Appendix To:
Turbocharging Profits? Contract Gaming and Revenue Allocation in Healthcare

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A Additional Details on Outlier Payments and the Legal Disputes

A.1 History of Outlier Payments

Outlier payments were originally implemented as a part of Medicare's shift from retrospective to prospective payment in 1983. While hospitals had previously been reimbursed for essentially all of their costs by Medicare, the new system would reimburse them for the expected cost of a typical, similar patient, defined as patients in the same Diagnosis-Related Group (DRG). Policymakers sought to use this fixed price payment approach (Laffont and Tirole, 1993) to incentivize hospitals to deliver care efficiently.

Policymakers included outlier payments in prospective payment to reduce the financial risk and cream-skimming incentives of the new payment scheme (Carter and Farley, 1992). There were originally two types of outlier payments: day outliers and cost outliers. The former system paid hospitals per diem rates when their patients had unusually long lengths of stay, while the latter paid hospitals when their patients had unusually high "costs". Originally, most payments (about 85%, according to HCFA 1988b, pp. 19515) were for day outliers, but over time, the system shifted to make the majority (and by FY1998, the entirety) of payments through the cost outlier system. In the main text, unless otherwise noted, we use outlier payments and cost outlier payments synonymously.

The key input to determine a hospital's payment for a patient under the cost outlier system is a measure of the cost of treating the patient. In practice, this measure is calculated by multiplying the charges (i.e., list prices) on a Medicare claim by a ratio of cost-to-charges. This approach can be seen in the formulas of Appendix B including equation B.7.

At first, Medicare multiplied the charges by a single national cost-to-charge ratio. The resulting number was used as the measure of hospital costs and determined the hospital's cost outlier payment. The approach failed to account for differences across hospitals in charge markups. Medicare sought to address this concern by using hospital-specific cost-to-charge ratios. They made the change in late 1989, stating that they believed it was "essential to ensure that outlier payments are made for cases that have extraordinarily high costs, and not merely high charges" (HCFA, 1988a, pp. 38503). Costs would be measured from the hospital's most recent settled cost report, while charges would be measured by summing the billed charges for patients during the same period as the cost report.

Prior to this change, hospitals could have gamed outlier payments by growing their charges, since Medicare did not even account for differences in markups across hospitals. However, cost outlier payments were small at the time, limiting the return on gaming. There had also been other barriers: If a patient qualified for both day and cost outlier payments, the hospital only received the former; and in the early years, hospitals had to follow a burdensome process of requesting cost outlier payments from Medicare contractors (Philipps and Wineberg, 1984; HCFA, 1985, pp. 12755).

After the switch to hospital-specific cost-to-charge ratios, gaming was possible due to the lag in updating the cost-to-charge ratio from the cost reports. This mechanism is described in Section 2.2 and was the primary avenue through which hospitals eventually gamed outlier payments during the episode we study.

Strikingly, Medicare was warned in 1988 about the possibility of gaming at the time of these changes. The agency's rulemaking includes a public comment expressing concern that

hospitals could game this system by manipulating their charges, much as they ultimately did between 1998 and 2003. Policymakers responded with skepticism, noting that cost-to-charge ratios would update (eventually), gaming would implicate payments from other payers, it could be counteracted by raising the outlier payments "deductible", and the return to gaming was low relative to the disruption it would cause:

> *Comment*: Some commenters were concerned that the increased emphasis on cost outliers in the proposed policy would provide an incentive for hospitals to increase their charges and to manipulate their charge structures.
>
> *Response*: Cost outliers are identified by, and the amount of cost outlier payment determined by, comparing the charges for the case, adjusted by a cost- to-charge ratio, to the cost outlier threshold. Since both the cost-to-charge ratio (whether national or hospital-specific) and the threshold are constant for the payment period, the payment received by the hospital can be increased by increasing charges. In addition, hospitals can conceivably change their charge structures, just as is the case at present, to maximize their outlier payments.
>
> Although concern about this type of incentive is appropriate, we believe that there are several factors that will mitigate its effects. First, increases in a hospital's overall charges relative to costs will be reflected in the cost-to-charge ratio assigned to the hospital in the future. This is one of the strong arguments for the use of hospital-specific cost-to-charge ratios. Second, many hospitals are restricted in their ability to arbitrarily increase their charges by the fact that they must deal with other third-party payers, some of whom base their payments on charges. In addition, several states place restrictions on hospital charge increases. Third, a general acceleration in hospital charge increases can be incorporated into the setting of thresholds in future years, which would limit the potential benefit to hospitals.
>
> Fourth, outlier payments comprise a small percentage of total hospital payments under the prospective payment system, diluting the incentive for hospitals to disrupt their operations by drastically and continually manipulating charges.
>
> It must be pointed out that this incentive to manipulate charges is not new; in fact, any measure of cost (including length of stay) that is based on an indicator that is within the control of the provider provides an incentive to manipulate that indicator. As previously stated, we will continue to investigate potential improvements in the measurement of case-level costs. (HCFA, 1988a, pp. 38509)

The 1989 reform also opened a loophole that made it easier to game outlier payments. Because the switch to hospital-specific cost-to-charge ratios meant relying on potentially noisy data, policymakers included a provision to identify and remove seemingly erroneous values. Specifically, if a hospital's log-cost-to-charge ratio was outside 3 standard deviations of the national average, Medicare would instead give the hospital the average cost-to-charge ratio of other urban (if it was urban) or rural (if it was rural) hospitals in its state. This seemingly innocuous provision meant that if a hospital raised its charges enormously, it could lower its cost-to-charge ratio until Medicare thought it was a data error. The hospital would

then have its inflated charges discounted by the markup of the average other hospital in its state, resulting in large outlier payments (see footnote 3).

Together, these changes created the vulnerabilities in the outlier payments program that hospitals would later exploit much as the commenter warned in 1988. As we explain in Section 2.2 of the main text, several additional developments in the ensuing years would touch off years of gaming. Lags in updating the cost-to-charge ratios grew, expanding the scope for gaming. Medicare phased out day outliers and moved their budget to cost outliers, raising the return on gaming. Finally, the Balanced Budget Act of 1997 cut hospital DRG payments, sending hospitals searching for alternative sources of revenue.

A.2 Additional Details on the Legal Disputes

We now provide additional details of the outlier payments controversies and subsequent lawsuits. The news media referred to the gaming of outlier payments as one of the biggest scandals in Medicare's history, with substantial news coverage starting in late 2002 (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 grew their charges to obtain more outlier payments.

The lawsuits frequently cite communications with hospital leadership. 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). When pressed by journalists to understand why these hospitals sought additional outlier payments, the "senior vice president of health economics at the New Jersey Hospital Association acknowledged that some New Jersey hospitals may have tried to find 'some mechanism to effectuate an increase' in their bottom lines" (Jaklevic, 2003). The materials also provide evidence on how hospitals may have learned of the loopholes. A whistleblower lawsuit filed in New Jersey state court alleges that the consulting firms Besler and Company and Shusko Consulting were the architects of the schemes, advising nearly a dozen hospital executives to engage in this behavior (United States District Court District of New Jersey: 3rd Circuit: Newark, 2010).

Much of the news focused on the for-profit hospital chain Tenet, the subject of Leder-Luis (2023)'s study. This was in part due to Tenet's size and the magnitude of its turbocharge: When charging Tenet with civil fraud, the SEC stated that "by fiscal 2002, Tenet's outlier revenue comprised over 40% of its earnings per share" (Securities and Exchange Comission, 2007). As in cases that targeted nonprofit hospitals, legal documents against Tenet presented evidence that leadership knowingly orchestrated this scheme. The chief operating officer, Thomas Mackey, was one of the parties sued. The case against him (Securities and Exchange Comission, 2009) detailed his role and the mechanism by which Tenet gamed outlier payments:

> 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 that this behavior was a top-down administrative strategy to increase revenues. Unsurprisingly, we find that most hospitals within the Tenet system engaged in gaming according to our definition, and we detect it in many of the other hospitals mentioned in the lawsuits. Ultimately, whistleblowers came forward in many of these organizations, which helped to pressure the government to close the loophole and pursue legal cases against the turbocharging hospitals (U.S. Department of Justice, 2006a,b, 2010).

Based on its own algorithm to identify gaming, CMS suggested 123 hospitals engaged in turbocharging, but did not provide a list of these hospitals (United States Senate, 2003). Using our methodology, which addresses several weaknesses in the CMS algorithm (see Section 4.1 of the main text), we tagged 180 hospitals as turbochargers. However, this is a conservative estimate based on restrictive cut-offs and more hospitals likely gamed the outlier payments program during this period.

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B Calculating and Simulating Outlier Payments

This appendix describes the formulas used by CMS to make outlier payments and explains how we calculate payments holding formulas constant. To do so, we make a number of simplifying assumptions, which we detail below.

B.1 Calculating DRG Payments

Because the hospital's "deductible" for outlier payments depends on the hospital's DRG payments, we begin by calculating the DRG payments. The payments for patient i in DRG d, at hospital h, in fiscal year t can be given by the following formula:

$$DRGPAY_i = WEIGHT_{d,t} \times BASE_{u(h),t} \times \left(\theta_t^L WAGE_{h,t} + \theta_t^{NL} COLA_{h,t}\right), \tag{B.1}$$

where $WEIGHT$ is the weight of the DRG, a measure of expected resource utilization that is updated annually; $BASE$ is the national base payment rate for the hospital's area urbanicity $u(h)$ (large urban area, other urban area, or rural) in that year; θ^L and θ^{NL} are the labor and non-labor shares, respectively; $WAGE$ is the hospital's area wage index; and $COLA$ is the area cost-of-living adjustment (which increases non-labor payments in Alaska and Hawaii).

We collected $WEIGHT$ from annual DRG weight files posted online by the NBER (National Bureau of Economic Research, 2025). $BASE$ and θ came from the PC PRICER COBOL code available from CMS (CMS, 2021). $WAGE$ and $COLA$ came from annual CMS Impact files.

In practice, this formula matches Medicare's actual formula for operating DRG payments for the years in question. It does not include capital payments; operating payments make up the bulk of total payments during the gaming period. The formula here also omits some add-on payments and adjustments. For instance, the formula does not include adjustments for teaching or safety net hospitals. It also omits a change to the θ that puts more weight on non-labor costs for low wage index hospitals starting in FY2005, after the main gaming period had ended.

B.2 Calculating Outlier Payments

Formula-Constant Payment Threshold

We next turn to calculating outlier payments. As with the DRG payment calculation, we focus again on operating payments and not capital payments, though the two use similar formulas. The first key calculation is determining the cost threshold beyond which hospitals will receive these payments. The threshold is hospital-specific and calculated as follows:

$$THRESH_{h,t} = \overline{THRESH}_t \times \left(\theta_t^L WAGE_{h,t} + \theta_t^{NL} COLA_{h,t}\right) \times OPSH_{h,t}, \tag{B.2}$$

where $\overline{THRESH}$ is a national threshold published by Medicare each fiscal year and the term in parentheses adjusts it for the hospital's area wage index and area cost-of-living. The final term is the hospital's share of charges devoted to operating costs and is defined as:

$$OPSH_{h,t} = \frac{CCR_{h,t}^{OP}}{CCR_{h,t}^{OP} + CCR_{h,t}^{CAP}}, \tag{B.3}$$

where $CCR^{OP}_{h,t}$ is the hospital's operating cost-to-charge ratio and $CCR^{CAP}_{h,t}$ is its capital cost-to-charge ratio. We observe $\overline{THRESH}$ in PC PRICER COBOL code and obtain CCR from the CMS Provider-Specific File, when available, and otherwise from CMS Impact files.

In practice, the national threshold was endogenous to gaming. Because Medicare did not understand that rising outlier payments came from excess charge growth, it responded by dramatically raising the threshold. In 1997, the threshold was \$9,700, but by 2003, it had grown to \$33,560.

We therefore must calculate a threshold that does not grow with gaming. To do so, we assume that absent gaming, the threshold would have been a fixed ratio of the national base payment rate $BASE$. Specifically, we estimate the following ratio for each month m during the fiscal years 2004-2008, after the loopholes were closed and outlier payment stabilized:

$$R_m = \frac{\overline{THRESH}_t}{\overline{BASE}_t},\ \overline{BASE}_t = \sum_u s_u \cdot BASE_{u,t}, \tag{B.4}$$

where s_u is the share of inpatient prospective payment system (IPPS) hospitals in urbanicity u in 1997 according to the CMS Impact file. The denominator $\overline{BASE}$ is the weighted average base payment rate across IPPS hospitals in that year. Let $\bar{R}$ be the average of the R_m, which we estimate to be 9.31.

We now define the formula-constant national threshold in each year as:

$$\overline{THRESH}^{FC}_t = \bar{R} \times \overline{BASE}_t. \tag{B.5}$$

And the formula-constant hospital-specific threshold is:

$$THRESH^{FC}_{h,t} = \overline{THRESH}^{FC}_t \times \left(\theta^L_t WAGE_{h,t} + \theta^{NL}_t COLA_{h,t}\right) \times OPSH_{h,t}. \tag{B.6}$$

Calculating Payments

With the DRG payment and outlier thresholds now known, we can calculate the outlier payment owed to the hospital for a given patient. The patient's "bill cost" is defined as their charges scaled by the cost-to-charge ratio:

$$BILLCOST_i = CHARGES_i \times CCR^{OP}_{h,t}. \tag{B.7}$$

It is immediately apparent from this formula that when hospitals grow their charges but the cost-to-charge ratio is not updated, the "bill cost" term will rise.

Now, we can calculate outlier payments. The "deductible" that hospitals must hit before Medicare begins making payments equals the threshold plus the DRG payment. Beyond this point, Medicare pays 80% at the margin. The general formula for these payments is:

$$OUTLIER_i = 0.8 \times \max\left(BILLCOST_i - THRESH_{h,t} - DRGPAY_i, 0\right). \tag{B.8}$$

Formula-constant outlier payments are thus equal to:

$$OUTLIER^{FC}_i = 0.8 \times \max\left(BILLCOST_i - THRESH^{FC}_{h,t} - DRGPAY_i, 0\right). \tag{B.9}$$

Other Formula Changes

The aforementioned formulas closely reflect the actual formulas used to calculate outlier payments during the gaming period. By design, they ignore certain formula changes that occurred during the full analysis period. For completeness, we now mention several of the key differences:

1. Before FY1995, the outlier payment threshold given by equation B.2 was calculated differently. It was the greater of two times the patient's DRG payment or an adjusted national threshold. At this time, only $THRESH$ (not $DRGPAY$) was subtracted from $BILLCOST$ to determine the outlier payment in equation B.9.

2. We hold fixed the marginal cost factor, written as 0.8 in equation B.9. Before FY1995, the marginal cost factor was 0.75. It changed to 0.8 in FY1995. In all years, Medicare used a higher marginal cost factor for burn DRGs of 0.9, which we ignore.

3. We ignore teaching and safety net adjustments, mimicking our approach for calculating DRG payments. In turn, we ignore a change in these adjustments. Before FY1998, charges were scaled down by these adjustments in equation B.7, but the outlier payments given by equation B.9 were scaled up by the adjustments. In FY1998, both of these scalings were dropped.

4. We ignore day outliers. This alternative outlier payment mechanism compensated hospitals for patients with long lengths of stay. When a patient would have emitted both day outlier payments and the outlier payments described here (called cost outliers), the hospital was paid the greater of the two amounts. Day outliers were phased out over time and eliminated in FY1998, with the funds set aside for them reallocated to cost outliers.

B.3 Holding Patients Constant

Our main approach to identifying gamers and non-gamers uses a constant sample of patients at the hospital and a constant set of outlier payment formulas (described previously), but allows their charges to grow along the actual path followed by the hospital. We now review how we calculate outlier payments under this approach.

We begin by assembling the set of patients treated at the hospital in FY1995-1996. Let t_0 be the fiscal year in which the patient was discharged and t be the target fiscal year for which we aim to simulate payments. We simulate the patient's DRG payment using the patient's actual DRG weight and the other parameters from the target year:

$$DRGPAY_i^{PC,t} = WEIGHT_{d,t_0} \times BASE_{u(h),t} \times \left(\theta_t^L WAGE_{h,t} + \theta_t^{NL} COLA_{h,t}\right). \quad \text{(B.10)}$$

To determine the "cost" of the patient as perceived to Medicare, we must scale their charges. To do so, define $\overline{CHARGES}_{h,t}$ as the average charge for patients at hospital h in fiscal year t. Then we can write:

$$BILLCOST_i^{PC,t} = CHARGES_i \times \frac{\overline{CHARGES}_{h,t}}{\overline{CHARGES}_{h,t_0}} \times CCR_{h,t}^{OP}. \quad \text{(B.11)}$$

Finally, we use these objects to calculate formula-constant outlier payments for the patient:

$$OUTLIER_i^{PC,t} = 0.8 \times \max\left(BILLCOST_i^{PC,t} - THRESH_{h,t}^{FC} - DRGPAY_i^{PC,t}, 0\right). \tag{B.12}$$

We now have, for every FY1995-1996 patient, their simulated DRG and outlier payments in each target fiscal year from 1993 through 2008. In practice, we use this data to calculate quarterly average DRG and outlier payments at each hospital holding both patients and formulas constant. To construct this series, we assume each patient is treated in the same quarter in the target year as in their actual treatment year.

References

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C Flow of Funds Calculation

We use cost report data to trace uses of excess revenue. We begin with the definitions. First, we define net worth (sometimes referred to as fund balance, net assets, or owner's equity) as assets minus liabilities:

$$NetWorth_t = Assets_t - Liabilities_t.$$

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.

Next, we define net income as income less operating costs:

$$NetIncome_t = Income_t - OperatingCost_t.$$

In a hospital, income mainly comprises net revenue from patients (i.e., gross revenue less contractual discounts) and investment revenue, while operating costs primarily include spending on staffing and hospital services.

Finally, we define net deductions as deductions less additions to the hospital's net worth (i.e., fund balance):

$$NetDeductions_t = Deductions_t - Additions_t.$$

Unfortunately, we do not observe the descriptions of specific deductions and additions in our data. However, in general, net deductions capture transfers off the balance sheet, often to the parent company, other affiliates, or in the case of for-profit firms, shareholders.

Net income flows to net worth unless it is deducted, leading to the following identity in hospital cost reporting:

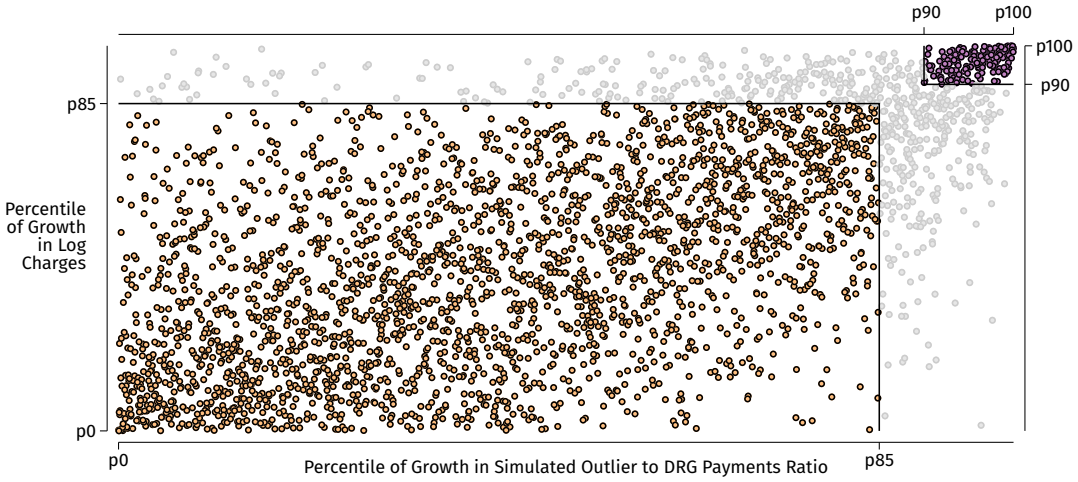
$$\Delta NetWorth_t = NetIncome_t - NetDeductions_t.$$

Finally, we expand $NetIncome$ and rearrange to produce the following identity with the three mutually exclusive and exhaustive outflow categories shown in the manuscript:

$$Income_t = OperatingCost_t + \Delta NetWorth_t + NetDeductions_t.$$

D Supplementary Figures and Tables

(a) Designating gamers (percentile values)



(b) Designating gamers (absolute values)

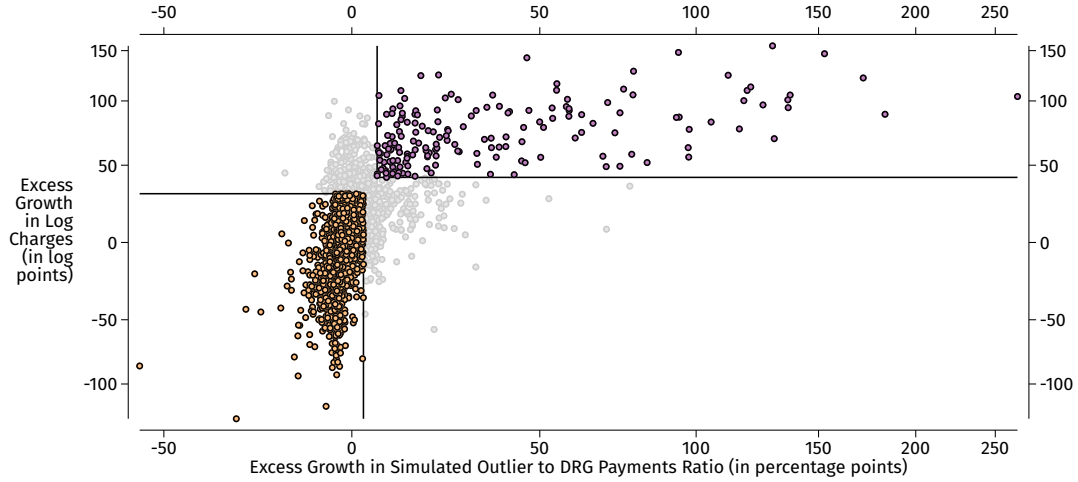
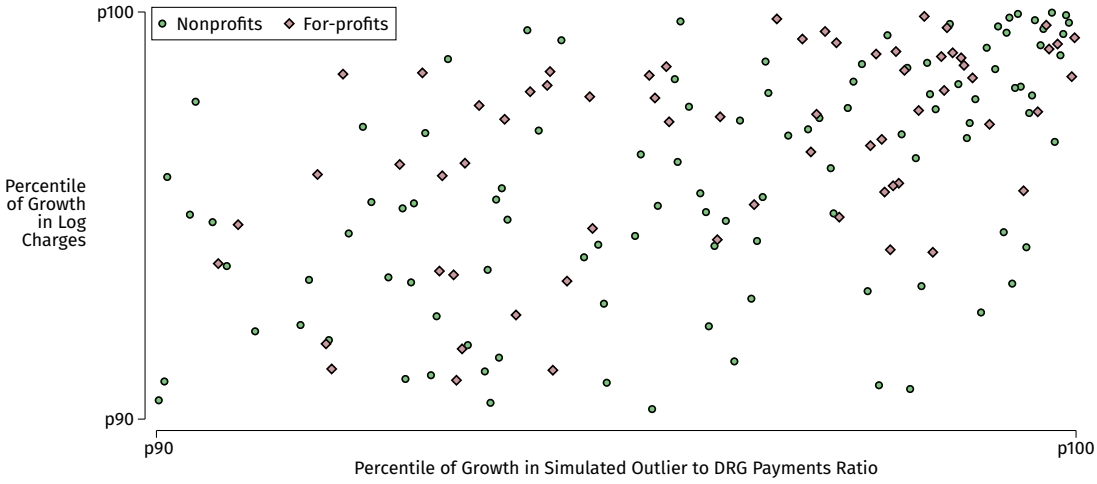


Figure D.1: Designating hospitals as "gamers"

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 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.

(a) Designating gamers, by ownership



(b) Gaming intensity by ownership

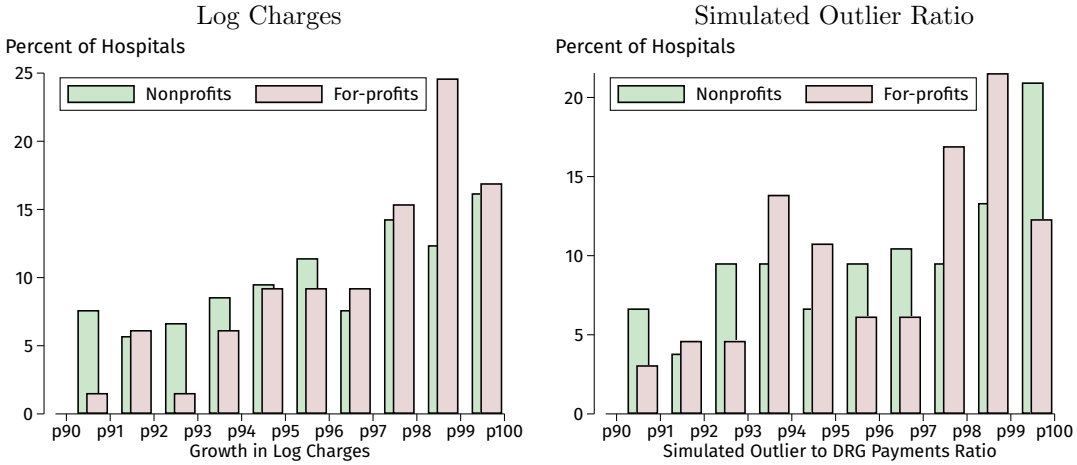


Figure D.2: Hospital ownership and gaming intensity

Notes: These figures illustrate the relationship between hospital ownership and the intensity of gaming. Panel (a) zooms in on the upper right area (p90+ on both axes) of Figure D.1(a). It distinguishes nonprofit and for-profit facilities. The limited number of flagged facilities that are government-owned or of unknown ownership, 10 in total, are suppressed. Panel (b) presents histograms of gaming intensity among the facilities displayed in upper panel. It shows distributions along the two dimensions used to define gaming, as described in the main text.

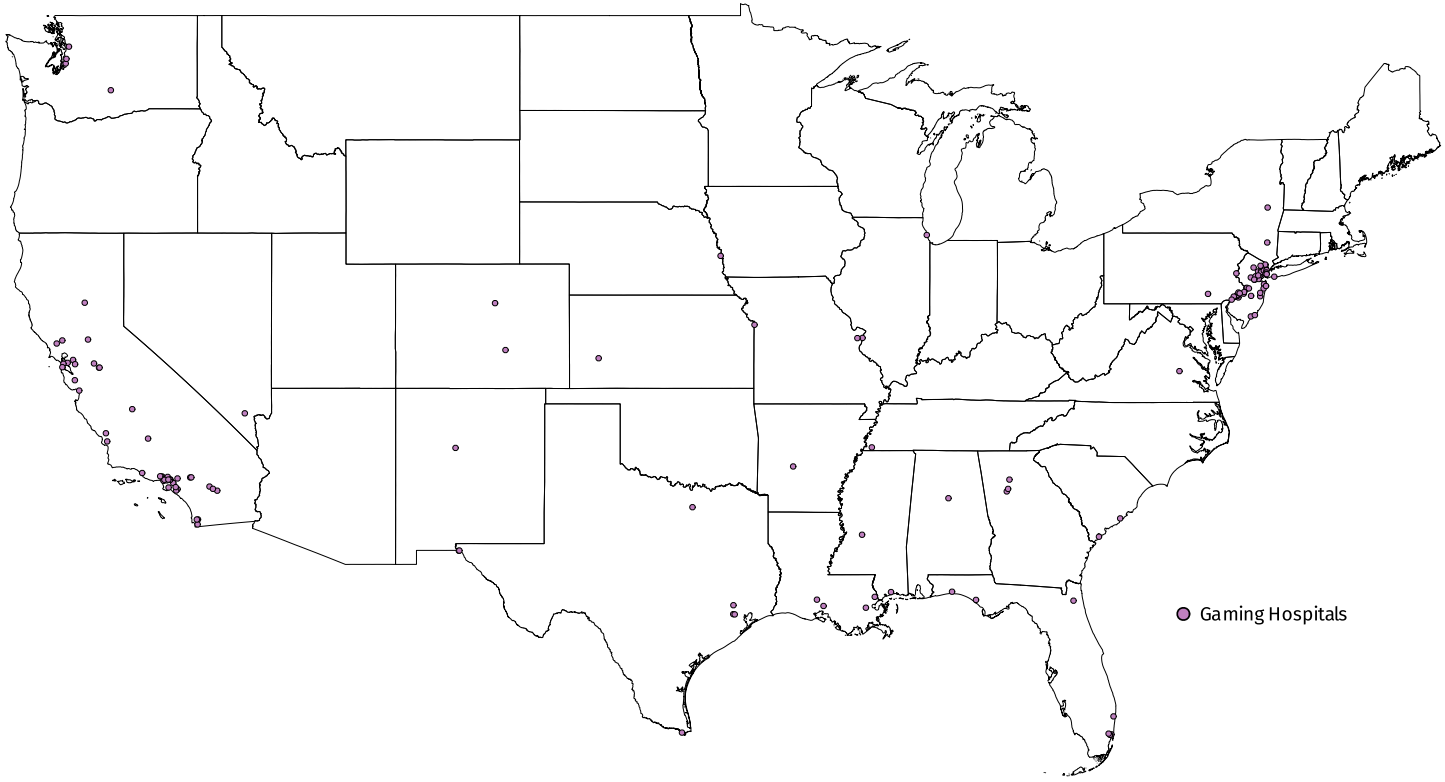


Figure D.3: Map of hospitals flagged as "gamers"

Notes: This figure displays the geographic distribution of the hospitals flagged as gamers of outlier payments and meeting analysis criteria. Hospital latitude and longitude are taken from American Hospital Association (2025) if available and otherwise from the hospital's ZIP code using data from Chandra et al. (2016); GeoNames (2025); SAS (2025). Map drawn from U.S. cartographic boundary files (U.S. Census, 2024).

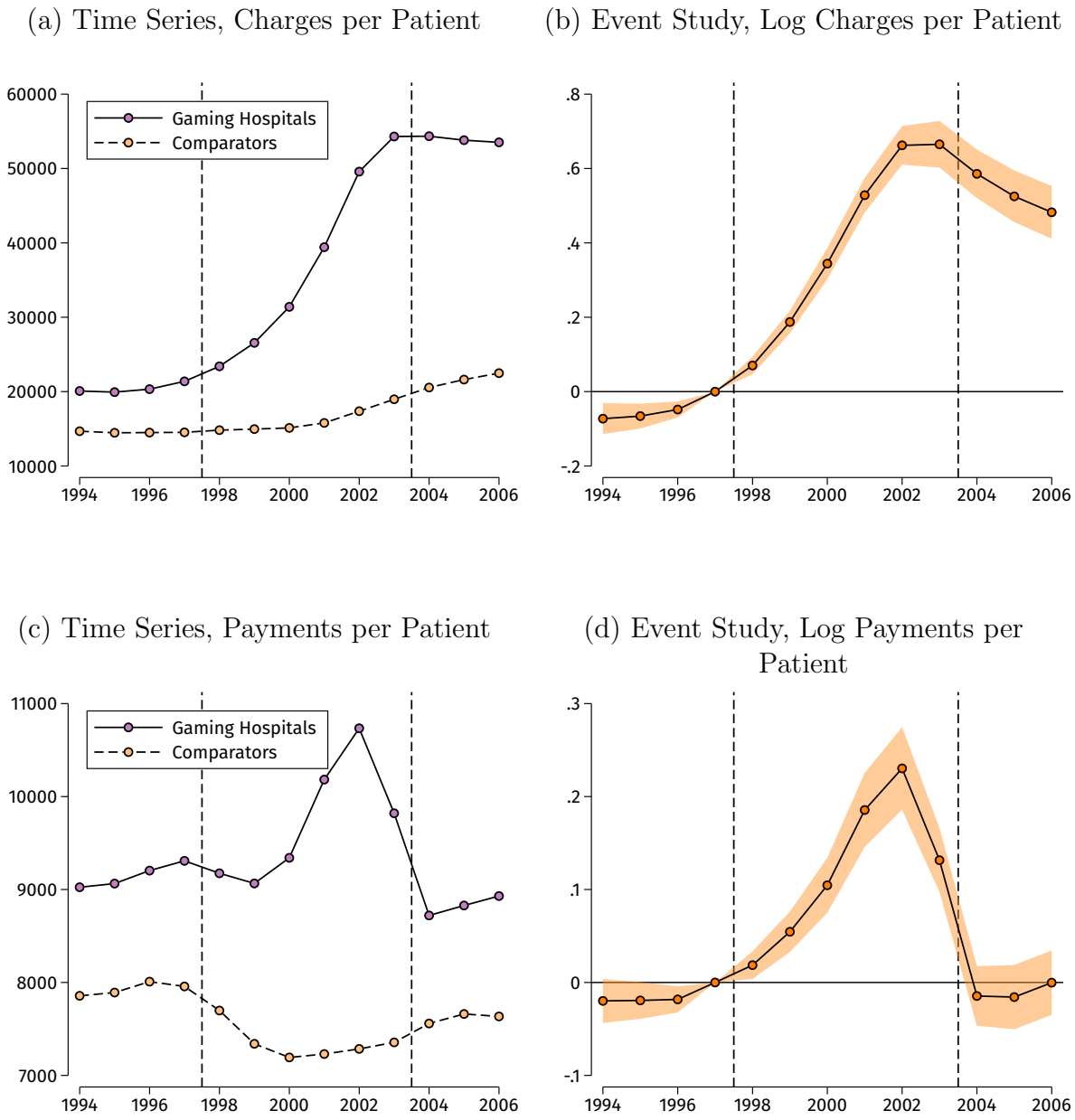


Figure D.4: Time Series and Event Study Plots of Medicare Inpatient Charges and Payments Per Patient

Notes: These figures visualize the evolution of average charges and payments per Medicare inpatient at hospitals in the analysis sample. Panel (a) plots average charges at gamers and non-gamers in the analysis sample, with the non-gamers weighted with the CEM weights used in regressions. Panel (b) shows the event study for average charges estimated with a Poisson model, so that the coefficients have a log-point interpretation. In the equation 2 (DD) analog to the event study, the average effect over the 1998–2003 period is 46.3 log points (s.e. 1.85), and the effect for just the 2001–2003 period is 67.1 log points (s.e. 2.41). Panels (c) and (d) present analogous exhibits for average Medicare inpatient payments. In the DD analog to the event study, the average effect over the 1998–2003 period is 13.5 log points (s.e. 1.33). The effect for just the 2001–2003 period is 19.7 log points (s.e. 1.85).

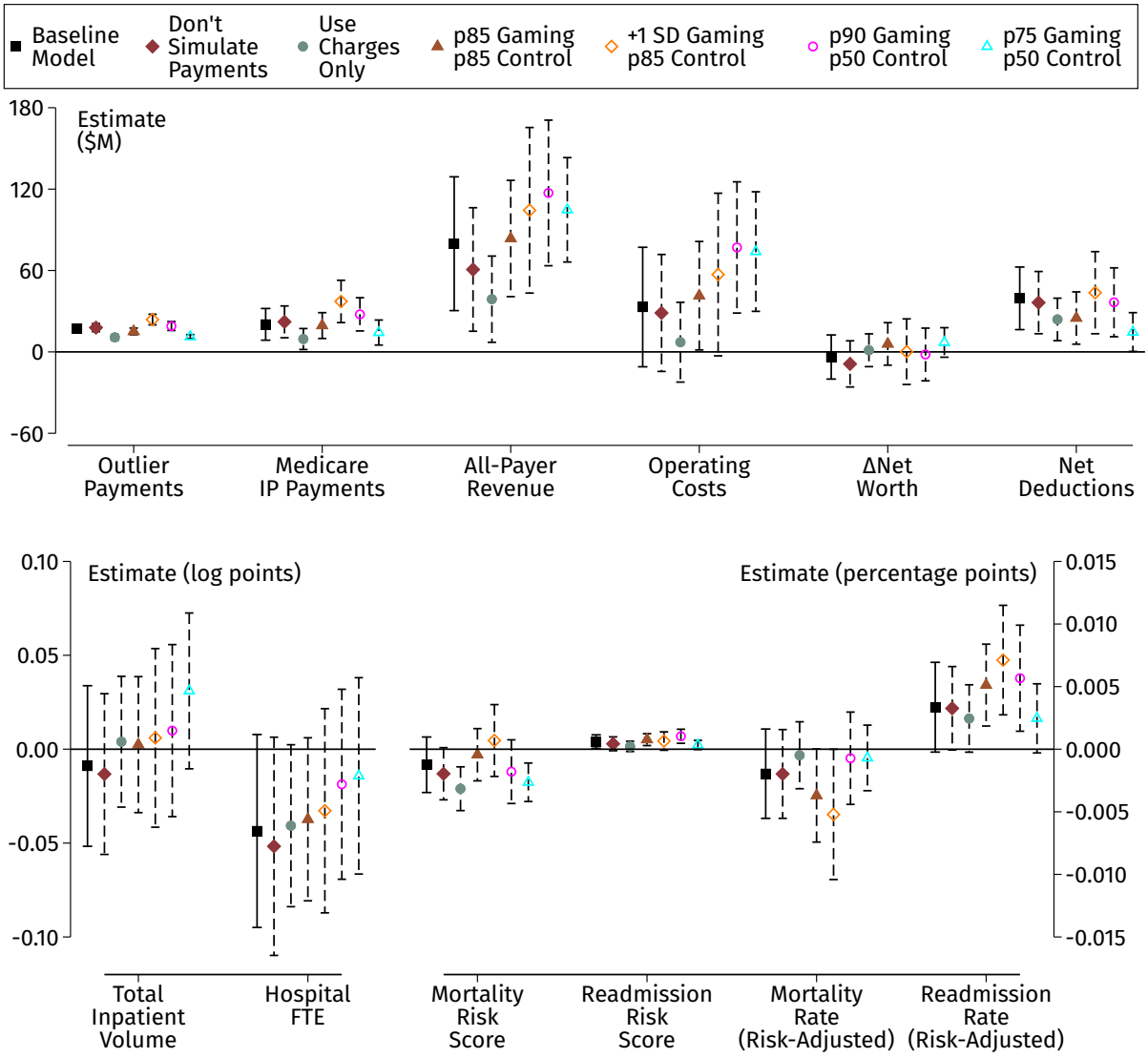


Figure D.5: Robustness checks: Alternate definitions of gaming

Notes: The figure presents estimates obtained from a number of robustness checks against using alternate definitions of gamers for key outcomes presented in Table 2. The dollar-valued estimates in the upper plot are analogous to the estimates from Table 2 column 2 multiplied by 6 to reflect the total flow over 1998–2003. The log point and percentage point estimates in the lower plot are analogous to the Table 2 column 2 estimates without multiplication to reflect the average effect during 1998–2003. See the main text for more details on the robustness models. The error bars depict 95% confidence intervals. Standard errors are clustered by hospital, which is the level of treatment in this analysis.

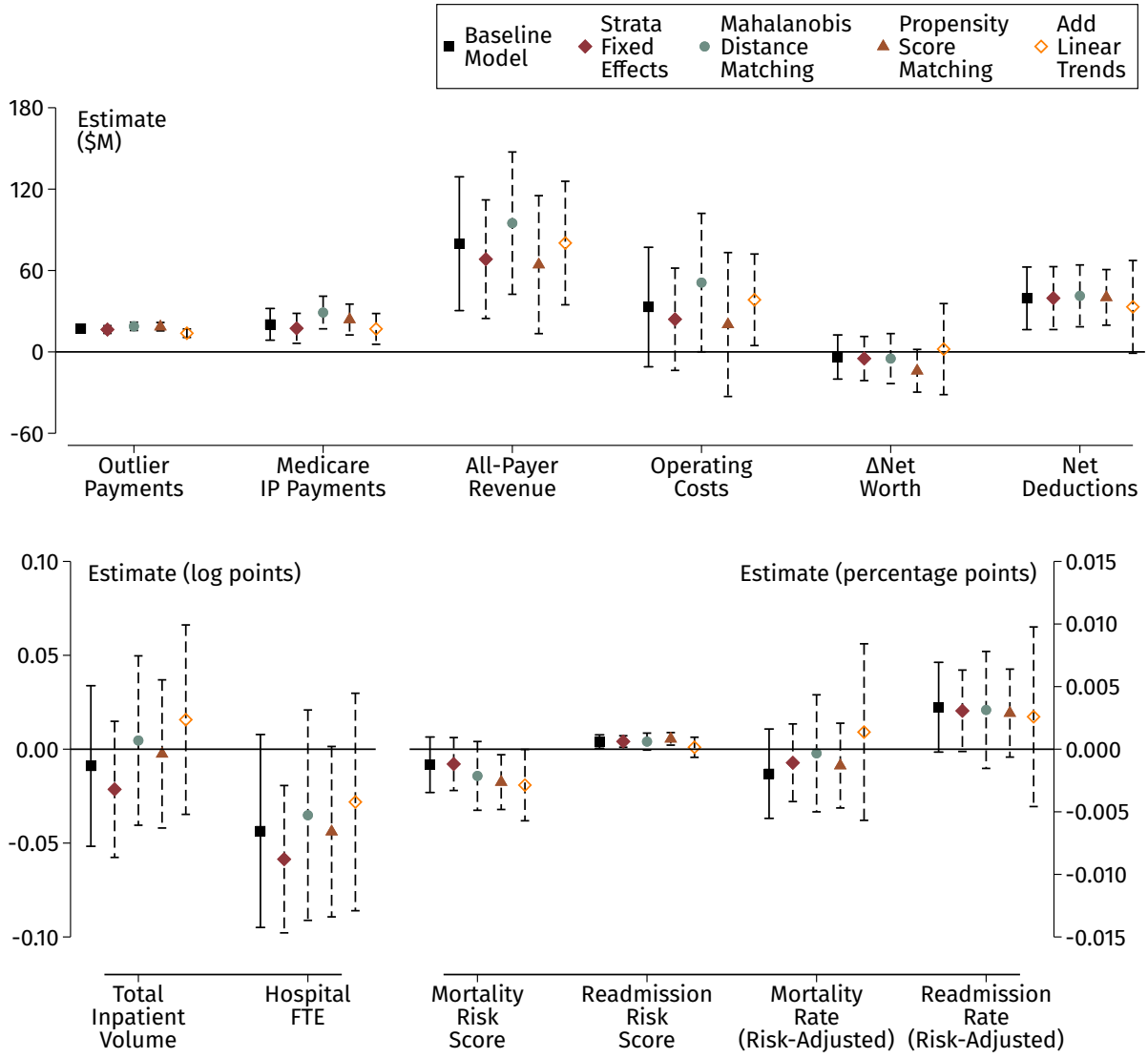


Figure D.6: Robustness checks: Alternate modeling assumptions

Notes: The figure presents estimates obtained from a number of robustness checks against changes to modeling assumptions for key outcomes presented in Table 2. The dollar-valued estimates in the upper plot are analogous to the estimates from Table 2 column 2 multiplied by 6 to reflect the total flow over 1998–2003. The log point and percentage point estimates in the lower plot are analogous to the Table 2 column 2 estimates without multiplication to reflect the average effect during 1998–2003. See the main text for more details on the robustness models. The error bars depict 95% confidence intervals. Standard errors are clustered by hospital, which is the level of treatment in this analysis.

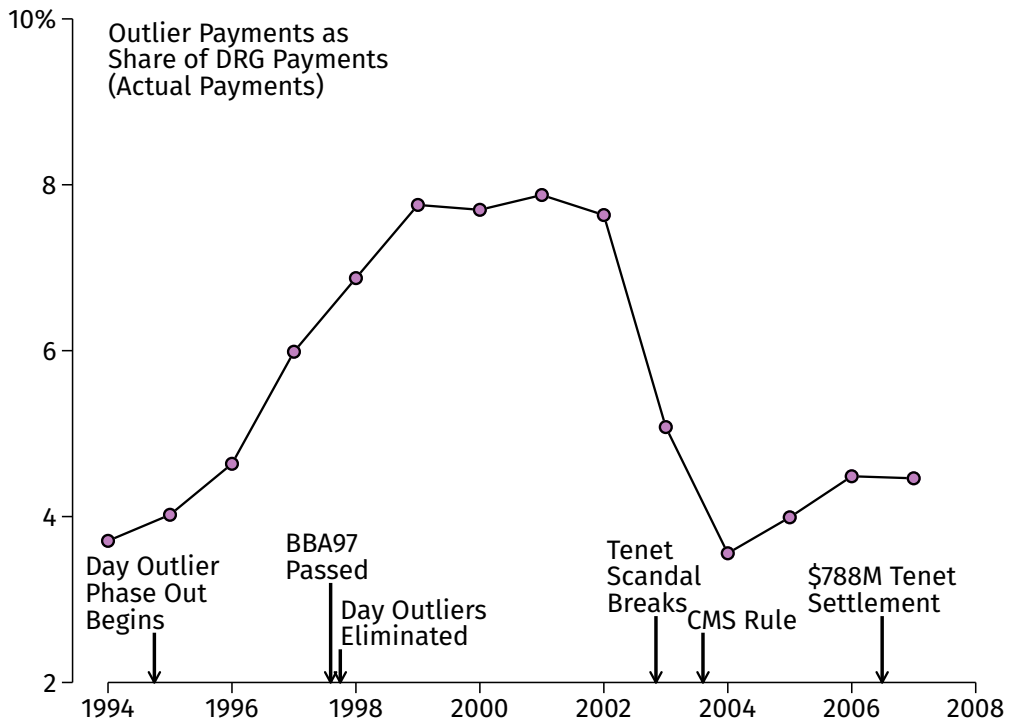


Figure D.7: Trend in Medicare outlier payments, actual payments

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 Tenet 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, day outlier payments were phased out in the mid 1990s, obscuring when gaming began in this version. 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. See Appendix B for more details on the outlier payment formulas and calculations.

Table D.1: Characteristics of Gamers

	(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: Nonprofit)				
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)
Hospitals	3,087	3,087	2,852	2,852

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 90^{th} 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 4.1. 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. For the bivariate regressions, the bottom row reports the number of distinct hospitals in the regressions in the column; the number of hospitals in any individual regression may be lower. DSH: disproportionate share, IME: indirect medical education. $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.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	89.53	86.61	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	1,789	1,655	1,396	1,396

Notes: The table extends Table 1 to show descriptive statistics on hospitals before matching and those in our final analysis sample. Column 1 presents the mean values for all turbocharging hospitals flagged as gamers by our algorithm that met the sample inclusion criteria. Column 2 limits this group to those that could be matched to a non-gamer hospital using coarsened exact matching (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. DSH: disproportionate share, IME: indirect medical education. See Table 1 for additional notes.

Table D.3: Summary Statistics by Hospital Ownership

	(1)	(2)	(3)	(4)	(5)	(6)
	Gamers in CEM			Non-Gamers in CEM, Unweighted		
	All	Non-Profits	For-Profits	All	Non-Profits	For-Profits
A. Payment Inputs Used for Matching						
Wage Index	1.099	1.124	1.053	0.944	0.949	0.913
Safety Net (DSH) Adjustment	0.0898	0.0810	0.106	0.0278	0.0271	0.0324
Teaching (IME) Adjustment	0.0301	0.0438	0.00483	0.00984	0.0107	0.00481
Medicare Inpatient Share	0.360	0.353	0.373	0.430	0.428	0.440
B. Additional Hospital Characteristics						
Beds	275.3	306.6	217.2	190.6	199.5	136.9
In System	0.730	0.595	0.976	0.520	0.461	0.874
Medicare Inpatient Payments	34.34	39.78	24.24	21.60	22.92	13.69
All-Payer Revenue	114.9	131.8	83.83	77.76	81.69	54.02
Ownership						
Non-Profit	0.650	1	0	0.857	1	0
For-Profit	0.350	0	1	0.143	0	1
Location						
Rural	0.0417	0.0256	0.0714	0.350	0.343	0.390
Urban	0.958	0.974	0.929	0.650	0.657	0.610
C. Risk Scores (Non-Deferrable Patients)						
Mortality	0.138	0.137	0.139	0.133	0.132	0.142
Readmission	0.135	0.135	0.137	0.135	0.134	0.136
D. Risk-Adjusted Outcomes (Non-Deferrable Patients)						
Mortality	0.140	0.141	0.139	0.137	0.137	0.136
Readmission	0.139	0.140	0.136	0.133	0.131	0.143
Hospitals	120	78	42	1,396	1,196	200

Notes: The table shows the characteristics of gamers and non-gamers in our main regression analyses by hospital ownership. Column 1 presents the mean values for gamers that entered our main regressions, replicating Column 1 of Table 1. Columns 2 and 3 show, respectively, the nonprofits and for-profits within this group. Column 4 shows means for non-gamers that entered our main regressions, albeit without CEM weights, replicating column 5 of Appendix Table D.2. Columns 5 and 6, respectively, show the nonprofits and for-profits in this group. DSH: disproportionate share, IME: indirect medical education. See Table 1 for additional notes.

Table D.4: Complete Regression Results for Full Sample

	(1) DV Mean	(2) 1998–2000	(3) 2001–2003	(4) 2004–2006	(5) Observations
ln(Medicare Charges/Patient)	20,430.4	0.254***	0.671***	0.577***	19,706
		(0.0198)	(0.0241)	(0.0322)	
Panel A. Income in Increasing Broadness					
Medicare Outlier Payments	1.715	1.331***	4.419***	-0.224	19,699
		(0.235)	(0.347)	(0.177)	
Medicare Inpatient Payments	32.94	1.537+	5.232***	-0.996	19,699
		(0.855)	(1.249)	(1.209)	
ln(Medicare Payments/Patient)	9,150.2	0.0732***	0.197***	0.00417	19,706
		(0.0114)	(0.0185)	(0.0161)	
All-Payer Revenue	111.0	4.794	21.79***	9.442	19531
		(3.142)	(5.781)	(7.841)	
Panel B. Outflows in Mutually Exclusive Categories					
Operating Costs	111.9	0.0624	10.96*	9.244	19586
		(2.754)	(5.054)	(7.097)	
Salaries	46.92	-0.153	1.583	1.904	19,699
		(1.317)	(2.047)	(2.783)	
ΔNet Worth	5.199	-3.317+	2.058	-3.923*	17,949
		(1.768)	(1.450)	(1.636)	
ΔTotal Assets	4.156	0.979	4.329*	-2.739	18,040
		(1.979)	(2.130)	(2.224)	
ΔFixed Assets	0.707	-0.173	0.410	-0.720	17,943
		(0.884)	(0.891)	(1.030)	
ΔLiabilities (subtracted)	-0.662	3.489*	1.989	0.335	18,009
		(1.694)	(1.534)	(1.637)	
Net Deductions	1.703	6.112**	7.048**	2.666	17,949
		(2.187)	(2.258)	(1.761)	
Panel C. Care Inputs					
ln(Total Inpatient Volume)	10812.4	-0.0160	-0.00192	-0.0185	19,519
		(0.0209)	(0.0256)	(0.0297)	
ln(Hospital FTE)	1076.8	-0.0526*	-0.0345	-0.0719+	19,505
		(0.0243)	(0.0312)	(0.0391)	
Panel D. Patient Risk (Non-Deferrable Conditions)					
Mortality	0.134	-0.000917	-0.00157	0.000200	19,064
		(0.00109)	(0.00139)	(0.00161)	
Readmission	0.135	0.000274	0.000941**	0.00134**	19,064
		(0.000259)	(0.000345)	(0.000476)	
Panel E. Patient Outcomes (Non-Deferrable Conditions)					
Mortality	0.139	-0.00208	-0.00183	-0.00166	19,064
		(0.00193)	(0.00219)	(0.00230)	
Readmission	0.134	0.00463*	0.00208	0.00238	19,064
		(0.00198)	(0.00213)	(0.00211)	

Notes: This table presents our complete regression results for the full sample. Each row presents effects on a different dependent variable estimated using Equation 2. Column 1 shows the mean of the dependent variables for gamers in the sample during 1994-1997. Columns 2-4 present, sequentially, the regression coefficients for the early (1998–2000) and late (2001–2003) gaming periods followed by the coefficient for the post-gaming period (2004–2006). Column 5 displays the number of observations in the regression. Effects on Medicare charges per patient and payments per patient are estimated using Poisson regression; these coefficients have a log-point interpretation. Standard errors are in parentheses and are clustered by hospital. $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.5: Complete Regression Results for Effects for Nonprofit Gamers

	(1) DV Mean	(2) 1998–2000	(3) 2001–2003	(4) 2004–2006	(5) Observations
ln(Medicare Charges/Patient)	19,237.3	0.208***	0.672***	0.635***	15,819
		(0.0275)	(0.0310)	(0.0403)	
Panel A. Income in Increasing Broadness					
Medicare Outlier Payments	1.908	1.225***	4.580***	-0.259	15,813
		(0.303)	(0.431)	(0.241)	
Medicare Inpatient Payments	38.61	1.409	4.987**	-0.387	15,813
		(1.192)	(1.554)	(1.612)	
ln(Medicare Payments/Patient)	9,091.7	0.0790***	0.202***	0.0381*	15,819
		(0.0143)	(0.0200)	(0.0192)	
All-Payer Revenue	127.6	4.456	25.48**	20.41+	15,670
		(4.168)	(8.050)	(11.13)	
Panel B. Outflows in Mutually Exclusive Categories					
Operating Costs	132.8	2.998	16.19*	18.21+	15,705
		(3.879)	(7.165)	(10.14)	
Salaries	57.50	0.724	3.384	5.863	15,813
		(1.960)	(3.002)	(4.031)	
ΔNet Worth	4.682	-1.665	4.509*	-1.706	14,407
		(2.036)	(1.834)	(1.908)	
ΔTotal Assets	4.444	2.579	7.622**	0.931	14,465
		(2.691)	(2.886)	(3.144)	
ΔFixed Assets	0.781	0.192	0.966	0.717	14,389
		(1.162)	(1.184)	(1.374)	
ΔLiabilities (subtracted)	-0.300	3.716+	3.332	1.551	14,436
		(2.205)	(2.089)	(2.246)	
Net Deductions	0.540	2.392	3.718	3.362	14,407
		(2.252)	(2.399)	(2.172)	
Panel C. Care Inputs					
ln(Total Inpatient Volume)	12,576.0	-0.0285	-0.0204	-0.0310	15,679
		(0.0241)	(0.0300)	(0.0346)	
ln(Hospital FTE)	1,306.4	-0.0321	-0.0123	-0.0321	15,667
		(0.0288)	(0.0367)	(0.0468)	
Panel D. Patient Risk (Non-Deferrable Conditions)					
Mortality	0.132	0.00258*	0.00330*	0.00350+	15,344
		(0.00118)	(0.00143)	(0.00184)	
Readmission	0.134	0.000664*	0.00140***	0.00200***	15,344
		(0.000310)	(0.000408)	(0.000551)	
Panel E. Patient Outcomes (Non-Deferrable Conditions)					
Mortality	0.137	-0.00492*	-0.00339	-0.00217	15,344
		(0.00200)	(0.00252)	(0.00245)	
Readmission	0.133	0.00656**	0.00480+	0.00629*	15,344
		(0.00243)	(0.00269)	(0.00245)	

Notes: This table presents our complete regression results for the analysis of effects for nonprofit gamers. Each row presents effects on a different dependent variable estimated using Equation 2. Column 1 shows the mean of the dependent variables for gamers in the sample during 1994-1997. Columns 2-4 present, sequentially, the regression coefficients for the early (1998–2000) and late (2001–2003) gaming periods followed by the coefficient for the post-gaming period (2004–2006). Column 5 displays the number of observations in the regression. Effects on Medicare charges per patient and payments per patient are estimated using Poisson regression; these coefficients have a log-point interpretation. Standard errors are in parentheses and are clustered by hospital. $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.6: Complete Regression Results for Effects for For-Profit Gamers

	(1) DV Mean	(2) 1998–2000	(3) 2001–2003	(4) 2004–2006	(5) Observations
ln(Medicare Charges/Patient)	22,646.2	0.325***	0.667***	0.474***	17,601
		(0.0228)	(0.0350)	(0.0389)	
Panel A. Income in Increasing Broadness					
Medicare Outlier Payments	1.355	1.536***	4.128***	-0.148	17,593
		(0.363)	(0.581)	(0.223)	
Medicare Inpatient Payments	22.42	1.725+	5.642**	-2.165	17,593
		(0.940)	(2.011)	(1.512)	
ln(Medicare Payments/Patient)	9,259.0	0.0631***	0.190***	-0.0606**	17,601
		(0.0181)	(0.0372)	(0.0225)	
All-Payer Revenue	80.51	5.165	14.70*	-11.09+	17,431
		(4.267)	(6.236)	(6.021)	
Panel B. Outflows in Mutually Exclusive Categories					
Operating Costs	73.21	-5.578*	1.071	-7.562	17,480
		(2.577)	(4.197)	(4.985)	
Salaries	27.29	-1.943*	-1.995	-5.694**	17,593
		(0.884)	(1.404)	(1.827)	
ΔNet Worth	6.139	-6.483*	-2.551	-8.022**	16,028
		(3.221)	(2.173)	(2.857)	
ΔTotal Assets	3.628	-1.944	-1.716	-9.466***	16,106
		(2.485)	(2.628)	(2.053)	
ΔFixed Assets	0.568	-0.907	-0.698	-3.497**	16,020
		(1.199)	(1.191)	(1.302)	
ΔLiabilities (subtracted)	-1.337	3.251	-0.285	-1.722	16,078
		(2.376)	(1.881)	(1.913)	
Net Deductions	3.818	12.94**	13.21**	1.462	16,028
		(4.375)	(4.440)	(2.909)	
Panel C. Care Inputs					
ln(Total Inpatient Volume)	7,432.2	0.0262	0.0561	0.0255	17,435
		(0.0381)	(0.0428)	(0.0508)	
ln(Hospital FTE)	633.8	-0.119**	-0.103*	-0.199***	17,420
		(0.0388)	(0.0498)	(0.0510)	
Panel D. Patient Risk (Non-Deferrable Conditions)					
Mortality	0.139	-0.00710***	-0.0101***	-0.00550*	17,037
		(0.00172)	(0.00202)	(0.00249)	
Readmission	0.136	-0.000460	0.0000764	0.000107	17,037
		(0.000427)	(0.000577)	(0.000811)	
Panel E. Patient Outcomes (Non-Deferrable Conditions)					
Mortality	0.141	0.00320	0.00109	-0.000598	17,037
		(0.00367)	(0.00380)	(0.00428)	
Readmission	0.136	0.00112	-0.00276	-0.00461	17,037
		(0.00296)	(0.00301)	(0.00319)	

Notes: This table presents our complete regression results for the analysis of effects for for-profit gamers. Each row presents effects on a different dependent variable estimated using Equation 2. Column 1 shows the mean of the dependent variables for gamers in the sample during 1994-1997. Columns 2-4 present, sequentially, the regression coefficients for the early (1998–2000) and late (2001–2003) gaming periods followed by the coefficient for the post-gaming period (2004–2006). Column 5 displays the number of observations in the regression. Effects on Medicare charges per patient and payments per patient are estimated using Poisson regression; these coefficients have a log-point interpretation. Standard errors are in parentheses and are clustered by hospital. $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.7: Effects on Cost Components for Nonprofits

	(1) DV Mean	(2) 1998–2000	(3) 2001–2003	(4) 1998–2003	(5) Observations
A. Estimates Using Full Sample					
Operating Costs	132.8	2.998	16.19*	9.594+	15,705
		(3.879)	(7.165)	(5.286)	
Direct Costs	127.5	3.219	13.77*	8.494+	15,813
		(3.726)	(6.843)	(5.079)	
Salaries	57.50	0.724	3.384	2.054	15,813
		(1.960)	(3.002)	(2.395)	
Other (Non-Salary)	70.03	2.567	10.41*	6.487*	15,813
		(2.220)	(4.531)	(3.242)	
B. Estimates Using Data Starting in 1997					
Operating Costs	138.7	1.957	15.08*	8.520*	12,083
		(2.605)	(6.267)	(4.214)	
Direct Costs	133.7	0.608	11.10+	5.852	12,170
		(2.364)	(5.816)	(3.890)	
Salaries	59.28	-0.126	2.515	1.195	12,170
		(1.401)	(2.614)	(1.924)	
Other (Non-Salary)	74.44	0.701	8.498*	4.599+	12,170
		(1.555)	(4.000)	(2.644)	
Clinical	32.23	1.088	4.564*	2.826+	12,170
		(0.934)	(2.211)	(1.529)	
Admin	17.34	-0.789	2.088	0.650	12,170
		(1.048)	(1.683)	(1.256)	
Mixed	22.73	-0.460	0.392	-0.0336	12,170
		(0.775)	(1.182)	(0.920)	

Notes: The table presents the coefficients estimated using Equation 2 for nonprofit gamers. Each row presents coefficients from a separate regression on a different dependent variable. Column 1 presents the sample mean value of the dependent variable in 1994–1997. 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. The values for operating costs are repeated from Table 2. Direct costs are a slightly narrower measure of expenditures and are divided into salaries and other (non-salary) costs. Panel A uses all years of data, while Panel B uses data beginning in 1997, when our data reliably covers finely disaggregated expenditure categories. It then uses this data to show a decomposition of costs into clinical, administrative, and mixed clinical/administrative costs. $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table D.8: Outcomes that are less likely to be affected by turbocharging

	(1) DV Mean	(2) During Gaming	(3) DV (NPs)	(4) During (NPs)	(5) DV (FPs)	(6) During (FPs)
Medicare Payments ex. Outliers	31.08	-0.543	36.56	-0.712	20.91	-0.286
		(0.662)		(0.878)		(0.849)
ln(Non-Medicare Inpatient Volume)	7193.7	0.00142	8395.2	-0.0150	4890.9	0.0561
		(0.0266)		(0.0306)		(0.0487)
ln(Hospital Beds)	273.8	-0.0271	307.2	-0.0340	211.8	-0.00964
		(0.0215)		(0.0264)		(0.0310)

Notes: This table presents our main pooled, nonprofit, and for-profit results for a set of plausibly unaffected outcomes where each row presents effects on a dependent variable estimated using Equation 2. The columns sequentially show results for all gamers, nonprofit gamers, and for-profit gamers. The odd columns show the mean of the dependent variables for gamers during 1994–1997. The even columns present the average coefficient for gaming for the 1998–2003 period. Standard errors are in parentheses and are clustered by hospital. $^{+}$ $p < 0.1$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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