1997 as the reference year and demarcating the gaming period (1998–2003) with vertical dashed lines. Table 2 presents the corresponding D-D estimates distinguishing between the early (1998–2000) and late (2001–2003) periods.

6.1 Excess revenue

We begin by quantifying the excess outlier payment revenue gained by the gamers due to turbocharging. Figure 4 Panel (a) presents the event study for total outlier payments in millions of dollars. Gamers and non-gamers have similar trends until 1998 when revenue increases differentially for gamers. Excess outlier revenue peaks for gamers in 2002. As expected, there was a sharp drop in 2004, the first full year in which the loophole was closed. Payments return to baseline and stay there through 2006. Table 2 presents the corresponding coefficients of interest from Equation 2 and shows that the hospitals gain \$1.3M in outlier payments per year in the early period and \$4.4M per year in the late period. Relative to the pre-gaming average of \$1.7M per year, gaming hospitals more than double their outlier payments at the height of turbocharging. Summing over the six years, the average gamer obtains over \$17M in excess outlier payment revenue.

Figure 4 Panel (b) plots the event study for Medicare inpatient revenue, a broader measure of income that adds in DRG payments. It shows a strikingly similar pattern as seen for outlier payments. The corresponding coefficients in Table 2 are very similar in magnitude to those estimated for outlier payments. A comparable increase in total Medicare inpatient revenue and outlier payments is expected since gamers cannot increase their DRG payments by increasing their charges.

To quantify the effective increase in Medicare payment rates hospitals receive from this aggregate payment change, we also consider the effects on payments per patient. Using the Poisson analog of equation 2, we find that gaming raises rates by 7.3 log points or 7.6% in the early period and 19.7 log points or 21.8% in the late gaming period (Table 2).

We next broaden the income measure to include revenue from all payers. We do so because turbocharging may have spillover effects on payments made by other insurers. Such spillovers could manifest if an insurer's pricing is set as a proportion of the hospital's list price, a practice that remains common today (Cooper et al., 2019). Another potential channel would be if insurers mimic Medicare's payment systems and also make outlier payments.[11]

Figure 4 Panel (c) presents the event study plot for all-payer revenue and finds a similar trajectory as for Medicare payments, with a peak in 2002; excess revenue subsequently falls and becomes statistically insignificant by 2004. Table 2 shows that the increase in total revenue is about triple the increase in Medicare inpatient revenue, just as baseline total revenue is about triple baseline Medicare inpatient revenue, suggesting similar Medicare and non-Medicare effects. The \$11.2M per year effect aggregates to \$67.3M over the whole period. Our results, therefore, imply large spillover effects of turbocharging to private insurers and consequently to employers that largely fund private health insurance plans.

6.2 Use of excess revenue

How do the gaming hospitals allocate the funds obtained from turbocharging? Each dollar of excess revenue must either flow toward increasing operating costs or profits (often referred to as surplus in the case of nonprofits). We begin by examining the effect on total operating costs. Figure 4 Panel (d) presents the corresponding event study plot. The groups follow similar pre-trends and trends through the early period, then gamers experience an uptick in the late period. Costs subsequently decline, in relative terms, after the loophole is closed.

[11] For instance, California's Workers' Compensation program uses essentially the same system as Medicare and is also affected by gaming (DeMoro, 2003; Wynn, 2003). Some contracts with private insurers have a similar structure, with hospitals eligible to receive insurance-like "stop-loss" payments that depend on charges. Filings from Tenet indicate that these payments become a significant source of revenue for the firm during the gaming period, then decline precipitously (Tenet Healthcare Corporation, 2003, 2004).

Table 2 presents the D-D coefficients. We estimate a differential increase in operating cost of \$10.8M per year during the late period. Aggregated over the whole gaming episode, operating costs increase by \$32.3M (not statistically significant) or roughly half the excess all-payer revenue. The statistically insignificant effect on total cost reflects the average of increases observed among nonprofit gamers and decreases observed among for-profit gamers, which we explore in Section 6.3. By construction, the remaining half of excess revenue flows toward increasing profits.

Greater profits can be used by the hospital for three purposes. First, they could add to short-term or long-term assets like cash reserves or fixed capital (e.g., purchase new equipment). Second, profits can be used to pay down short-term or long-term debt and, accordingly, would appear as a decline in short-term or long-term liabilities. Third, the profits can be transferred by the hospital to another entity (e.g., to its parent firm), thus not affecting its assets or liabilities. We observe these transfers in the hospital cost reports submitted to CMS and refer to them as net deductions (our analysis considers deductions net of additions to the hospital's balance sheet, i.e., the net transfers off balance sheets). Appendix B provides accounting identities and further details on these categories.

The change in a hospital's total assets net of the change in liabilities represents the change in a hospital's net worth. Figure 4 Panel (e) presents the event study plot. While the series lacks a pre-trend, it follows a sawtooth pattern during the gaming period, returning to baseline by 2004, when the loophole is closed.[12] The D-D results confirm an early decline in net worth that is later partly reversed (Table 2). The overall effect is essentially zero and is statistically insignificant. The estimated confidence interval allows us to reject an increase of more than \$12.5M in net worth for the average gamer hospital during this episode, which is one-sixth of the estimated inflow in revenue. This result suggests that excess revenue is not diverted towards paying down liabilities or increasing assets.

The lack of a meaningful change in net worth for gamer hospitals leaves only one possible avenue for the remaining excess profits: net deductions. Table 2 shows that net deductions increase by \$6.6M per year or \$39.5M over the whole period. In Section 6.3 we show that this increase in net deductions is predominantly driven by for-profit hospitals.

Figure 4 Panel (f) presents the associated event study plot, which confirms similar trends before 1998 and a sharp increase in deductions that closely tracks the increase in revenue. This result implies that over half of the revenue obtained by turbocharging is transferred off hospital balance sheets. These transfers can reflect funds sent to the hospital's

[12] Figure C.4 presents event study plots for the change in assets and liabilities separately. They suggest an increase in liabilities over 1998–2000, which was offset by a similar-sized increase in assets later in the period. The coefficients in Table 2 also exhibit this pattern.

parent organization, which could be disbursed to executives or shareholders for publicly traded firms or to other hospital affiliates.[13] While the cost report data alone does not permit us to examine the ultimate uses of these deductions, we shed light on whether the revenue is transferred to executives and shareholders in Section 6.3 comparing outcomes for nonprofits and for-profit hospitals.

Taken together, we find that during the 6-year gaming period turbocharging hospitals increase operating costs by $32.3M, increase net balance deductions by $39.5M, and decrease net worth by $3.8M. These changes roughly sum to the total 67.3M increase in all-payer revenue.[14] These results are consistent with firms spending rather than saving the unearned windfall, as discussed in Section 3.

6.2.1 *Inputs to care*

The results in the previous section imply that about 60% of the funds obtained by turbocharging were transferred outside the hospital. We also find some signs that funds were directed to operating costs, though the results are imprecise. We now directly explore the effect on measures of care inputs to assess whether patients or hospital staff may have benefited due to the revenue windfall.

We first examine changes in three measures of care inputs. Figure 5 Panels (a), (b), and (c) present the event study plots for total inpatient volume, hospital FTE, and total spending on salaries, respectively. Reassuringly, each has flat pre-trends. Gamer hospitals also do not appear to differentially serve more patients, employ more staff, or increase spending on personnel during 1998–2003. In fact, the FTE series implies a slight decline in staff during this period and a larger decline after the outlier payment loophole is closed.

Table 3 Panel A presents the corresponding coefficients on patient volume and hospital FTE. The point estimate on patient volume is close to zero and is statistically insignificant. The confidence intervals allow us to reject an increase of more than 3.4%. Similarly, the coefficients on staff FTE imply, if anything, a decline in staffing during the gaming period. Averaging over the entire episode, we can reject an increase of more than 0.8%.

Since the spending on salaries is a component of total operating cost, we prefer to report the coefficient on salaries in Table 2 Panel B. By this measure, the average effect over

[13]For example, in California cost reports, the list of additions and deductions includes a line for "intercompany transfers". Unfortunately, older Medicare cost report data does not provide the lines that add to net deductions.

[14]The two sides are not exactly equal due to due to variable-specific data cleaning like winsorizing; the use of slightly different samples for net balance deductions and change in net worth, since we do not observe these values for 1994; and our use of all-payer revenue rather than total income, which also includes investment income but yields essentially identical results.

the entire period is small and statistically insignificant and implies an increase of \$4.2M. This is disproportionately small relative to the estimated increase in operating cost (\$32M) given that salaries account for more than 40% of total costs. However, since this coefficient is imprecisely estimated we cannot reject an increase in total salaries of up to \$23M over this period, about a third of the estimated excess revenue. Taking the results on FTE and salaries together, however, we conclude there is no consistent evidence of gamers deploying the excess revenue toward labor inputs. This finding is consistent with the hypothesis discussed in Section 3 that hospitals would be reluctant to use these funds to enter into longer-term commitments due to their transience.

6.2.2 *Quality of care*

Finally, we directly investigate whether patient health outcomes improve at gamer hospitals. As discussed in Section 4, we examine changes in standard measures of quality used by Medicare and other payers in performance pay incentive programs to improve hospital quality. These analyses focus on patients hospitalized through the emergency department for any of 29 non-deferrable conditions (Doyle et al., 2015). We observe patients' 30-day mortality and readmission as well as key covariates that might affect their risk of experiencing these outcomes: their demographics, their illness histories (derived from previous hospitalizations), and their principal diagnosis category.

We begin by looking for signs of patient selection. To do so, we model the risk of mortality and/or readmission among the non-deferrable patients as a function of their key covariates.[15] Then, we calculate the average observable mortality and readmission risk of non-deferrable patients in each hospital in each year and study it as an outcome. Table 3 Panel B presents the estimated effects. The results show an (insignificant) decline in predicted mortality risk matched by a small but significant increase in predicted readmission risk; we detect no change in the composite risk of mortality *or* readmission.

Then, we test whether patient outcomes improved. We assemble yearly cohorts of the non-deferrable patients and run the following first-step regression:

$$mr_{iht} = \gamma_{ht} + Z_{iht}\Phi + \eta_{iht} \;\; t \in 1994, \ldots, 2006 \tag{4}$$

Where i indexes patients and mr_{iht} is an indicator for patient endpoint (mortality, readmission, or a composite of both). The γ_{ht} are hospital fixed effects, and the Z_{iht} are

[15] Specifically, we regress an indicator for mortality, readmission, or a composite of both on patient demographics, illness histories, and principal diagnosis categories. This regression is run only for patients at the comparator hospitals. Then, using the coefficients from the regression, we predict the probability of mortality, readmission, or the composite for all non-deferrable patients.

patient covariates. We extract the fixed effects, which can be interpreted as the hospital's risk-adjusted mortality rate (Chandra et al., 2016). These fixed effects become the outcome variables in the hospital-level event study or D-D model.

Table 3 Panel C presents the coefficients on these three patient health endpoints. There are no detected improvements in care. We find a small and statistically insignificant decline in mortality. We detect an increase in readmissions of 0.3 percentage points, about 3% of the baseline mean. However, when we consider the composite outcome of mortality or readmission, we are unable to detect an effect. Event studies reaffirm these findings, with no clear pre-trends and no clear signs of improvement during or after the gaming period (Figure 5 Panels d-f).

Overall, there is an insufficient signal here to conclude that the quality of care changes at gamer hospitals during this episode. The coefficients are estimated precisely enough to allow us to rule out an average decline in mortality of more than 0.55 percentage points (4% relative to the baseline mean), and we can nearly rule out any decline in readmissions. Thus, in addition to detecting no statistically significant gains in patient outcomes, we can also statistically reject moderate improvements in quality.

6.3 Heterogeneity by hospital ownership type

Thus far, we have shown that hospitals use the excess revenue obtained by gaming to increase operating costs and transfer greater amounts off their balance sheets in roughly equal proportions. This section explores whether hospitals under for-profit and nonprofit ownership make different choices.[16] Previous studies have found evidence that for-profit and nonprofit hospitals often behave similarly (Dranove and Ludwick, 1999; Duggan, 2000; Capps, Carlton and David, 2020). However, we find significant differences in how for-profit and nonprofit hospitals allocate the windfall. Our findings are more consistent with theories of altruism and non-contractible quality that predict different behavioral responses from nonprofit compared to for-profit firms.

As seen in Table 4, for-profit and nonprofit gamer hospitals experience comparable increases in outlier payments, Medicare inpatient payments, and all-payer revenue. This suggests spillovers onto other payers at both hospital types. However, nonprofit hospitals appear to mainly allocate excess revenue towards operating costs: the average nonprofit increases operating costs by \$56.7M over the 6-year gaming period. In contrast, for-profit hospitals mainly transfer funds off the balance sheet, presumably to their parent company:

[16] We do so by matching for-profit gamers to the pool of non-gamers via CEM with the same coarsening as in the main analyses. Then, we estimate equations 3 and 2 using this sample. Next, we repeat the method for nonprofit gamers.

for-profits increase net deductions by \$78.4M over the 6-year gaming period. This estimate appears puzzling at first since it is larger than the corresponding estimated increase in their all-payer revenue. This is made possible by reducing operating costs and net worth and using these proceeds to increase net deductions. Appendix Figure 6 provides the accompanying event studies for these subgroup analyses.

We examine the effects on operating costs for nonprofit gamers in more detail to determine the categories where they allocated the excess funds. Appendix Table C.3 presents the associated results. We continue to find no significant increase in salaries even among nonprofit gamers. The increase in costs is mainly driven by "other direct" costs, which account for about half of the total cost base. We estimate a statistically significant increase of about \$6.5M per year during the gaming period in other direct costs, more than two-thirds of the total increase in costs, disproportionately larger than its share of the cost base.

This category of other direct costs includes general, inpatient, and ancillary services. However, we have limited statistical power to detect the effects of these smaller spending items. We detect a statistically significant increase only in non-salary hospital inpatient services of about \$0.6M per year. This implies a disproportionately large increase of about 25% relative to the baseline spending on inpatient services. The coefficients also suggest an increase in spending on non-salary general services, though it is not statistically significant. Taken together, these results suggest nonprofits invest at least some of the excess funds into clinical inputs, yielding higher spending even as patient volume is flat or falling. These results are consistent with the flypaper effect discussed in Section 3 since we find the funds are disproportionately used for inpatient care, which is the justification for receiving them in the first place.

Table 4 Panels D and E present the effects on patient complexity and health outcomes. The coefficients in Panel D show that nonprofit gamers treated a higher-risk patient population during the gaming period, and the pattern increased over time. The additional spending on patient care by nonprofit gamers may have helped to improve their quality of care because patient mortality decreased by 0.4 percentage points, about 3% of the baseline mean. It is more impressive given these hospitals also served a more complex patient cohort during this period. At the same time, we also detect a modest increase in readmission rates at nonprofit gamers of about 0.57 percentage points. High readmission rates were not penalized by Medicare during this period nor a topic of policy debate. Hence, it is unclear whether the increase in readmissions is unambiguously an indication of quality decline, as it is considered today.

For-profit hospital outcomes reveal a different pattern. There are statistically significant reductions in hospital FTE and total spending on salaries among for-profit gamers.

Accordingly, operating costs decline, though this decline is not statistically significant. Since little of the income is invested into the hospital and the majority is sent off the balance sheet, it is perhaps unsurprising that there are no changes in quality outcomes among for-profit gamers. Below we provide evidence that for-profit hospitals likely use the windfall gain to enrich executives and shareholders.

6.3.1 *Executive compensation and shareholder payouts*

We now investigate if some of the excess revenue is used to increase compensation for key executives, like CEOs and other top-level managers, or is disbursed to shareholders for publicly traded companies. Executives are employed at both the system (i.e., the parent organization) and hospital levels. Compensation to system-level executives represents a potential use of funds deducted from hospital balance sheets since the compensation costs for these employees may not be allocated to individual hospitals. In contrast, compensation to hospital-level executives represents a part of hospital operating costs, though the cost report data does not disaggregate executives from non-executive salaries.

Unfortunately, the data on executive compensation is not systematically collected nor made available for research, as discussed in Section 4. Because of how the data is organized, we present this analysis separately for system-level executives at publicly traded for-profit firms, whose compensation we observe through SEC filings, and hospital-level executives at nonprofit firms, whose compensation we observe through tax filings. Since few health systems are publicly traded during our sample period, we can only study compensation at a single for-profit firm that gamed – Tenet Corporation.[17] Given that there is only one "treated" firm for this analysis, we present simple time series analyses of executive compensation at Tenet compared to an average of the four other publicly traded for-profit health systems consistently observed in the data.

We find that executive compensation follows a similar pattern to that of outlier payments. Figure 7 Panel (a) shows total executive compensation at Tenet reaching a peak of $13.4M in 2001 before falling in the year the scandal broke. This is about double the compensation level of $6M observed in 1998. The pattern is even more striking in Panel (b), which expands the measure to include stock options exercised. By this metric, Tenet executives received $92.5M in 2001. No such patterns are observed among the non-Tenet systems. We are likely underestimating the true amount distributed to executives since we are unable to measure executive compensation of subsidiary hospital managers, only the executives of the parent organization. Publicly traded firms can also disburse profits to

[17] There are also a few gamer hospitals owned by other publicly traded firms, but they account for negligible fractions of bed capacity or patient volume, so we do not tag these firms as gamers.

shareholders. As seen in 7 Panel (c), we find that Tenet shareholder payouts also coincide with the gaming period, with shareholders receiving $923M between 2000 and 2004. While non-Tenet systems also sporadically disbursed profits to shareholders, Tenet only did so during the gaming period.

Among nonprofit hospitals, we observe trends in compensation for key hospital-level executives for a large number of both gamer and comparator firms and, therefore, analyze this outcome with the baseline model. Table 4 Panel (b) reports the DD estimates and Figure 7 Panel (c) presents the corresponding event study plot. In complete contrast to the patterns observed for Tenet, we do not observe any increase in compensation during 1998–2003. These results strongly suggest divergence with regard to the use of funds for executive pay between for-profit and nonprofit firms. These results provide supporting evidence for the organization theories discussed in Section 3 regarding the differences in how managers can use surplus funds at nonprofit and for-profit firms.

6.4 Robustness checks

This section describes results from robustness checks testing the sensitivity of our key results to changing important assumptions or methods. The estimates obtained from these robustness checks are presented in Appendix Figure C.5, which focuses on the six key outcomes representing the flow of funds for hospitals (upper plot), two measures of hospital inputs, patient selection, and patient outcomes (lower plot). We present alternate estimates for each of these outcomes using six different robustness checks and compare them to the baseline estimate from the preferred model. To simplify presentation, we focus on average effects across the gaming period.

Our baseline approach uses Coarsened Exact Matching (CEM) to identify the matched comparator set of hospitals. To assess sensitivity to alternative matching strategies, we first replicate our estimates using the Mahalanobis-distance based matching approach, which picks for each treated unit the comparison unit that is closest in Mahalanobis distance along the matching covariates. Figure C.5 shows that the estimates remain essentially unchanged from the baseline even after this substantial modification.

The next check uses Propensity Score Matching (PSM). We estimate a propensity score as a function of the matching covariates we used in CEM, then reweight the comparators to again target the TOT estimand. Results are similar to CEM under this alternative matching approach, though effects on all-payer revenue and operating costs are attenuated. This approach includes all hospitals, even in parts of the propensity score distribution with little or no overlap. To further test robustness, we run PSM and trim the sample to the range with substantial overlap in propensity score distributions among gamers and comparators

(Stürmer et al., 2010).[18] This approach returns similar results.

Having assessed robustness to matching strategy, we next turn to the DD model. This model assumes that absent gaming, the gamers and matched comparators would have evolved on parallel trends. We relax this assumption and allow the two groups to evolve on differential trends in a linear fashion. We include an additional term in the model which interacts an indicator for gamer hospitals with a linear time trend. The estimates are similar with this modification, though in some cases more imprecise.

Finally, we consider three modifications to our strategy for identifying gamers. First, we modify the threshold of growth in charges and simulated outlier payments above which we tag a hospital as a likely gamer. In the baseline model, this threshold was the 90th percentile. In robustness, we lower it to the 85th percentile, which yields essentially identical results. Second, we modify the algorithm to use realized outlier payments rather than simulated outlier payments. This approach also does not change our findings. Third, we use only charge growth to identify gamers, rather than additionally using growth in the ratio of outlier payments to DRG payments. In this approach, gamers are those in the top decile of charge growth and non-gamers are those under the 85th percentile of charge growth. Results are similar with this method, though the scale of revenue is, as expected, smaller than in the baseline approach.

7 Discussion and Conclusion

In this paper, we use a design flaw in Medicare's outlier payments program to study how hospitals allocate revenue obtained by exploiting loopholes or gaming. CMS was first warned of the potential for outlier payments gaming in 1988, suggesting these vulnerabilities could have been anticipated by policymakers. Our work estimates that the agency's failure to close the loophole in a timely fashion cost Medicare at least $3 billion, with large spillover effects for other payers. When pooling together all hospitals identified as gamers, we find uneven evidence that revenue obtained from gaming is used in ways that might benefit patients. About half the excess revenue flows toward operating costs while the rest is transferred off the hospital balance sheets, likely to their parent organizations.

However, we find significant heterogeneity in outcomes by hospital owner type. For-profit hospitals drive the observed transfer of funds off balance sheets. For-profits also reduce spending on hospital and staff FTE, contributing to a decline in operating costs. In

[18] Specifically, we narrow the range to the common support of the two groups, then to the first percentile of the propensity scores in the gamer group and the 99th percentile of propensity scores in the non-gamer group. We follow standard practice and re-estimate the scores within the trimmed sample (Li and Thomas, 2018; Stürmer et al., 2021).

contrast, nonprofit hospitals mainly allocate excess revenue to increasing operating costs, particularly non-salary costs on general services and inpatient care. Nonprofit hospitals also produce modest improvements in mortality rates, suggesting that the additional spending on operations improves care delivery. Consistent with this argument, there are no quality improvements among for-profit hospitals since little of the excess revenue is invested into the hospital. These results suggest hospitals engineered a windfall with significant fiscal costs, while the benefits vary by ownership type.

We caution the reader about two limitations of our analysis. First, we must rely on a statistical rule to designate specific hospitals as likely gamers, i.e., they manipulate their list prices to dramatically increase their Medicare revenue. This threshold approach could lead us to undercount the true set of gamers, and while less likely, could also incorrectly flag some non-gamer hospitals. We find it reassuring that our list largely includes the hospitals accused of turbocharging by the DOJ based on whistleblower testimonies and other evidence. Second, most of the for-profit gamers in our sample belong to one large hospital chain, which may limit the generalizability of the results to the average for-profit hospital. That being said, our results on for-profit gamers are consistent with theories on hospital and organizational behavior.

Overall, we provide new evidence on how firms in healthcare deploy windfalls engineered by exploiting payment loopholes. However, the issue of intermediaries exploiting loopholes to increase their revenue at taxpayer expense is not limited to healthcare. Federal, state, and local governments are increasingly spending their budgets on social programs that span multiple sectors of the economy and are typically delivered through private firms. These include, among others, food vouchers redeemed at grocery stores and K-12 education delivered by private schools. Our results suggest that investing more in strengthening the design of and preventing the abuse of such programs is socially valuable. More research is needed across sectors to assess the full extent of potential abuse and waste in tax-funded programs.

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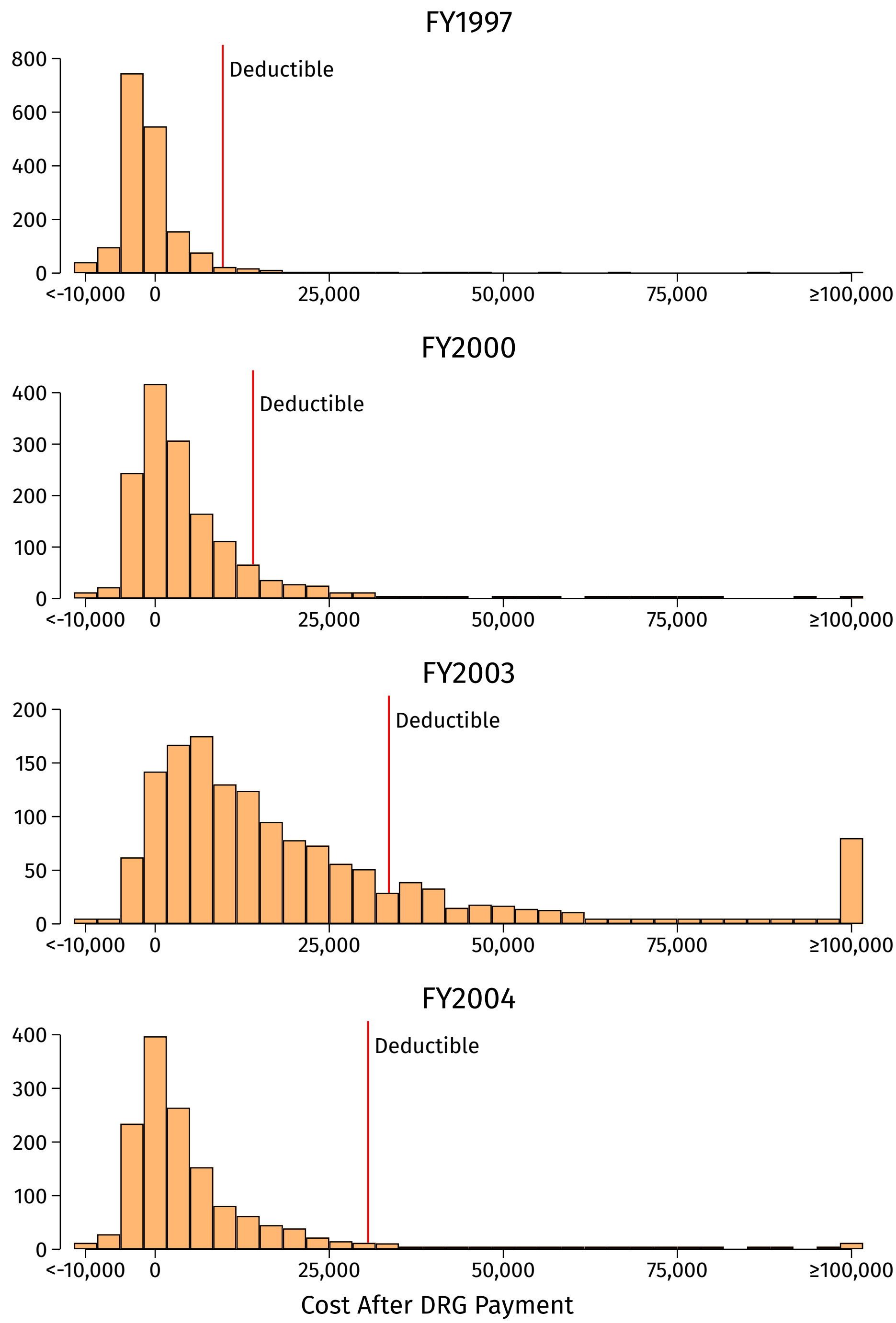


Figure 1: Evolution of excess "cost" distributions at an extreme gamer hospital

Notes: Each panel of this figure shows a histogram of the excess "cost" distribution of patients at the most extreme gamer hospital in our data in the stated year. Excess "costs" were defined as the hospital's submitted charges deflated by the cost-to-charge ratio used by the payment contractor, less the DRG payment. Bars indicating patient counts between 1 and 10 set to 5.5 to follow CMS cell suppression rules. The vertical red line indicates the deductible for outlier payments. Hospitals received payments equal to 80% of "costs" beyond this threshold.

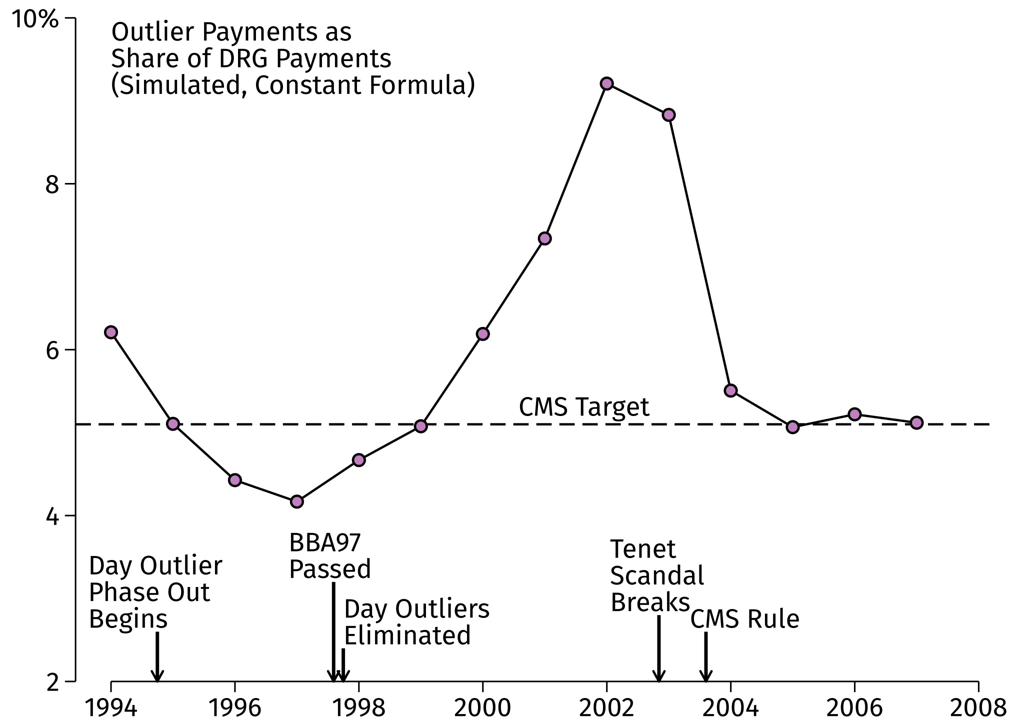


Figure 2: Trend in Medicare outlier payments

Notes: The figure presents outlier payments as a share of DRG (non-outlier) Medicare hospital payments, using our simulation approach holding fixed payment formulas. We also note key events associated with the scandal over this period. Appendix Figure C.1 shows the same time series using actual payment data.

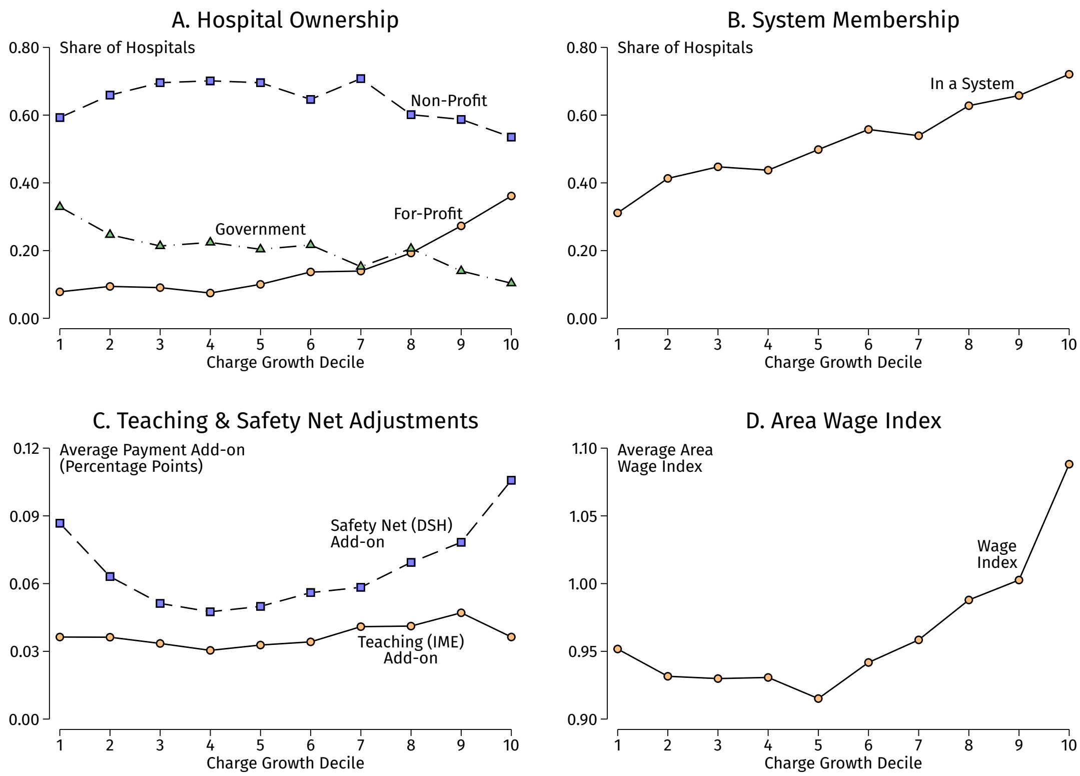


Figure 3: Characteristics of Hospitals by Charge Growth Decile

Notes: Each panel of this figure shows the association between charge growth and a hospital characteristic or set of characteristics. Hospitals are binned according to their decile of charge growth, displayed along the x-axis. Each point is the average characteristic of hospitals in the given decile. Panel A shows hospital ownership, Panel B shows the share of hospitals in a system, Panel C shows average payment add-ons for teaching and safety-net hospitals, and Panel D shows the average area wage index. Characteristics taken at their 1997 values.

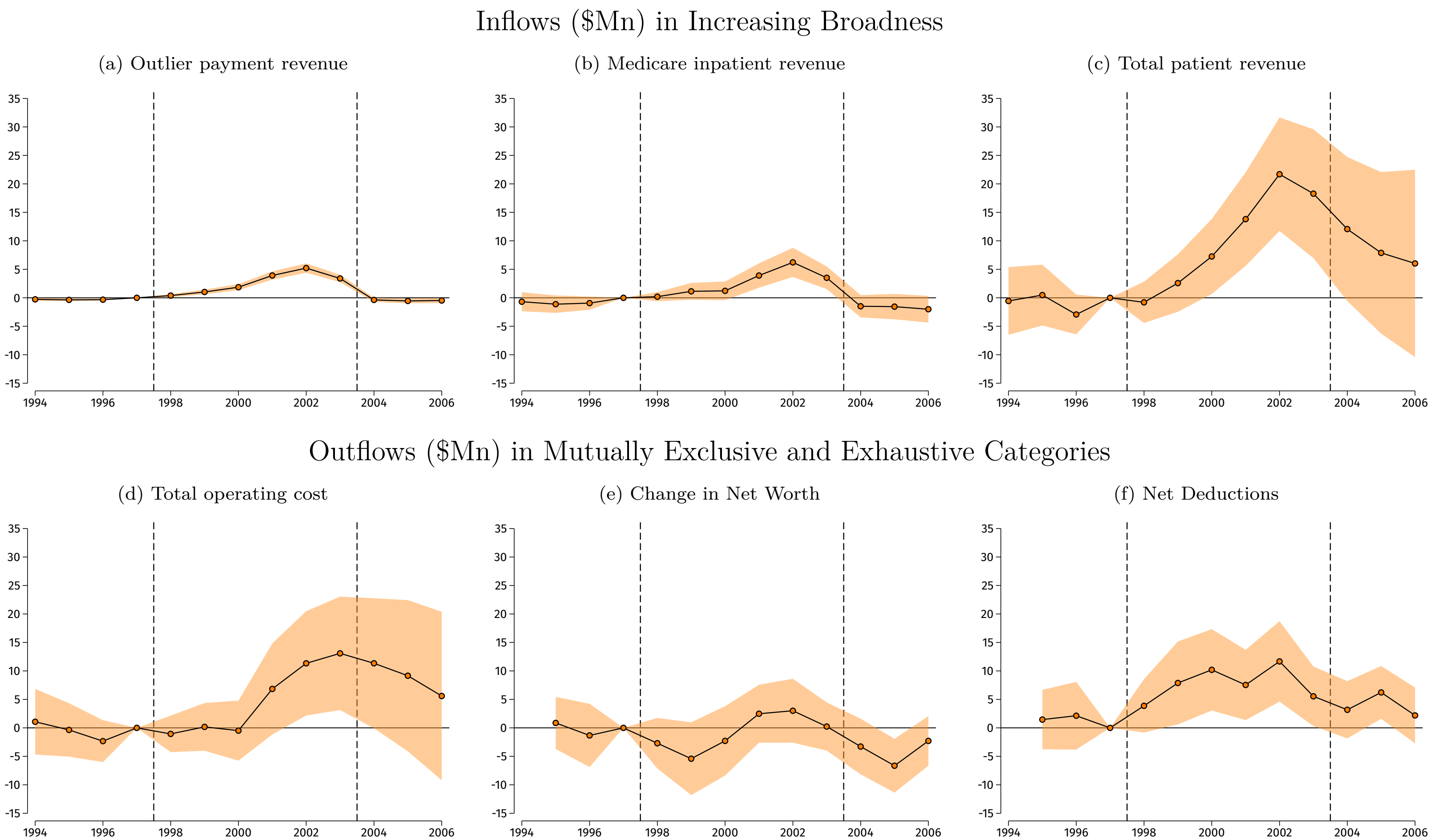


Figure 4: Flow of funds

Notes: The figure presents event study plots obtained by estimating the dynamic effects model in Equation 3 on our main analysis sample. The outcomes here are various measures of income (outlier revenue, Medicare inpatient revenue, and total patient revenue), costs (operating costs), and changes in balance sheet items (change in net worth, net deductions), as reported in the Medicare cost reports for the corresponding years. All values are expressed in millions of real year 2000 dollars. All coefficients are estimated relative to 1997 as the reference year. The shaded area represents 95% confidence intervals. Standard errors are clustered by hospital.

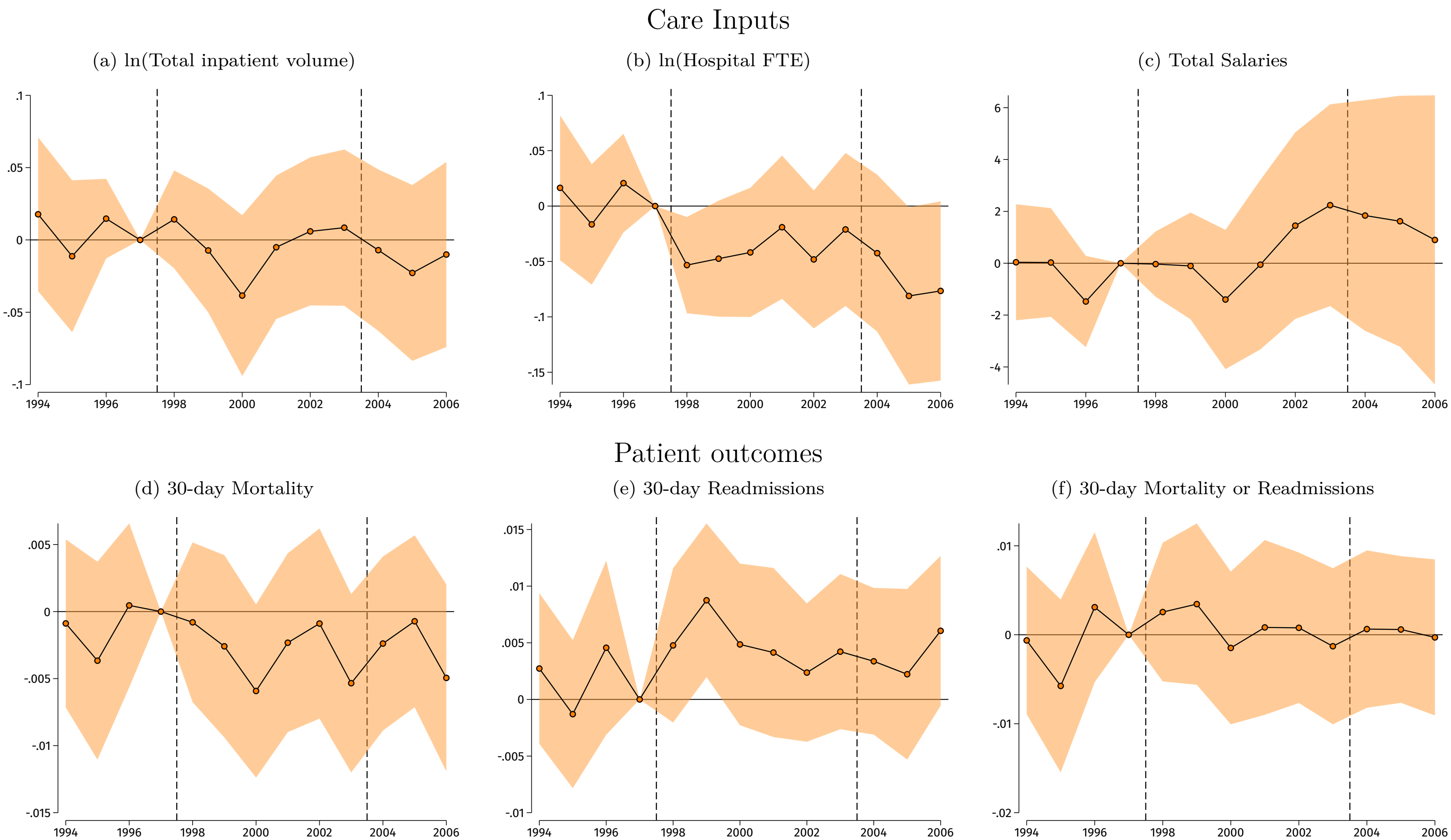


Figure 5: Inputs and Patient Outcomes

Notes: The figure presents event study plots obtained by estimating the dynamic effects model in Equation 3 on our main analysis sample. The outcomes here are measures of care inputs (total number of inpatients, full-time equivalent employment, and total salaries) and measures of health outcomes for the cohort of patients admitted with non-deferrable conditions (30-day mortality and readmission rates). Event studies for inpatient volume and full-time equivalent employment estimated with Poisson models. Data on inputs is sourced from the Medicare cost reports, while health outcomes are observed for Medicare fee-for-service patients admitted with non-deferrable conditions. All coefficients are estimated relative to 1997 as the reference year. The shaded area represents 95% confidence intervals. Standard errors are clustered by hospital.

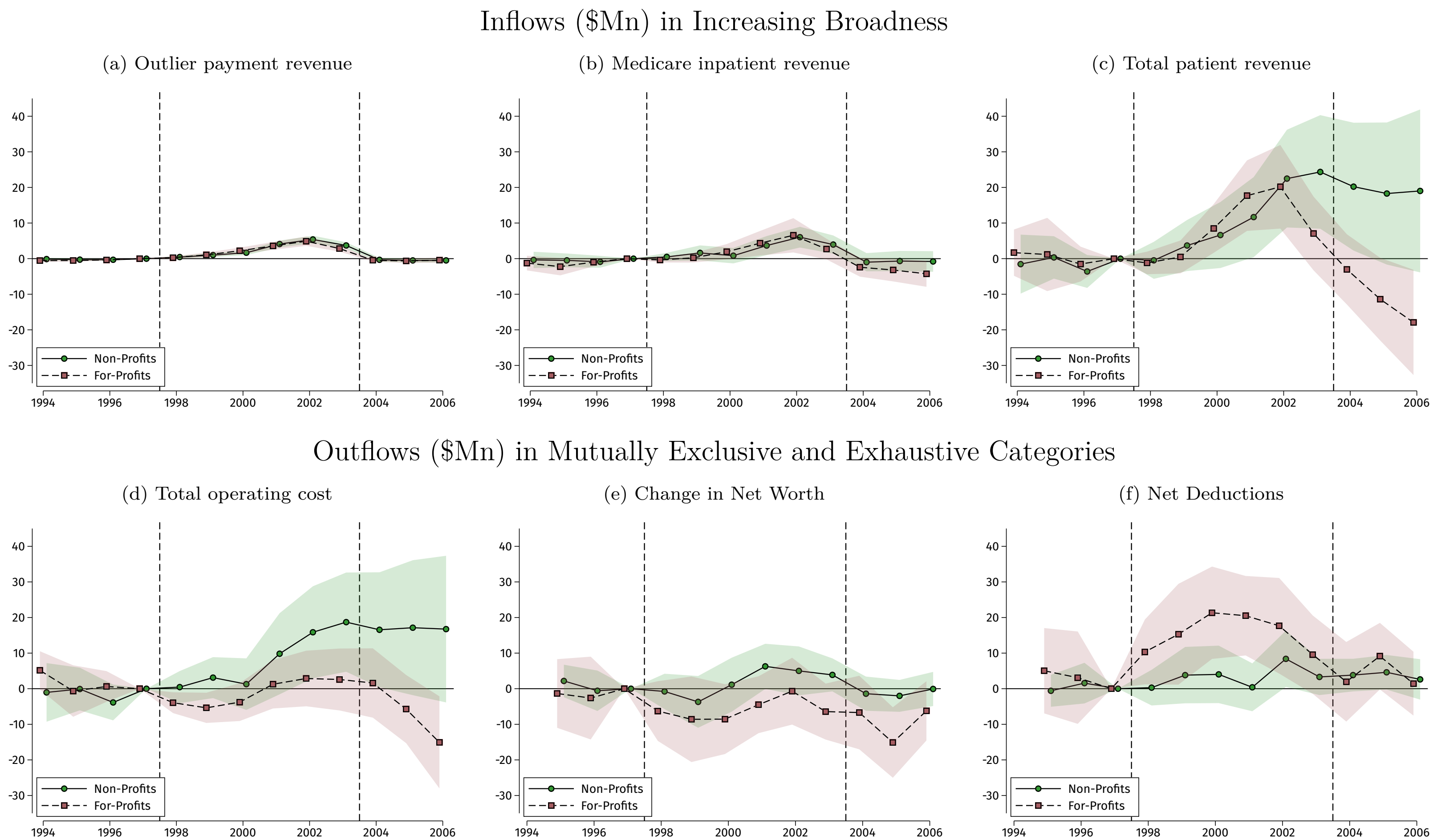


Figure 6: Flow of funds for nonprofits and for-profits

Notes: The figure presents event study plots obtained by estimating the dynamic effects model in Equation 3 separately for nonprofits and for-profits. The outcomes here are various measures of income (outlier revenue, Medicare inpatient revenue, and total patient revenue), costs (operating costs), and changes in balance sheet items (change in net worth, net deductions), as reported in the Medicare cost reports for the corresponding years. All values are expressed in millions of real year 2000 dollars. All coefficients are estimated relative to 1997 as the reference year. The shaded area represents 95% confidence intervals. Standard errors are clustered by hospital.

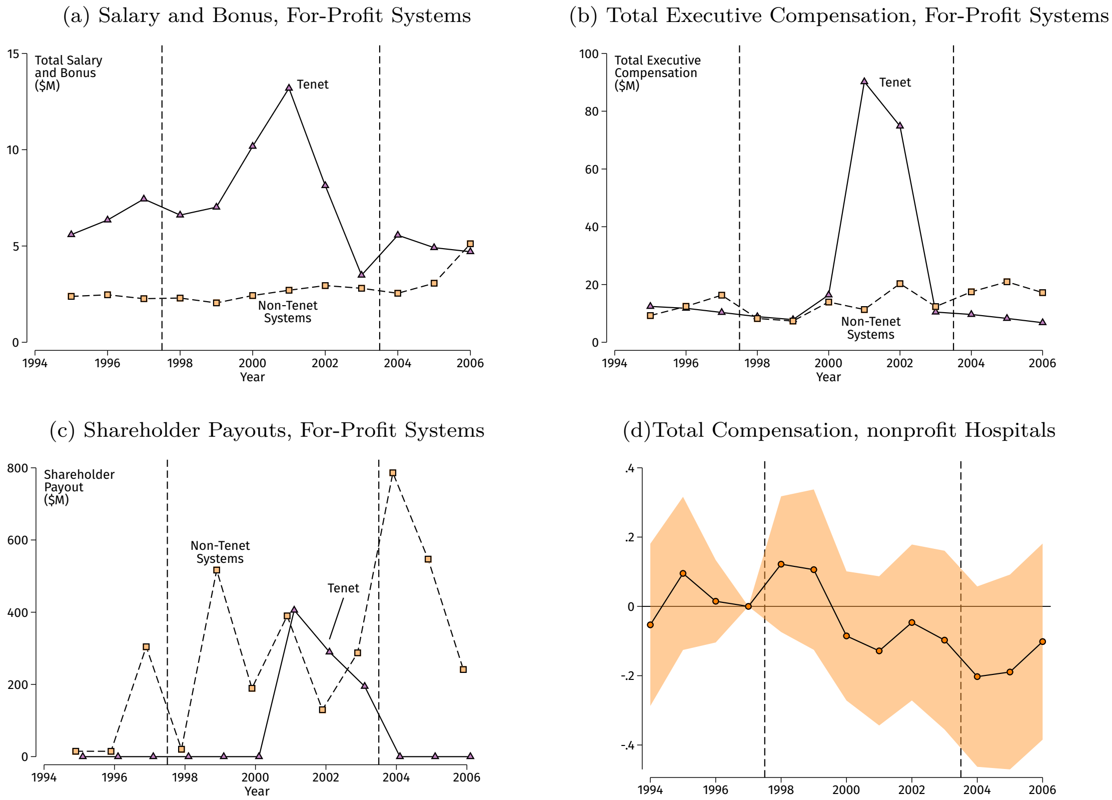


Figure 7: Compensation of Executives and Shareholders

Notes: Figure (a) presents the average total salary and bonus for the top 5 highest-paid executives in for-profit systems for Tenet compared to the following non-Tenet systems with data available from 1995-2006: Health Management Associates, Health Corporation of America, Sunlink, and Universal Health Systems. Data is not consistently available for all of these systems before 1995. Figure (b) is an extension of Figure (a) but instead shows a broader measure of executive compensation available in Compustat that captures total compensation realized by an executive in a given year. Figure (c) presents total shareholder payouts representing the sum of dividends and purchase of common and preferred stock. Figure (d) presents event study plots obtained by estimating the dynamic effects model in Equation 3 for the outcome of compensation for key individuals measured in form 990 data. Total compensation represents all salary and bonus payments made to a nonprofit hospital's officers, directors, trustees, and other key employees.

Table 1: Summary Statistics

	(1) Gamers	(2) Matched Comparators
A. Payment Inputs Used for Matching		
Wage Index	1.099	1.086
Safety Net (DSH) Adjustment	0.0898	0.0789
Teaching (IME) Adjustment	0.0301	0.0275
Medicare Inpatient Share	0.360	0.361
B. Additional Hospital Characteristics		
Beds	275.3	226.1
In System	0.730	0.523
Medicare Inpatient Payments	34.34	27.62
All-Payer Revenue	114.9	101.2
Ownership		
Non-Profit	0.650	0.866
For-Profit	0.350	0.134
Location		
Rural	0.0417	0.106
Urban	0.958	0.894
C. Risk Scores (Non-Deferrable Patients)		
Mortality	0.138	0.134
Readmission	0.135	0.136
D. Risk-Adjusted Outcomes (Non-Deferrable Patients)		
Mortality	0.140	0.139
Readmission	0.139	0.137
Hospitals	120	1396

Notes: The table presents descriptive statistics on the hospitals in our analysis sample. Column 1 presents mean values for the turbocharging hospitals we designate as gamers, while column 2 presents corresponding values for the matched comparator hospitals. Panel A presents values for the variables used to match gamers to non-gamers. Panel B presents values for other relevant attributes or outcomes of interest. Panel C reports the estimated risk of mortality and readmission among non-deferrable patients. Panel D reports realized mortality and readmission rates among these patients after adjusting for observable risk. All values are computed using data from 1997 except Medicare inpatient share, which is the 1994-1997 average. Revenue values are expressed in millions of real year 2000 dollars.

Table 2: Flow of Funds

	(1) DV Mean	(2) 1998–2000	(3) 2001–2003	(4) 1998–2003	(5) Observations
Panel A. Income in Increasing Broadness					
Medicare Outlier Payments	1.715	1.331***	4.419***	2.875***	19699
		(0.235)	(0.347)	(0.257)	
Medicare Inpatient Payments	32.94	1.537+	5.232***	3.384***	19699
		(0.855)	(1.249)	(0.993)	
ln(Medicare Payments/Patient)	9150.2	0.0732***	0.197***	0.135***	19706
		(0.0114)	(0.0185)	(0.0133)	
All-Payer Revenue	111.0	3.776	18.66***	11.22**	19515
		(3.021)	(5.528)	(4.089)	
Panel B. Outflows in Mutually Exclusive Categories					
Operating Costs	111.9	-0.0489	10.82*	5.387	19580
		(2.755)	(5.056)	(3.745)	
Total Salaries	46.85	-0.158	1.565	0.703	19699
		(1.302)	(1.998)	(1.584)	
ΔNet Worth	5.199	-3.317+	2.058	-0.630	17949
		(1.768)	(1.450)	(1.383)	
ΔTotal Assets	4.156	0.979	4.329*	2.654	18040
		(1.979)	(2.130)	(1.736)	
ΔFixed Assets	0.707	-0.173	0.410	0.118	17943
		(0.884)	(0.891)	(0.769)	
ΔLiabilities (subtracted)	-0.662	3.489*	1.989	2.739*	18009
		(1.694)	(1.534)	(1.265)	
Net Deductions	1.703	6.112**	7.048**	6.580***	17949
		(2.187)	(2.258)	(1.960)	

Notes: The table presents the coefficients estimated using Equation 2. Each row presents coefficients from a separate regression on a different dependent variable, typically estimated on a slightly different sample. Column 1 presents the sample mean value of the dependent variable in 1997. Columns 2 and 3 present the coefficients pertaining to the 1998–2000 and 2001–03 periods, respectively. Column 4 presents the average coefficient across 1998–2003. Column 5 presents the number of observations used for each regression. All dollar values are expressed in millions of real year 2000 dollars. Effects on Medicare payments per patient estimated using Poisson regression and these coefficients have a log-point interpretation. All-payer revenue includes both inpatient and outpatient components. Change in net worth is equal to the change in assets minus the change in liabilities. Net deductions refers to the funds transferred off the hospital's balance sheet, typically to its corporate parent. Standard errors are in parentheses and are clustered by hospital. $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Care Inputs, Patient Risk and Outcomes

	(1) DV Mean	(2) 1998–2000	(3) 2001–2003	(4) 1998–2003	(5) Observations
Panel A. Care Inputs					
ln(Total Inpatient Volume)	10812.4	-0.0160	-0.00192	-0.00895	19519
		(0.0209)	(0.0256)	(0.0218)	
ln(Hospital FTE)	1076.8	-0.0526*	-0.0345	-0.0436^{+}	19505
		(0.0243)	(0.0312)	(0.0262)	
Panel B. Patient Risk (Non-Deferrable Conditions)					
Mortality	0.134	-0.000917	-0.00157	-0.00125	19064
		(0.00109)	(0.00139)	(0.00113)	
Readmission	0.135	0.000274	0.000941**	0.000607*	19064
		(0.000259)	(0.000345)	(0.000274)	
Mortality or Readmission	0.258	-0.000666	-0.000662	-0.000664	19064
		(0.00111)	(0.00143)	(0.00115)	
Panel C. Patient Outcomes (Non-Deferrable Conditions)					
Mortality	0.139	-0.00208	-0.00183	-0.00196	19064
		(0.00193)	(0.00219)	(0.00182)	
Readmission	0.134	0.00463*	0.00208	0.00335^{+}	19064
		(0.00198)	(0.00213)	(0.00183)	
Mortality or Readmission	0.264	0.00232	0.000926	0.00162	19064
		(0.00249)	(0.00281)	(0.00237)	

Notes: The table presents the coefficients estimated using Equation 2. Each row presents coefficients from a separate regression on a different dependent variable, typically estimated on a slightly different sample. Column 1 presents the sample mean value of the dependent variable in 1997. Columns 2 and 3 present the coefficients pertaining to the 1998–2000 and 2001–03 periods, respectively. Column 4 presents the average coefficient across 1998–2003. Column 5 presents the number of observations used for each regression. Health outcomes are estimated using the two-step approach described in Section 6.2.2. All health outcomes are computed for patients admitted with non-deferrable conditions, following the algorithm used in Card, Dobkin and Maestas (2009). Mortality and readmissions are measured at 30 days following discharge from the index admission. We generate predicted risk values using one-year history of co-morbidities associated with the patient and their principal diagnosis category, but not co-morbidities recorded on the index stay itself. Standard errors are in parentheses and are clustered by hospital. $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Results for nonprofits and For-Profits

	(1)	(2)	(3)	(4)	(5)	(6)
	Non-Profits			For-Profits		
	1998–2000	2001–2003	1998–2003	1998–2000	2001–2003	1998–2003
Panel A. Income in Increasing Broadness						
Medicare Outlier Payments	1.225***	4.580***	2.903***	1.536***	4.128***	2.832***
	(0.303)	(0.431)	(0.310)	(0.363)	(0.581)	(0.453)
Medicare Inpatient Payments	1.409	4.987**	3.198*	1.725+	5.642**	3.684**
	(1.192)	(1.554)	(1.299)	(0.940)	(2.011)	(1.405)
All-Payer Revenue	4.482	20.70**	12.59*	2.289	14.64*	8.466+
	(4.164)	(7.663)	(5.662)	(3.507)	(6.236)	(4.648)
Panel B. Outflows in Mutually Exclusive Categories						
Operating Costs	2.864	16.04*	9.453+	-5.640*	0.954	-2.343
	(3.881)	(7.166)	(5.288)	(2.577)	(4.199)	(3.225)
Total Salaries	0.776	3.369	2.073	-2.053*	-2.011	-2.032+
	(1.934)	(2.921)	(2.332)	(0.881)	(1.405)	(1.080)
Compensation of Key Personnel	0.0320	-0.104	-0.0360			
	(0.0999)	(0.112)	(0.0997)			
ΔNet Worth	-1.665	4.509*	1.422	-6.483*	-2.551	-4.517+
	(2.036)	(1.834)	(1.569)	(3.221)	(2.173)	(2.534)
Net Deductions	2.392	3.718	3.055+	12.94**	13.21**	13.07**
	(2.252)	(2.399)	(1.821)	(4.375)	(4.440)	(4.216)
Panel C. Care Inputs						
ln(Total Inpatient Volume)	-0.0285	-0.0204	-0.0245	0.0262	0.0561	0.0412
	(0.0241)	(0.0300)	(0.0252)	(0.0381)	(0.0428)	(0.0393)
ln(Hospital FTE)	-0.0321	-0.0123	-0.0222	-0.119**	-0.103*	-0.111**
	(0.0288)	(0.0367)	(0.0309)	(0.0388)	(0.0498)	(0.0425)
Panel D. Patient Risk (Non-Deferrable Conditions)						
Mortality	0.00258*	0.00330*	0.00294**	-0.00710***	-0.0101***	-0.00862***
	(0.00118)	(0.00143)	(0.00112)	(0.00172)	(0.00202)	(0.00174)
Readmission	0.000664*	0.00140***	0.00103**	-0.000460	0.0000764	-0.000192
	(0.000310)	(0.000408)	(0.000326)	(0.000427)	(0.000577)	(0.000456)
Panel E. Patient Outcomes (Non-Deferrable Conditions)						
Mortality	-0.00492*	-0.00339	-0.00415*	0.00320	0.00109	0.00215
	(0.00200)	(0.00252)	(0.00197)	(0.00367)	(0.00380)	(0.00333)
Readmission	0.00656**	0.00480+	0.00568*	0.00112	-0.00276	-0.000820
	(0.00243)	(0.00269)	(0.00232)	(0.00296)	(0.00301)	(0.00251)

Notes: The table presents the coefficients estimated using Equation 2. Each row presents coefficients from a separate regression on a different dependent variable, typically estimated on a slightly different sample. Columns 1-3 consider effects for nonprofit hospitals while columns 4-6 consider for-profit hospitals. See notes to tables 2 and 3 for more details on the outcome measures. Standard errors are in parentheses and are clustered by hospital. $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Online Appendix

A Outlier Payments Scandal

This section provides additional details of the outlier payments scandal and subsequent lawsuits. This is considered one of the largest scandals in Medicare history with substantial coverage in prominent journals such as the New York Times and Wall Street Journal (Abelson, 2002; Pollack, 2003; Eichenwald, 2003; Jaklevic, 2003; Bernstein, 2012). These articles as well as legal documents provide anecdotal evidence that a diverse set of hospitals knowingly engaged in turbocharging.

For example, in a lawsuit filed against New York's Beth Israel Hospital an "executive wrote of "feeling a bit giddy" at the thought of "getting $10M of outlier revenue," while another advised caution because she had become wary that Beth Israel's turbocharging would be detected" (Bernstein, 2012). Turbocharging was also rampant among both for-profit and nonprofit hospitals in New Jersey: "Nine-hospital Saint Barnabas Health Care System, West Orange, which had 10 hospitals in 2001, received $302 million, or 41% of its total inpatient Medicare revenue, from outlier payments. Kimball Medical Center in Lakewood, N.J., received more outlier payments as a percentage of Medicare revenue-63%-than any other U.S. hospital" (Jaklevic, 2003). When pressed by journalists to understand why these hospitals were gaming Medicare, the "senior vice president of health economics at the New Jersey Hospital Association, acknowledged some New Jersey hospitals may have tried to find "some mechanism to effectuate an increase" in their bottom lines" (Jaklevic, 2003).

No hospital or health system received as much coverage as Tenet Corporation. This was in part due to Tenet's size and the magnitude of turbocharging: "Tenet's outlier growth from fiscal 1999 to fiscal 2002 accounted for over 54% of its cumulative growth in earnings per share from operations. Similarly, by fiscal 2002, Tenet's outlier revenue comprised over 40% of its earnings per share" (Securities and Exchange Comission, 2007). In legal documents, substantial evidence was found via email records that Tenet executives knowingly orchestrated this scheme. The chief operating officer, Thomas Mackey, was one of the parties sued (Securities and Exchange Comission, 2009):

> The Complaint alleges that Mackey, of Keswick, Virginia, was the principal architect of Tenet's scheme to inflate its earnings by exploiting Medicare's outlier reimbursement regulations, which provided for additional reimbursement to hospitals to cover the additional costs for treating extraordinarily sick patients. Mackey realized that additional outlier reimbursement could be triggered simply by increasing Tenet's gross charges, regardless of the actual cost incurred by Tenet to treat its Medicare patients. In 1999, and under Mackey's direction, Tenet management calculated the precise increase to Tenet's gross charges needed to boost its revenue from Medicare outlier payments to a level that would allow Tenet to reach its earnings targets. For the next three years, Mackey continued to oversee aggressive gross charge increases by Tenet.

This quote and other materials included in the lawsuits against Tenet suggest this behavior was a top-down administrative strategy to increase revenues. Unsurprisingly, most hospitals within Tenet and other systems, like Saint Barnabas, engaged in turbocharging.

Ultimately, whistleblowers came forth in these organizations, which helped trigger CMS to close the loophole and pursue legal cases against the turbocharging hospitals (U.S. Department of Justice, 2006*a*,*b*, 2010).

Based on their identification strategy, CMS reports suggest 123 hospitals engaged in turbocharging, but they did not provide a list of these hospitals (United States Senate, 2003). We found that 15 individual hospitals and 5 health systems settled with CMS under the False Claims Act. Using our methodology which improves the CMS algorithm (see Section 5.1), we find that 180 hospitals engaged in turbocharging. However, this is a conservative estimate based on restrictive cut-offs, and dozens more hospitals likely engaged in this behavior. We calculate that the average gaming hospital obtained $17M over a six-year period. This suggests that turbocharging cost CMS over $3 billion dollars, yet only $1 billion was recovered via settlements.

CMS effectively closed the loophole in 2003 and established a program to claw back payments if hospitals received excessive outlier payments, referred to as payment reconciliation. However, because of budgetary issues and flaws in the payment reconciliation design, very few hospitals had payments clawed back (HHS OIG, 2019). For example, the OIG report states that "CMS paid 53 hospitals $541 million more than they would have been paid" in part because hospital "cost reports did not meet the 10-percentage-point threshold for reconciliation" (HHS OIG, 2019). This suggests that hospitals are continuing to game vulnerabilities in the outlier payments program.

B Flow of Funds Calculation

We use cost report data to trace uses of excess revenue. Using basic accounting identities, every dollar of excess revenue must go towards operating costs, net worth, or net deductions:

$$\Delta NetWorth_t = (Income_t - Cost_t) - (Deductions_t - Additions_t)$$

$$\begin{aligned} NetIncome_t &= Income_t - Cost_t \\ NetDeductions_t &= Deductions_t - Additions_t \\ NetWorth_t &= Assets_t - Liabilities_t \end{aligned}$$

$$\begin{aligned} Income_t &= Cost_t + (\Delta Assets_t - \Delta Liabilities_t) + (Deductions_t - Additions_t) \\ Income_t &= Cost_t + \Delta NetWorth_t + NetDeductions_t \end{aligned}$$

In a hospital, operating costs primarily include spending on staffing and hospital services. Net worth (sometimes referred to as fund balance, net assets, or owner's equity) is comprised of assets minus liabilities. Assets include spending on fixed assets such as healthcare-specific equipment, as well as financial assets such as stocks and bonds. Liabilities represent the economic obligations of the organization to outsiders. Net deductions capture transfers off the balance sheet, often to the parent company, other affiliates, or for publicly-traded firms, shareholders.

C Supplementary Figures and Tables

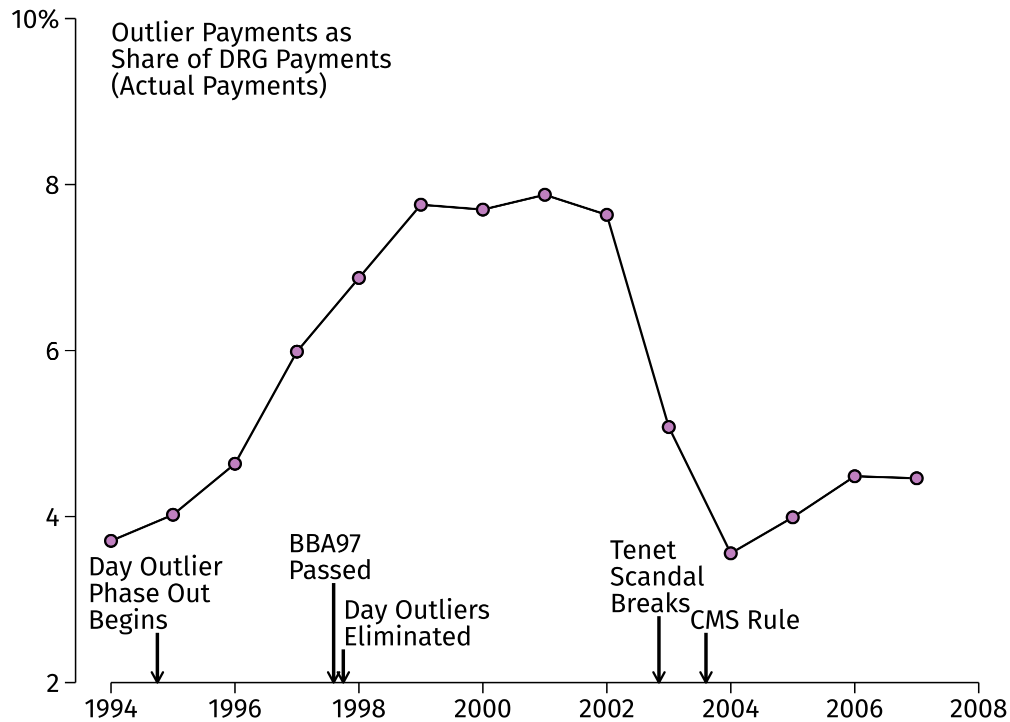
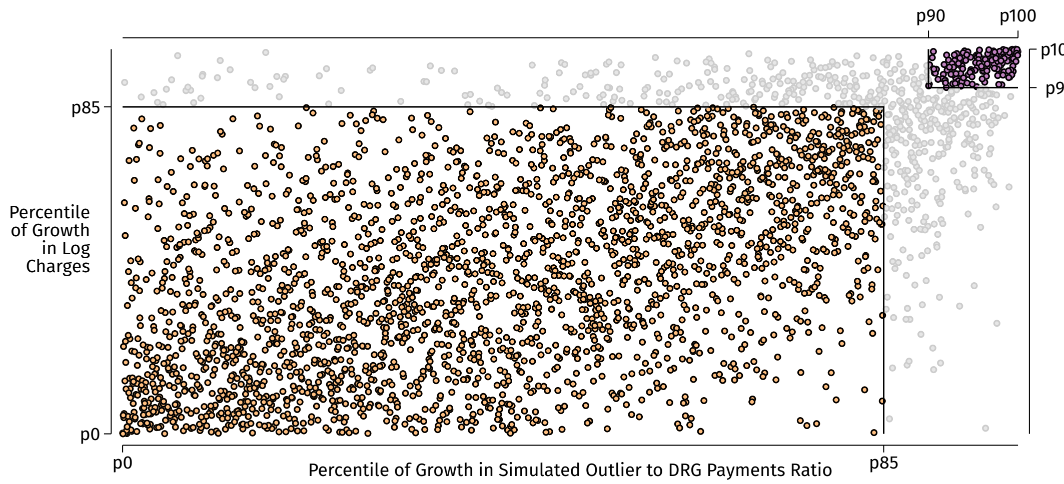


Figure C.1: Trend in Medicare outlier payments, actual payments

Notes: The figure presents outlier payments as a share of DRG (non-outlier) Medicare hospital payments, using actual payments made by Medicare during the time period. We also note key events associated with the scandal over this period. This plot differs in several ways from Figure 2, which shows the same time series using simulated payments holding the outlier formula constant. First, the CMS data does not allow us to distinguish "cost" outliers, the focus of this study and Figure 2, from "day" outliers, which were not gamed and are not our focus. We therefore show the sum of both here. Unfortunately, outlier payments were phased out in the early 1990s, obscuring when gaming began in this view. Second, while the figure in the main text holds outlier payment formulas constant, the figure here is based on payment formulas, including the "deductible", which update annually. Since CMS raised the deductible to blunt growth in payments, this feature of the data also obscures the scope and timing of gaming here. Third, in the CMS data we use, the DRG payments include both capital and operating payments, while the outlier payments include only operating outlier payments; the figure in the main text simulates only operating payments for both series.

(a) Designating gamers (percentile values)



(b) Designating gamers (absolute values)

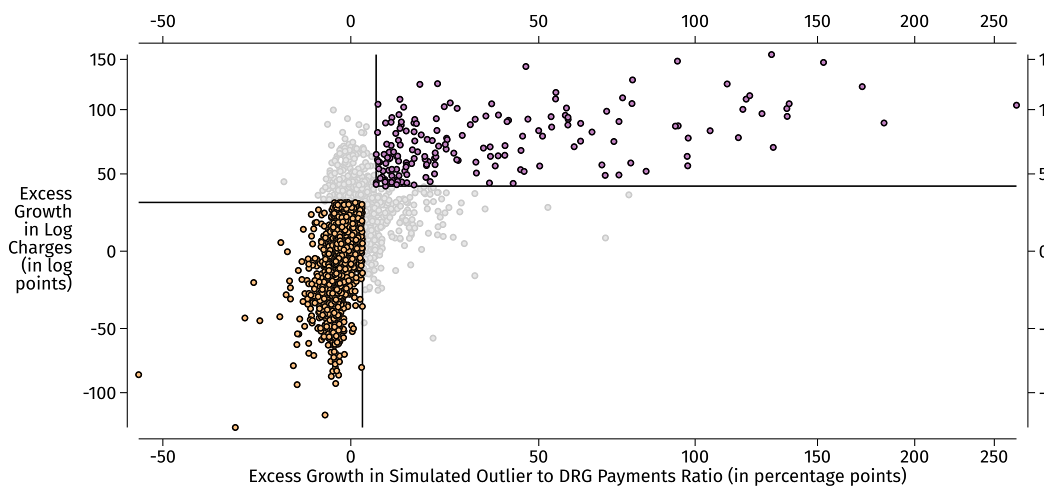


Figure C.2: Designating hospitals as "gamers"

Notes: These figures illustrate our approach to arriving at the set of hospitals we study as potential gamers. Each panel is a scatter plot with each dot denoting a separate hospital. The X-axis plots the growth in the ratio of simulated outlier payments to simulated DRG payments. The Y-axis plots the growth in log hospital charges. In panel (a), the scales are in percentile terms, while in panel (b), the scales are in absolute terms and the axes use inverse hyperbolic sine to better to display extreme values. Our approach to calculating growth rates is described in the main text. Hospitals that are on or above the 90^{th} percentile on both dimensions are designated "gamers" and constitute the "treated" group in our analysis. Hospitals above the 85^{th} percentile but below the 90^{th} percentile on one or both dimensions are excluded from the sample because their gaming status is indeterminate. Hospitals below the 85^{th} percentile on both dimensions form the pool of potential comparison hospitals. We further restrict the samples as described in the main text to form the analysis sample.

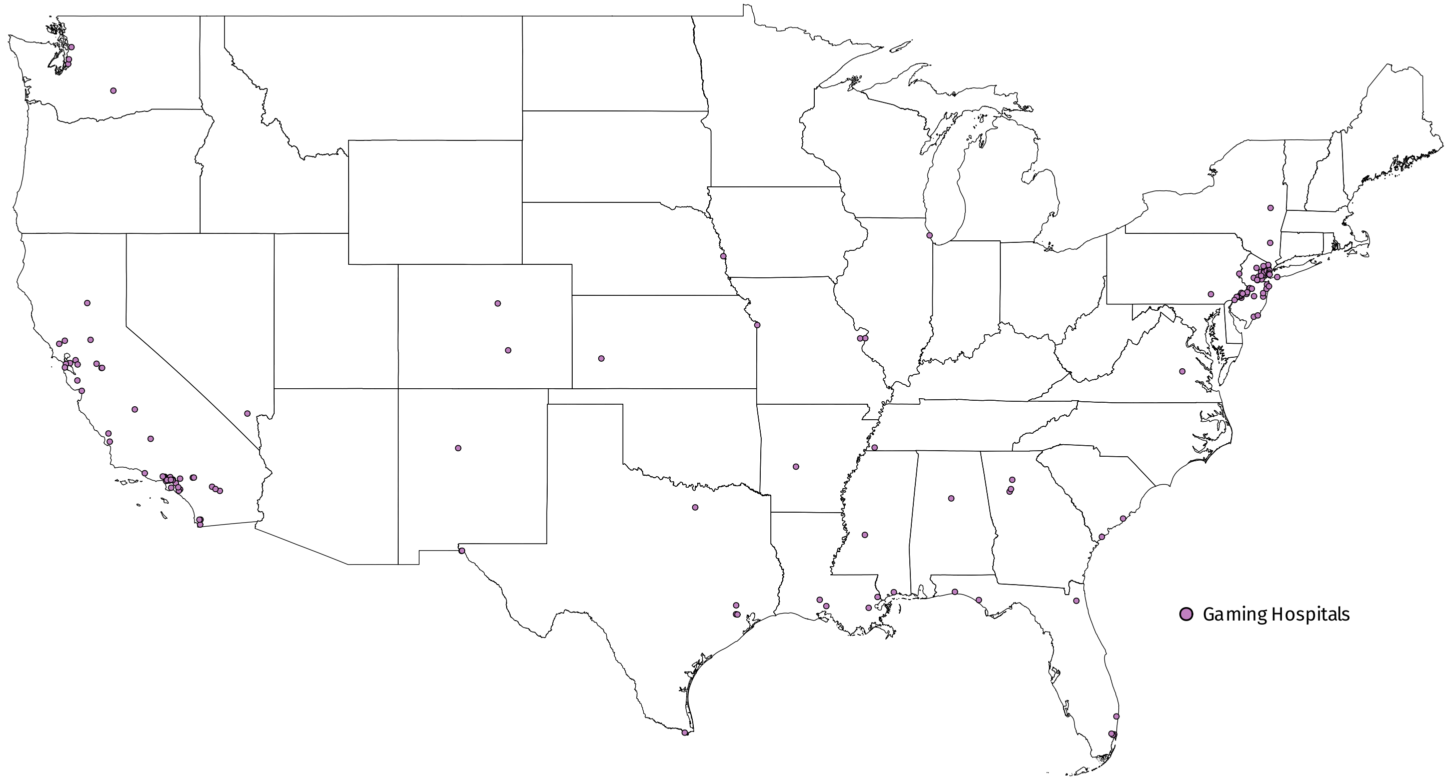


Figure C.3: Map of hospitals flagged as “gamers”

Notes: The displays the geographic distribution of hospitals flagged and analyzed in the main text as likely gamers of outlier payments.

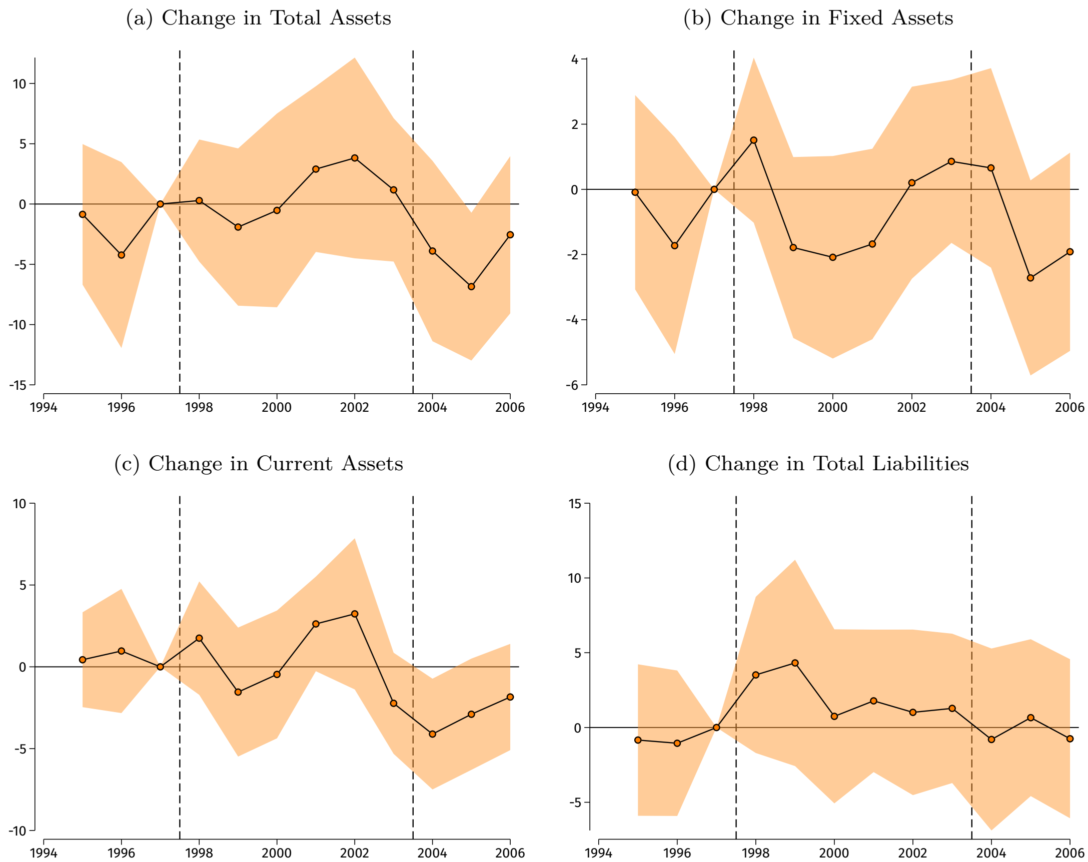


Figure C.4: Changes in Assets and Liabilities

Notes: The figure presents event study plots obtained by estimating the dynamic effects model in Equation 3 on our main analysis sample. The outcomes here are changes in assets or liabilities, as reported in the Medicare cost reports for the corresponding years. All coefficients are estimated relative to 1997 as the reference year. The shaded area represents 95% confidence intervals. Standard errors are clustered by hospital.

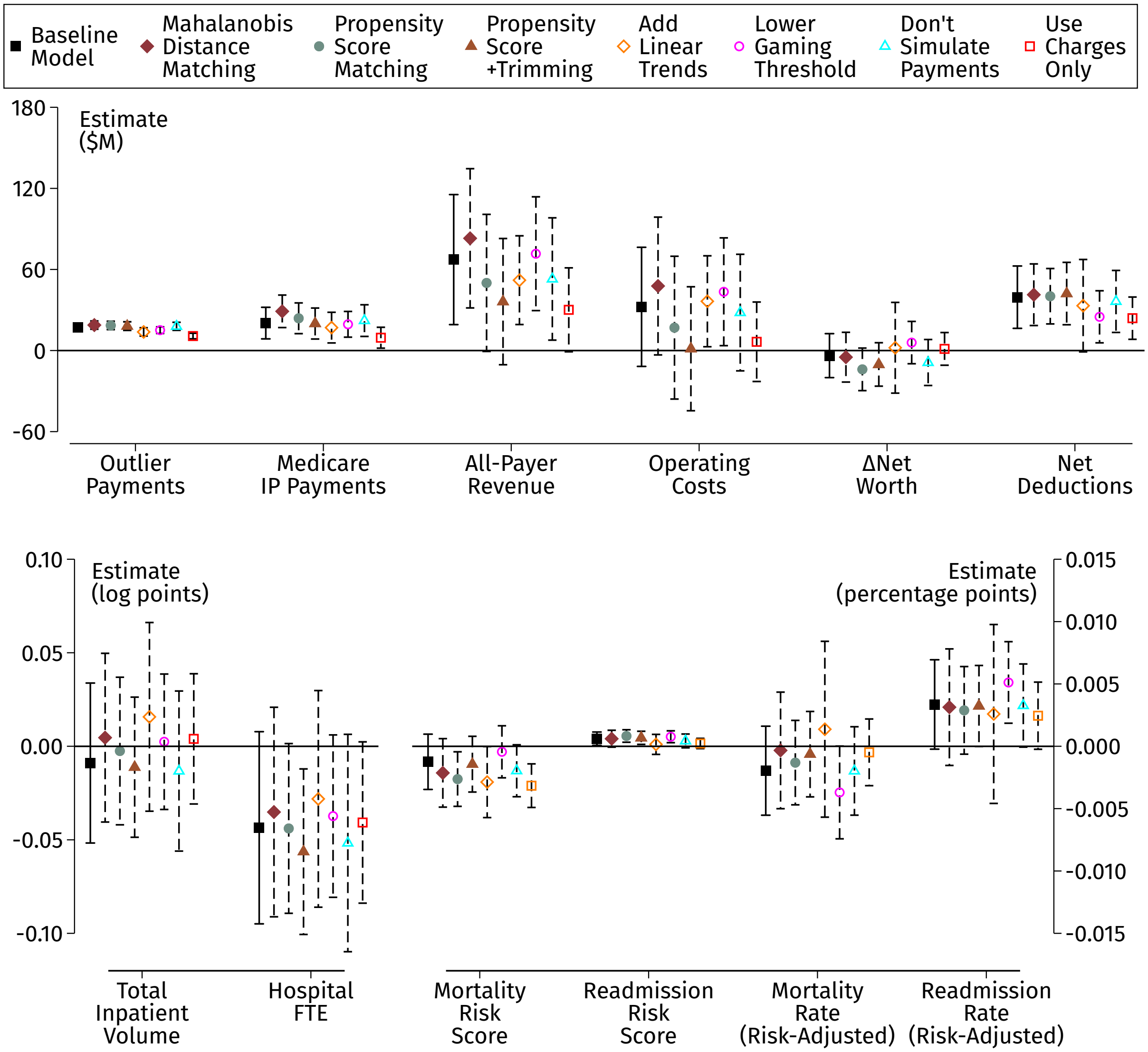


Figure C.5: Robustness checks

Notes: The figure presents estimates obtained from a number of robustness checks for the key measures of revenue and use of funds that were also presented in Table 2 (upper plot) and key measures of inputs, selection, and patient outcomes presented in Table 3 (lower plot). The dollar-valued estimates in the upper plot simply reproduce the main coefficients from Table 2 column 4 multiplied by 6, to reflect the total flow over 1998–2003. The log point and percentage point estimates in the lower plot reproduce the coefficients from Table 3 to reflect the average effect during 1998–2003. See main text for more details on the robustness models. The error bars depict 95% confidence intervals. The standard errors are clustered by hospital, which is the level of treatment in this analysis.

Table C.1: Targeting Regression

	(1)	(2)	(3)	(4)
	Bivariate Regressions		Multivariate Regressions	
	Charge Growth >p90	Flagged as Gamer	Charge Growth >p90	Flagged as Gamer
Payment Parameters				
Wage Index	0.354***	0.246***	0.420***	0.293***
	(0.0354)	(0.0269)	(0.0489)	(0.0393)
Safety Net (DSH) Adjustment	0.249***	0.263***	0.269***	0.243***
	(0.0554)	(0.0492)	(0.0718)	(0.0645)
Teaching (IME) Adjustment	-0.0175	0.117*	-0.268***	-0.168**
	(0.0534)	(0.0489)	(0.0668)	(0.0614)
Additional Hospital Characteristics				
Medicare Inpatient Share	-0.169***	-0.185***	0.0722	0.0313
	(0.0411)	(0.0310)	(0.0521)	(0.0351)
ln(Beds)	0.0215***	0.0338***	0.0159*	0.0208***
	(0.00596)	(0.00417)	(0.00700)	(0.00495)
Urban	0.0692***	0.0690***	-0.0288*	-0.0173*
	(0.00988)	(0.00616)	(0.0125)	(0.00765)
In System	0.0772***	0.0375***	0.0336**	0.0163*
	(0.0104)	(0.00775)	(0.0103)	(0.00770)
Ownership (Ref: Non-Profit)				
For-Profit	0.148***	0.0682***	0.140***	0.0651***
	(0.0202)	(0.0155)	(0.0210)	(0.0156)
Government	-0.0309**	-0.0352***	-0.00297	-0.00638
	(0.0106)	(0.00656)	(0.0110)	(0.00734)
Risk-Adjusted Outcomes (Non-Deferrable Patients)				
Mortality Risk-Adj	-0.177+	0.0213	-0.0214	0.0951
	(0.106)	(0.0768)	(0.110)	(0.0844)
Readmission Risk-Adj	0.194+	0.0880	0.0610	0.00709
	(0.104)	(0.0675)	(0.117)	(0.0718)
Risk Scores (Non-Deferrable Patients)				
Mortality Score	1.433***	0.678**	0.489	0.124
	(0.346)	(0.219)	(0.304)	(0.226)
Readmission Score	1.074	1.272*	-0.814	-0.0488
	(0.805)	(0.627)	(0.988)	(0.718)
Adjusted R^2	0.012	0.012	0.107	0.089
Observations	36224	36224	2852	2852

Notes: This table presents the coefficients of a targeting regression that estimates the probability of a hospital turbocharging based on each hospital's characteristics in 1997 using the full hospital sample. The outcome variable for Columns 1 and 3 is equal to 1 if the hospital had charge growth greater than the 90th percentile during the gaming period, and the outcome variable for Columns 2 and 4 is equal to 1 if the hospital was flagged as a gamer according to our algorithm described in Section 5.1. Bivariate regressions between each hospital characteristic and the outcome variables are presented in Columns 1 and 2, and multivariate regressions which jointly measure the influence of all hospital characteristics on each outcome are presented in Columns 3 and 4. Standard errors are in parentheses and are clustered by hospital. $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.2: Expanded Summary Statistics

	(1)	(2)	(3)	(4)	(5)	(6)
	Gamers		Non-Gamers			
	All	In CEM	All	+ Restrict Markets	+ in CEM	+ Reweight
A. Payment Inputs Used for Matching						
Wage Index	1.115	1.099	0.959	0.944	0.944	1.086
Safety Net (DSH) Adjustment	0.129	0.0898	0.0507	0.0397	0.0278	0.0789
Teaching (IME) Adjustment	0.0516	0.0301	0.0276	0.0239	0.00984	0.0275
Medicare Inpatient Share	0.344	0.360	0.414	0.422	0.430	0.361
B. Additional Hospital Characteristics						
Beds	293.5	275.3	212.5	206.1	190.6	226.1
In System	0.727	0.730	0.528	0.524	0.520	0.523
Medicare Inpatient Payments	37.34	34.34	25.14	24.42	21.60	27.62
All-Payer Revenue	126.1	114.9	89.47	86.54	77.76	101.2
Ownership						
Non-Profit	0.648	0.650	0.859	0.864	0.857	0.866
For-Profit	0.352	0.350	0.141	0.136	0.143	0.134
Location						
Rural	0.0345	0.0417	0.311	0.336	0.350	0.106
Urban	0.966	0.958	0.689	0.664	0.650	0.894
C. Risk Scores (Non-Deferrable Patients)						
Mortality	0.138	0.138	0.134	0.134	0.133	0.134
Readmission	0.136	0.135	0.135	0.135	0.135	0.136
D. Risk-Adjusted Outcomes (Non-Deferrable Patients)						
Mortality	0.139	0.140	0.137	0.137	0.137	0.139
Readmission	0.141	0.139	0.136	0.134	0.133	0.137
Hospitals	145	120	1789	1655	1396	1396

Notes: The table extends Table 1 to show descriptive statistics on hospitals overall and those in our analysis sample. Column 1 presents mean values for all turbocharging hospitals flagged as gamers by our algorithm that met sample inclusion criteria. Column 2 limits this group to those that could be matched to a non-gamer hospital with CEM. Column 3 shows means for the set of hospitals flagged as non-gamers. Column 4 removes non-gamers in the same markets as gamers (i.e. within 5 miles of any gamer). Column 5 further restricts to those matched to a gamer with CEM, yielding the set of comparators analyzed in the main text. Column 6 re-weights this group with the same weights used in the main analyses, targeting the treatment on the treated estimand. See Table 1 for additional notes.

Table C.3: Breakdown of Effects on Cost Components for Nonprofits

	(1) DV Mean	(2) 1998–2000	(3) 2001–2003	(4) 1998–2003	(5) Observations
Operating Costs	132.8	2.864	16.04*	9.453+	15699
		(3.881)	(7.166)	(5.288)	
Direct Costs	127.5	3.219	13.77*	8.494+	15813
		(3.726)	(6.843)	(5.079)	
Direct Salaries	57.50	0.724	3.384	2.054	15813
		(1.960)	(3.002)	(2.395)	
Other Direct	70.03	2.567	10.41*	6.487*	15813
		(2.220)	(4.531)	(3.242)	
General Service	42.57	-0.307	4.612+	2.153	15813
		(1.281)	(2.589)	(1.840)	
Hospital Inpatient	2.561	-0.00292	1.182**	0.590+	15813
		(0.220)	(0.458)	(0.321)	
Ancillary Service	15.65	0.486	1.357	0.921	15813
		(0.627)	(1.241)	(0.900)	
Other	9.039	1.107	1.534	1.321	15813
		(0.921)	(1.144)	(1.012)	

Notes: The table presents the coefficients estimated using Equation 2 for nonprofits. Each row presents coefficients from a separate regression on a different dependent variable, typically estimated on a slightly different sample. Column 1 presents the sample mean value of the dependent variable in 1997. Columns 2 and 3 present the coefficients pertaining to the 1998–2000 and 2001–03 periods, respectively. Column 4 presents the average coefficient across 1998–2003. Column 5 presents the number of observations used for each regression. All dollar values are expressed in millions of real year 2000 dollars. Operating costs repeated from Table 4. Direct costs are a slightly narrower measure of expenditures and are divided into direct salaries and other direct costs (measurement of direct salaries differs slightly from total salaries reported in Table 4). Other direct costs are divided into general service costs, hospital inpatient routine service costs, ancillary service costs, and other costs. Standard errors are in parentheses and are clustered by hospital. + $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.4: Additional Results on Flow of Funds

	(1) DV Mean	(2) 1998–2003	(3) 2004–2006	(4) Observations
Panel A. Income in Increasing Broadness				
Medicare Outlier Payments	1.715	2.875***	-0.224	19699
		(0.257)	(0.177)	
Medicare Inpatient Payments	32.94	3.384***	-0.996	19699
		(0.993)	(1.209)	
ln(Medicare Payments/Patient)	9150.2	0.135***	0.00417	19706
		(0.0133)	(0.0161)	
All-Payer Revenue	111.0	11.22**	9.412	19515
		(4.089)	(7.821)	
Panel B. Outflows in Mutually Exclusive Categories				
Operating Costs	111.9	5.387	9.100	19580
		(3.745)	(7.098)	
Total Salaries	46.85	0.703	1.806	19699
		(1.584)	(2.712)	
ΔNet Worth	5.199	-0.630	-3.923*	17949
		(1.383)	(1.636)	
ΔTotal Assets	4.156	2.654	-2.739	18040
		(1.736)	(2.224)	
ΔFixed Assets	0.707	0.118	-0.720	17943
		(0.769)	(1.030)	
ΔLiabilities (subtracted)	-0.662	2.739*	0.335	18009
		(1.265)	(1.637)	
Net Deductions	1.703	6.580***	2.666	17949
		(1.960)	(1.761)	

Notes: The table presents the coefficients estimated using Equation 2. Each row presents coefficients from a separate regression on a different dependent variable, typically estimated on a slightly different sample. Column 1 presents the sample mean value of the dependent variable in 1997. Column 2 presents the coefficients pertaining to the 1998–2003 period when hospitals used turbocharging. Column 3 presents the coefficients pertaining to 2004–06 after turbocharging ended. Column 5 presents the number of observations used for each regression. All dollar values are expressed in millions of real year 2000 dollars. Effects on Medicare payments per patient estimated using Poisson regression and these coefficients have a log-point interpretation. All-payer revenue includes both inpatient and outpatient components. Change in net worth is equal to the change in assets minus the change in liabilities. Net deductions refers to the funds transferred off the hospital's balance sheet, typically to its corporate parent. Standard errors are in parentheses and are clustered by hospital. $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table C.5: Additional Results on Care Inputs and Quality

	(1) DV Mean	(2) 1998–2003	(3) 2004–2006	(4) Observations
Panel A. Care Inputs				
ln(Total Inpatient Volume)	10812.4	-0.00895	-0.0185	19519
		(0.0218)	(0.0297)	
ln(Hospital FTE)	1076.8	-0.0436^{+}	-0.0719^{+}	19505
		(0.0262)	(0.0391)	
Panel B. Patient Risk (Non-Deferrable Conditions)				
Mortality	0.134	-0.00125	0.000200	19064
		(0.00113)	(0.00161)	
Readmission	0.135	0.000607*	0.00134**	19064
		(0.000274)	(0.000476)	
Mortality or Readmission	0.258	-0.000664	0.00142	19064
		(0.00115)	(0.00170)	
Panel C. Patient Outcomes (Non-Deferrable Conditions)				
Mortality	0.139	-0.00196	-0.00166	19064
		(0.00182)	(0.00230)	
Readmission	0.134	0.00335^{+}	0.00238	19064
		(0.00183)	(0.00211)	
Mortality or Readmission	0.264	0.00162	0.00113	19064
		(0.00237)	(0.00287)	

Notes: The table presents the coefficients estimated using Equation 2. Each row presents coefficients from a separate regression on a different dependent variable, typically estimated on a slightly different sample. Column 1 presents the sample mean value of the dependent variable in 1997. Column 2 presents the coefficients pertaining to the 1998–2003 period when hospitals used turbocharging. Column 3 presents the coefficients pertaining to 2004–06 after turbocharging ended.Column 5 presents the number of observations used for each regression. Health outcomes are estimated using the two-step approach described in Section 6.2.2. All health outcomes are computed for patients admitted with non-deferrable conditions, following the algorithm used in Card, Dobkin and Maestas (2009). Mortality and readmissions are measured at 30 days following discharge from the index admission. We generate predicted risk values using one-year history of co-morbidities associated with the patient, but not diagnoses recorded on the index stay itself. Standard errors are in parentheses and are clustered by hospital. $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$