NBER WORKING PAPER SERIES

PAINFUL BARGAINING:
EVIDENCE FROM ANESTHESIA ROLLUPS

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Working Paper 33217
http://www.nber.org/papers/w33217

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
November 2024, revised April 2025

We thank Leemore Dafny and Matt Grennan for their thoughtful discussions. We also thank Eric Budish, Dave Balan, John Barrios, Mike Dickstein, David Dranove, Craig Garthwaite, Dan Francis, Matt Grennan, Scott Hemphill, Tom Hubbard, Ambar La Forgia, Matt Notowidigdo, Fiona Scott Morton, Carl Shapiro, and Ashley Swanson as well as seminar participants at Harvard Health Policy, Singapore Management University, Northwestern University, Chicago Booth, NYU Law, University of Michigan, UC Berkeley, NYU Stern, FDIC, the Northwestern Conference on Antitrust Economics and Competition Policy, the BYU Future of Antitrust Conference, and the Chicago Health Economics Workshop for their helpful comments. Wollmann thanks the Fama-Miller Center, Becker Friedman Institute Healthcare Initiative, and William Ladany Research Fund for support. The authors acknowledge the assistance of the Health Care Cost Institute (HCCI) and its data contributors in providing the claims data analyzed in this study. Josh Byrne provided excellent research assistance. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

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NBER Working Paper No. 33217
November 2024, revised April 2025
JEL No. I11,L1

ABSTRACT

A rollup is a series of acquisitions through which a financial sponsor consolidates ownership. Increasingly, this strategy is shaping economically important markets, but historically, it has escaped antitrust enforcement. We study this phenomenon in the anesthesia industry, site of the first rollup-based antitrust case in US history. First, we identify eighteen other rollups of anesthesia practices that are observationally similar to the litigated ones. Next, we show that rollups consolidate ownership and that prices rise sharply as competing practices are acquired. Last, we estimate a structural bargaining model and simulate counterfactual equilibria under remedies that courts are likely to consider.

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1 Introduction

Most economic analysis, whether prospective or retrospective, conceptualizes mergers as one-off transactions that are formulated and financed by operating companies. Pioneering work by Nevo (2000) exemplifies this approach, simulating mergers among popular ready-to-eat cereal brands that are produced by multinational manufacturing conglomerates, such as General Mills and Ralston Purina. Increasingly, however, market structures are being shaped by an investment strategy called the "rollup"—consolidation through a series of acquisitions that are devised and backed by an investment fund. The strategy is easy to characterize. A "financial sponsor" makes an initial acquisition, which is called the "platform," and then acquires one or more competitors, which are called "add-ons."[1] In the US, transaction values associated with these acquisitions now exceed $1 trillion annually (Asil et al., 2023).

Analysis of rollups is both policy-relevant and economically important. Most generally, since the strategy involves multiple transactions per market and employs vast sums of capital, rollups may have economy-wide consequences for industrial organization and efficiency. More specifically, due to their serial nature, rollups may need to be evaluated not as "individual transactions" but rather a "cumulative process" (DOJ and FTC, 2023). Moreover, since add-on acquisitions are often comparatively small, they are exempt from premerger notification, meaning that most escape antitrust scrutiny in their incipiency (Wollmann, 2024). Additionally, sponsor involvement may impact consumer welfare for reasons unrelated to competition.[2] Such concerns are the subject of newly established *Merger Guidelines*, recent rule changes, proposed legislation, and ongoing litigation (FTC, 2024; Warren, 2024; DOJ, 2025). They are further heightened by the fact that rollups disproportionately target healthcare services, which are already highly concentrated (Capps et al., 2017) and require competition to discipline prices and maintain quality (Dafny, 2009a; Gaynor and Town, 2012; Cooper et al., 2019; Garthwaite et al., 2022).

We study this phenomenon in the anesthesia industry, site of the first rollup-based antitrust case in US history.[3] According to court documents described below, a large financial sponsor, Welsh, Carson, Anderson & Stowe (WCAS), and its portfolio company, US Anesthesia Partners (USAP), consolidated three large Texas markets through a total of 13 acquisitions. Internal communications state that the "goal" was to acquire "practices with high market share in a few key markets" and gain "negotiating leverage with commercial payors." The Federal Trade Commission (FTC) alleges the defendants were successful, stating that prices rose following each add-on acquisition; after one such transaction, the head of WCAS's healthcare group exclaimed, "Cha-ching!"[4] Consistent with the agency not being notified of the deals in

[1] In this paper, a rollup occurs when a sponsor acquires multiple providers in a market. Our definition aligns with Mergers & Acquisitions from A to Z, among the best-selling practitioner guides: "the buyer is a holding company" and the strategy "typically involves aggressive acquisition of competitors in a given market" (Sherman, 2018). However, some use the term more broadly, applying it to acquisitions of firms that produce complementary products or that operate in the same industry but not market.

[2] See a summary by Gompers and Kaplan (2022) and works cited at the end of this section.

[3] One large multinational law firm states, "For the first time, the FTC has focused merger enforcement action on the so-called 'roll up' strategy" (Casas and Pepper, 2023). See Section 2.3 for details and Appendix A.1 for comparisons to prior cases.

[4] See pp. 27 and 2, respectively. We use terms in this paper such as "anticompetitive" and "market allocation" to characterize certain transactions and behavior, not to reflect the findings of the court. Our language represents a subjective interpretation that is informed, in part, by facts presented in *FTC v. USAP*, 4:23-cv-03560, (S.D. Tex.). FTC settled with WCAS,

their incipiency, the FTC's press release that announced the lawsuit borrowed language from Wollmann (2019), calling the transactions a "stealth consolidation scheme."

We combine procedure-level claims data with other information sources to identify 18 rollups that are observationally similar to the 3 litigated ones but involve different markets and sponsors. In total, our main sample comprises 20 platform acquisitions and 50 add-ons. We then measure changes in market structure, price, and other outcomes following these transactions and, based on our findings, develop a structural model of payor-provider bargaining (Ho, 2009). Finally, we estimate the model and use it to simulate counterfactual equilibrium outcomes under remedies, rules, and laws that judges, agency staff, and legislators are most likely to consider.

We begin by documenting key facts. First, rollups are the main determinant of structural changes in the markets we study, increasing Herfindahl–Hirschman Indices (HHIs) by more than 1,000 points in many large metropolitan areas. Second, even if the serial nature of rollups is ignored, nearly all transactions would be presumptively anticompetitive according to US Merger Guidelines. Third, prices are stable in the quarters leading up to add-on acquisitions but rise sharply thereafter by around 25-35%. In contrast, prices do not rise following platform acquisitions, indicating the previous result is not driven by independent effects of financial sponsors. Fourth, neither anesthesia quality nor non-anesthesia prices of anesthetized procedures are affected by either type of transaction. Finally, within the set of add-on acquisitions, postacquisition price increases are associated with consolidation predicted by preacquisition market structure.

These facts motivate and inform our structural model. In each market and period, insurers and firms simultaneously Nash bargain and aim to maximize profit. If they reach an agreement, the anesthesia provider will charge the negotiated rate and is said to be "in-network." Otherwise, the provider will charge the maximum allowable rate, of which the insurer will only pay a fraction. The balance of the bill is sent to the patient, who is typically "surprised" by it. Once bargaining ends, demand is realized. Unlike most other medical specialties, patients rarely select their anesthesia provider; instead, hospitals decide. Each chooses a provider from among the practices in its market that will deliver all anesthesia services for that hospital. Their choices maximize payoffs, which are additively separable in practice characteristics. Among them, payor relationships are particularly important—hospitals avoid practices that are out-of-network (OON) for many of their patients (Cooper et al., 2020). Equilibrium prices reflect this fact. Providers can threaten to leave the network and charge exorbitant rates but recognize that doing so makes them less attractive to hospitals.

We recover the parameters that govern hospital preferences and practice costs by minimizing objective functions based on empirical analogs of moments implied by the model. Conceptually, demand-side moments maximize the log-likelihood of observing hospitals' choices, while supply-side moments minimize

which must limit involvement in USAP and notify the agency of specified future investments. The case against USAP is ongoing at the time of writing, so claims that the defendant violated laws are allegations. The complaint is available at https://www.ftc.gov/system/files/ftc_gov/pdf/2010031usapcomplaintpublic.pdf (accessed October 1, 2024).

the distance between observed bargaining outcomes and predicted values. The resulting estimates confirm that hospitals strongly avoid out-of-network providers and reveal how they trade that preference off against their tastes for other practice characteristics. Marginal cost estimates imply that profit margins average 39%.

We use these estimates to study various remedies and alternative policies. First, courts may order divestitures of acquired practices, so we simulate "unwinding" rollups. We find that these remedies reduce anesthesia expenditures by $96 million, or 4%, per year. Second, court-ordered divestitures—or even court-awarded damages to private plaintiffs—may disincentivize future rollups, so we simulate deterrence. We forecast additional savings of $40 million per year and discuss how this figure may under- or overestimate true savings. Third, motivated by an alleged agreement in which one firm paid another $9 million not to enter its market, we simulate entry. We learn that while entry reduces expenditures, its effects are more limited. Finally, to assess how recent legislation related to "balance billing" may affect anesthesia markets, we also vary relevant parameters of our model and report how expenditures respond in equilibrium.

This paper connects several literatures. Empirically, we address a key gap in our understanding of healthcare market competition. While a rich literature examines competition and consumer welfare in healthcare services (Dafny, 2009b; Gaynor and Town, 2012; Cooper et al., 2019), it has focused predominantly on hospital markets. Physician practice consolidation is notably understudied despite its accelerating pace (Capps et al., 2017). The limited existing work on physician markets focuses primarily on vertical integration between hospitals and physicians (Capps et al., 2018). In contrast, we provide an in-depth study of horizontal combinations, document large and abrupt postacquisition price increases, relate these changes to competition, and simulate counterfactual equilibria. To put our findings in perspective, Brot et al. (2024) estimate that "predictably anticompetitive mergers" among US hospital mergers raise prices by 5% and conclude that antitrust laws are under-enforced in the sector; the comparable figure in our paper is 35%.

Methodologically, we incorporate "surprise" billing, which Cooper, Scott Morton, and Shekita (2020) identified using emergency department visits, into a structural model of payor-provider bargaining (Ho, 2009; Gowrisankaran et al., 2015; Ho and Lee, 2017; Dafny et al., 2019) and apply it to negotiations between insurers and clinician practices. Our modeling choices reflect patterns in our data, which suggest that anesthesia rollups affect prices through bargaining "leverage" rather than through bargaining "power" (Nevo, 2015; Hemphill and Rose, 2018; Balan, 2020) or the "corporatization of medicine" (see La Forgia (2023), especially pp. 4646-8, for an excellent discussion).[5] Our work emphasizes that extensions of existing theory and methodology suffice to analyze anesthesia rollups.

Our findings also tie into recent work examining stealth consolidation (Wollmann, 2019). Wollmann (2024) finds that nonreportable dialysis mergers almost entirely avoid antitrust scrutiny, resulting in

[5]By definition, we study sponsor-backed acquisitions, so if we ignored competitive effects, then we would attribute higher prices to ownership by investment funds. Rigorous empirical work (e.g., studies of privately owned physician management companies (La Forgia et al., 2022; La Forgia, 2023) or dialysis facilities operated by large chains (Eliason, Heebsh, McDevitt, and Roberts, 2020) that do not explicitly model equilibrium behavior carefully tailor their specifications and claims accordingly. Relatedly, Liu (2022) cleverly shows how private equity buyouts can raise prices by shifting a provider's bargaining position independent of any competitive considerations. Finally, we do not detect quality effects. On this dimension, the literature is mixed (Gao et al., 2021; Gandhi et al., 2023; Gupta et al., 2023; Kannan et al., 2023). Gompers and Kaplan (2022) survey the findings.

consolidation that reduces the quality of care. In the pharmaceutical industry, Feng et al. (2023) find that nonreportable acquisitions of competing drugs lead to 50% or greater price increases, while Cunningham et al. (2021) find that nonreportable acquisitions of competing drug development projects enable incumbents to "kill" future competition. Aggarwal and Baxamusa (2024) reach broader but similar conclusions. Given the risk of discovery by antitrust authorities, firms may structure their transactions to avoid scrutiny, resulting in higher prices and profits (Kepler et al., 2023), and/or select targets that limit this risk, leading to a "new era of midnight mergers" (Barrios and Wollmann, 2022). Our work highlights that—conditional on premerger notification—existing remedies can address any potential or apparent harms. This is true despite the stealth and serial nature of the acquisitions we study.

The paper is organized as follows. Sections 2 and 3 describe the setting and data, respectively. Section 4 reports descriptive facts. Section 5 presents a model of bargaining between providers and insurers. Section 6 describes the methods we use to estimate the model and reports our parameter estimates. Section 7 simulates equilibrium in counterfactual environments. Section 8 concludes.

2 Setting

In this section, we describe the key features of our institutional setting. We characterize the rollup strategy, summarize the US anesthesia industry, and then recount recent, novel litigation that intersects the two.

2.1 "Buy-and-build"

Various tax and regulatory changes, such as the removal of restrictions on how pension funds could allocate capital, open the way for investment managers to develop and deploy aggressive new strategies throughout the late 1970s and early 1980s. Leveraged buyouts, turnarounds, and venture capital all emerged during this period.[6] So, too, did the rollup, which was formulated in 1984 by the firm Golder Thoma & Cressey.

Rollups are easily characterized. An investment company—typically called the "financial sponsor"—makes an initial acquisition and then uses the acquired firm as a "platform" to "add on" competing or complementary businesses. To facilitate integration, platforms are comparatively large, and, due to this asymmetry, add-ons are most affected in the rollup. Often, but not always, the sponsor is a PE fund.[7] Complete monopolization—owning all of the productive assets in a market—rarely occurs, so holdout incentives among prospective targets are probably irrelevant in all but the most extreme cases.[8]

[6]The most commonly cited catalyst is a 1979 ruling on the Employee Retirement Income Security Act (ERISA) by the Dept. of Labor, which let pension funds make risky investments. One could argue that these changes caused strategies like the leveraged buyout to be *refined and popularized* rather than *emerge*. All were of course used in one form or another at some earlier point in history.

[7]Some sponsors resemble PE funds but are nonetheless publicly traded. Onex Corporation is an early, prominent example. In other cases, platforms that were at one time private later issued public stock and used the proceeds to roll up other markets. Mednax, for example, completed its IPO in 1995 but, at the time of writing, continues to consolidate healthcare service markets.

[8]Practitioner-oriented merger-related reference books enumerate a host of issues that can arise during a rollup, which range from clashes between the targets' and acquirers' "strategic visions" to nuanced tax considerations, so if holdout problems were a practical concern, then these books would discuss them. None, to the best of our knowledge, mention them. Along these lines, none of the rollups in our data yield monopoly; at least two apparent targets remain in each market at the end of our sample.

Once considered a niche strategy, rollups now exceed $1 trillion in US deal volume annually. In PE specifically, they have eclipsed all other investment strategies. For instance, *Pitchbook* reports that add-on acquisitions accounted for less than 40% of PE deal volume in the early 2000s but over 80% by 2022 (Asil et al., 2023). Moreover, since add-ons are less frequently publicized and, by extension, more frequently omitted from research datasets, such figures understate the scale and scope of rollups. As one indication of future growth, successors to Golder Thoma & Cressey continue to raise ever-larger funds. One such firm, Thoma Bravo, founded just 16 years ago to focus on software-sector rollups, is now the seventh largest financial sponsor in the world (Private Equity International, 2024).

2.2 US anesthesia industry

The industry we study traces back to the famous physician and epidemiologist John Snow, who pioneered the safe delivery of ether in the mid-1850s. Today, the industry consists of highly trained medical professionals that we call *clinicians*, whose job it is to evaluate, monitor, and supervise the administration of anesthesia during surgery. Historically, they have been highly compensated. For instance, anesthesiologists earn on average over $500,000 each year (Gottlieb, Polyakova, Rinz, Shiplett, and Udalova, 2023).[9]

Most anesthesiologists are full-time employees of single-specialty groups that we call *practices*. Whether through acquisition or other means, a single entity may own multiple practices. In these cases, practices often retain much of their identity and clinical autonomy. For example, although Princeton Anesthesia Associates was acquired a decade ago by NJ Healthcare Specialists, the practice employs separate clinicians, maintains a separate website, and can be reached at a separate email address and phone number.[10] However, certain business decisions, such as price-setting, are made by the parent companies, which we call *firms*.

Anesthesia is arranged differently than many other healthcare services. While patients often carefully select their surgeon, they rarely choose their anesthesia provider. Instead, hospitals decide. For operational and organizational simplicity, most hospitals sign an exclusive agreement with a practice in their market.[11] The hospital's main alternative is to contract with or employ anesthesiologists directly. Under this arrangement, the hospital is responsible for organizing and managing clinicians, scheduling, and billing. Hospitals may use an intermediary to recruit staff. The industry term for this practice—which we treat as the hospital's outside option—is *locum tenens*, a Latin phrase meaning "to hold the place."

Firms bill insurers directly for the time of the anesthesiologists they employ. Public payors like Medicare set prices but commercial payors bargain over them. When the firm and insurer fail to reach an agreement,

[9] Anesthesia may also be administered by certified registered nurse anesthetists (CRNAs) and certified anesthesiologist assistants (CAAs). Anesthesiologists undergo the longest and most extensive training. CRNAs are registered nurses with advanced clinical training. The supervision they require depends on the state. CAAs have completed an anesthesiologist assistant education program and work under the direct supervision of anesthesiologists.

[10] Formally, it calls itself "a division of" its acquirer. See http://www.princetonanesthesia.com/about/ (accessed on July 10, 2024).

[11] Practices are less generously reimbursed for certain lines of service, such as round-the-clock trauma surgery coverage, or patients, such as Medicaid enrollees. In some cases, hospitals may pay stipends to compensate anesthesia providers. As measured by the federally administered Healthcare Provider Cost Reporting Information System (HCRIS) stipends are trivial in comparison to the revenues we study, so we abstract away from them. Using more detailed information from California, the only meaningful correlation we were able to obtain was between stipends and the demographics of the surrounding population, which we present in Section C.6.

the practices owned by the firm are said to be "out-of-network." In these cases, firms charge the maximum legal rate, and insurers pay only a fraction of the bill, leaving the rest to the patient, which is often unexpected. "Surprise billing" is a persistent issue for hospital-based clinician groups (Cooper et al., 2020). For example, during the period we study, approximately 7% of anesthesiology care at in-network hospitals is billed out-of-network in our final sample. To address the problem, Congress passed the No Surprises Act in 2022, which restricts the practice of billing patients for out-of-network anesthesia provided at an in-network hospital. (The law change takes effect after our sample ends, so it does not affect our estimates. Nonetheless, we revisit the legislation when we simulate counterfactual equilibria.)

Practices compete locally. Markets most closely correspond to metropolitan statistical areas (MSAs). As the complaint states, "Industry participants, including USAP and payors, recognize metropolitan areas, such as the Houston MSA, as markets for anesthesia services" (p. 67). Within each market and year, with very few exceptions, each firm-insurer pair negotiates a uniform price, with adjustments applied for observable patient- and procedure-specific factors (that we observe in our data).

Entry barriers are high. Staffing concerns are the most salient. Long-term noncompete and no-poach agreements are vigorously enforced, preventing many experienced clinicians from moving freely between firms.[12] State licensing requirements also impede movement. At the same time, the supply of newly trained physicians is severely limited. Last, new practices require managers that combine some mix of skill, experience, and resources. However, in spite of the restrictions on the supply of clinicians and managers, in certain circumstances opportunities to enter may arise from rivals in adjacent markets, creating incentives for incumbents to reach anticompetitive market allocation agreements. We return to this possibility and potential entry more broadly in Section 7.

2.3 USAP-Texas

To understand how anesthesia rollups are motivated and structured, we turn to three closely related "textbook" examples. According to court documents, all trace back to early 2012, when a former healthcare executive, JR, proposed an investment idea to a large financial sponsor, WCAS. The plan involved funding and executing an "aggressive 'buy and build' consolidation strategy" of US anesthesia practices. A few months later, WCAS partners voted on the proposal and decided to invest. Around this time, the firm formed the portfolio company that would become USAP and appointed a chief executive officer, KB, with an almost ideal resume. In his prior role as the CEO of Pediatrix, KB led the acquisition of over 100 neonatal clinics in just eight years. By the end of the year, USAP was prepared to consolidate markets.

Internal documents shed light on its plan to "Roll Up Houston." First, USAP would acquire a relatively large practice, which it called the "platform." Next, it would buy other practices, which it obtained through "add-on" acquisitions. According to complaint (and our data), everything went according to plan. On

[12]Equity research coverage of publicly traded sponsors suggest that this barrier is particularly high. As an example, a report on Mednax by Hedgeye (2020) emphasizes that the sponsor is insulated by "two layers of noncompetes."

December 12, 2012, WCAS acquired Greater Houston Anesthesiology, which employed 220 anesthesiologists, and was the largest practice in the market. Then, over the next seven years, USAP acquired three additional practices employing 93 anesthesiologists.

The Houston rollup was in no way unique. In the Dallas market, USAP followed its 2014 acquisition of Pinnacle with *six others in just two years*—it added on Anesthesia Consultants of Dallas, Excel, Southwest, BMW, Medical City, and Sundance between 2015 and 2016. In the Austin market, it acquired East Texas in 2016 and Capitol in 2018. Consistent with the idea that these firms previously competed with one another, each add-on acquisition was allegedly followed by a sharp price increase.

An obvious question arises as to how these transactions escaped prosecution in their incipiency. The most likely answer is that they escaped ex ante merger review because they were exempt from premerger notification (Wollmann, 2019, 2024). Under the Hart-Scott-Rodino Antitrust Improvements Act, only mergers valued at more than about $80 million needed to be reported to federal antitrust authorities during our sample period. Moreover, given the nature of the assets and acquirers, much higher thresholds may have applied to the acquisitions we study (Asil et al., 2023). For example, if practices have insufficient physical assets to meet the statute's "size-of-person" requirement, the $80 million "size-of-transaction" threshold would instead be $320 million.

Likely due to growing scrutiny of both stealth consolidation and privately backed investments,[13] the FTC launched an investigation and filed charges. The complaint, dated September 21, 2023, alleges that USAP and WCAS violated Section 7 of the Clayton Act, Section 2 of the Sherman Act, and other antitrust statutes, i.e., the defendants' transactions substantially reduced competition and their conduct monopolized markets. The lawsuit has been described as "groundbreaking" and "novel," marking the first time that federal authorities have challenged a series of completed deals under US merger law and charged a financial sponsor. (For its resemblances to and differences from earlier litigation, see Appendix A.1.) In relation to the case, the agency indicated that it intends to pursue other "serial acquisitions, roll-ups, and other stealth consolidation schemes" (FTC, 2023).

3 Data

In this section, we summarize the data we use in our analysis.

3.1 Sources

We combine three main types of data. We obtain lists of US clinicians and their affiliations from the Doctors and Clinicians National File ("Physician Compare"), which is published by CMS. We observe each clinician's unique identifier (i.e., their National Provider Identifier, or "NPI"), the practice of which each is a part (e.g.,

[13]See, e.g., an OECD (2024) memo submitted by the US to the supranational Competition Committee on December 6, 2023. Its first sentence states its focus on "stealth consolidation" in healthcare. Later, it emphasizes private equity.

Greater Houston Anesthesiology) and the facilities with which each is affiliated (e.g., Morristown Memorial Hospital). We use annual snapshots of the File from 2012 to 2021.[14]

We record ownership changes using four data sources. *Pitchbook* reports platform acquisitions, while *Pitchbook*, *Becker's Hospital Review*, *Refinitiv*, and platforms' press releases report add-on acquisitions. For each transaction, we observe the target and acquirer as well as the month and year that the deal was completed. (To ensure we account for ownership changes that occurred before the start of our sample, no restrictions are placed on the completion dates of the transactions.) The records are an exact match to the information published in the complaint, which covers all USAP/WCAS-related acquisitions in Texas.

We measure price and quantity using procedure-level claims data provided by HCCI. The records comprise a 30% sample of all claims filed for individuals under 65 years of age with employer-sponsored insurance administered by several large, national managed care organizations. The data capture spending by all healthcare providers including anesthesia services. For each claim, we observe a unique hospital identifier, a unique patient identifier, the date of service, negotiated transaction prices, and cost sharing (see Section 3.2 below). The data span from 2012 to 2021.

Auxiliary data sources supplement the main ones. We map hospitals to ZIP codes using Hospital Care Compare, a dataset provided by CMS, and we map ZIP codes to MSAs using a crosswalk released by the US Department of Labor. We incorporate hospital characteristic and patient population attributes from the Area Health Resource Files, a dataset provided by the Health Resources & Services Administration. We obtain hospital-by-year financial statement reports from HCRIS. We assign each procedure a Current Procedural Terminology (CPT) code using the procedure described in Cooper et al. (2019).

3.2 Sample

We begin with nearly 70 million anesthesia claims, which cover both inpatient and outpatient procedures. We employ standard restrictions suggested by the data provider, such as eliminating observations with missing or erroneous facility identifiers, risk adjustment factors, and price- or quantity-related measures. To limit measurement error, we restrict attention to common CPT codes—ones with at least 10,000 episodes—and omit nonstandard insurance products (i.e., we only include EPO, HMO, PPO, and POS arrangements). To eliminate other ambiguities, we limit the sample to procedures with a single anesthesia claim. We arrive at around 23 million claims, i.e., procedures (see Appendix B for step-by-step eliminations).

We observe the allowed amount and number of units associated with each procedure. With one exception, anesthesia is billed on a per-quarter-hour basis, meaning units correspond to 15 minute intervals

[14]Practices may change their names and identifiers. For instance, "Anesthesia Consultants LLC" changed its name to "Anesthesia Consulting Group LLC" in 2015. As evidence that they are one and the same, all 20 clinicians associated with "Anesthesia Consultants LLC" in 2014 were associated with "Anesthesia Consulting Group LLC" in 2015. To account for this, we construct constant identifiers by assuming that if at least 80% of a practice's clinicians appear under a different practice in the following year, then we carry forward the preceding practice's identifier. Critically, doing so *does not* obscure acquisitions, since we track firms and practices separately. For example, when we observe Greater Houston Anesthesiology acquirer North Houston, we carry North Houston's constant identifier forward but change the firm identifier.

of clinician time. Accordingly, we remove single-unit observations and compute prices by dividing allowed amounts by numbers of units. The exception is obstetrics-related anesthesia, which is typically billed on a per-procedure basis (Vaidyanathan, 2022). To maintain comparability, we remove obstetrics from our main sample, although our key estimates are unchanged when we re-estimate them using only obstetrics-related procedures (see Appendix C.3 for these results).

We collapse the dataset down to the quarter or year level, depending on the specification. For every practice in every market and period, we observe its price, quantity, number of clinicians, and ownership structure. We can also infer whether it is in- or out-of-network with the insurers. All monetary values are reported in constant 2021 US dollars.

3.3 Summary

Table I presents market-level summary statistics. Of the 339 markets in our data, 85 experience at least one sponsor-backed acquisition. In 18, we observe a sponsor make at least two acquisitions—a platform acquisition and at least one add-on, which together constitute a rollup.

Table I: *Summary of markets*

	No sponsor	Sponsor but no add-ons	Sponsor and add-ons
N	254	67	18
Population (in 10,000s)	42.06	145.61	328.65
GDP per capita	42248.56	43633.42	56786.74
HHI average, 2012-2021	6050.44	4322.44	3075.17
HHI change, 2012-2021	633.43	409.78	1501.18
Noncompete (Beshara) index	0.69	0.74	0.67
Nurse supervision opt-out	0.33	0.19	0.11
CPOM Index	0.75	0.69	0.70
Share privately insured	0.54	0.55	0.53
Balance billing protection index	0.19	0.43	0.40

The unit of observation is a market. For disclosure reasons, the concentration indices on which this table is based use clinician "head counts" obtained from the Physician Compare data, although these closely correspond to actual units. Population and GDP per capita are taken from the Area Resource Files. Our metrics of the regulatory environment—statutes affecting scope of practice, noncompete agreements, surprise billing, and corporate practice of medicine—are described in Appendix A. (A previous draft incorrectly identified 89 rather than 67 markets as sponsor-backed. Occasionally, a small fraction of a practice's clinicians are located outside its main market. Previously, we counted the acquisition of such practices as two acquisitions, even though the relevance to the secondary market is minimal.)

Markets differ from one another in predictable ways. The 18 "rollup markets" are larger, more affluent, and experience more consolidation over the sample period. The 85 markets with at least one sponsor-backed acquisition tend to be found in states with narrow scope-of-practice rules and more consumer protections against balance billing. On other dimensions, the markets closely resemble one another. For instance, they are similar in terms of restrictions on noncompete agreements and corporate practice of medicine. Appendix A provides additional details on the regulatory environment.

For the remainder of the paper, unless otherwise stated, we restrict attention to the rollup markets. (The exceptions are Section 7.1.2 and 7.1.3, which study deterrence and entry, respectively.) To eliminate any confusion, we call these 18 markets our main sample. Notably, they cover around 20% of the US population and account for around the same share of gross domestic product.

Table II presents summary statistics at the practice level. Consistent with the idea that small firms are easier to merge into large ones than vice versa, platforms are larger than targets. For instance, prior to add-on acquisitions, acquirers (i.e., platforms) comprise an average of 147 clinicians whereas targets (i.e., the firms being "added-on") comprise an average of 26. At the same time, acquirers' average market share is 28%, whereas targets' average market share is 9%. Expectedly, platform acquisitions occur slightly earlier in our sample (early 2015 vs. mid 2016).

Table II: *Summary of rollup acquisitions*

	Target			Acquirer		
	N	Mean	Std. Dev.	N	Mean	Std. Dev.
Platform acquisitions:						
Number of clinicians	20	61.45	81.32	-	-	-
Market share	20	.23	.18	-	-	-
Transaction year	20	2015.1	1.8	-	-	-
Add-on acquisitions:						
Number of clinicians	50	26.24	29.8	40	146.8	146.95
Market share	50	.09	.11	40	.28	.17
Transaction year	50	2016.76	2.25	50	2016.76	2.25

The unit of observation is a practice. For data disclosure reasons, the market shares on which this table is based use clinician "head counts" obtained from the Physician Compare data, although these closely correspond to actual units.

4 Descriptive evidence

In this section, we describe the key patterns in the data that inform our model and subsequent analysis.

4.1 Market structure

We start by asking whether rollups are an important determinant of market structure. To answer this, we compare two times series within each market. One tracks how concentration *actually changed*, while the other tracks how concentration *would have changed* solely as a result of add-on acquisitions. To construct the first measure, we compute HHI in each market-year and then calculate differences relative to a base period, 2013. To construct the second measure, we use the fact that, holding all other behavior fixed, merging two firms mechanically increases HHI by twice the product of the target's and acquirer's preacquisition market shares. We compute the value for each add-on acquisition and then calculate the sum up to every point in time in each market.

Formally, we index markets, time, and firms by m, t, and f, respectively. We denote f's market share by s_{mtf}, represent the set of firms in m at t using $\mathcal{F}_{mt}$, and define HHI_{mt} equal to $\sum_{f \in \mathcal{F}_{mt}} s_{mtf}^2$. For ease of exposition, we refer to acquired practices as *targets*, index them by r, and index their acquirers by $\alpha(r)$. We define $\widehat{\Delta HHI}_r$ equal to $2 s_{m,t-1,r} s_{m,t-1,\alpha(r)}$. Our first measure, ΔHHI_{mt}, equals $HHI_{m,t} - HHI_{m,2013}$. Our second measure, $\widehat{\Delta HHI}_{mt}$, equals the sum of $\widehat{\Delta HHI}_r$ over targets acquired in m between between 2012 and t. We plot the evolution of ΔHHI_{mt} and $\widehat{\Delta HHI}_{mt}$.

Figure I reports the result. Panels A-C depict the three litigated markets. Two important facts emerge from these graphs. First, rollups are the dominant force shaping the structure of these markets. Actual concentration changes very closely track ones mechanically produced by add-on acquisitions. All other forces and factors—entry, exit, and the expansion and contraction of firms' shares—are comparatively unimportant. Second, substantial consolidation occurs. In Dallas and Houston, which each house nearly eight million residents, HHI rises by over 1,000 points.

Panels D-R depict the remaining 15 markets in our sample—areas that are affected by rollups but, at least at the time of writing, are not the subject of any federal antitrust case. The graphs reveal that the litigated markets are by no means unique. Rollups are the dominant force shaping the structure of other large, metropolitan markets such as Phoenix, Las Vegas, and Denver as well as small ones such as Trenton-Ewing and Syracuse. Most experience dramatic consolidation. HHI rises by over 1,000 points in many cases; in some, it increases over 2,500 points.

We then ask whether the serial nature of rollups has practical consequences for enforcement. For guidance on how to answer this, we turn to newly established *Merger Guideline 8*, introduced by the DOJ and FTC to address serial acquisitions. It states that "when a merger is part of a series of multiple acquisitions, the agencies may examine the whole series," so we check whether transactions would be presumptively anticompetitive on a cumulative but not individual basis. For the structural presumption, we turn to *Merger Guideline 1*, which specifies concentration-based tests that "play a central role in merger analysis" (Nocke and Whinston, 2022). In the markets we study, HHI levels exceed 1800, so HHI changes are pivotal.

For each add-on acquisition, which can be indexed by its target r, we compute $\widehat{\Delta HHI}_r$. When the result exceeds 100, we call the add-on *presumptively anticompetitive on an individual basis*. We then sum $\widehat{\Delta HHI}_r$ over add-ons within each rollup. When result exceeds 100, we call all add-ons associated with the rollup *presumptively anticompetitive on a cumulative basis*.

Figure II summarizes the comparisons. Only 6 of 50 add-ons are presumptively anticompetitive on a cumulative but not individual basis. Moreover, in 4 of these 6 cases, another add-on in the same rollup is presumptively anticompetitive. Under our strict application of *Merger Guideline 8*, accounting for the serial

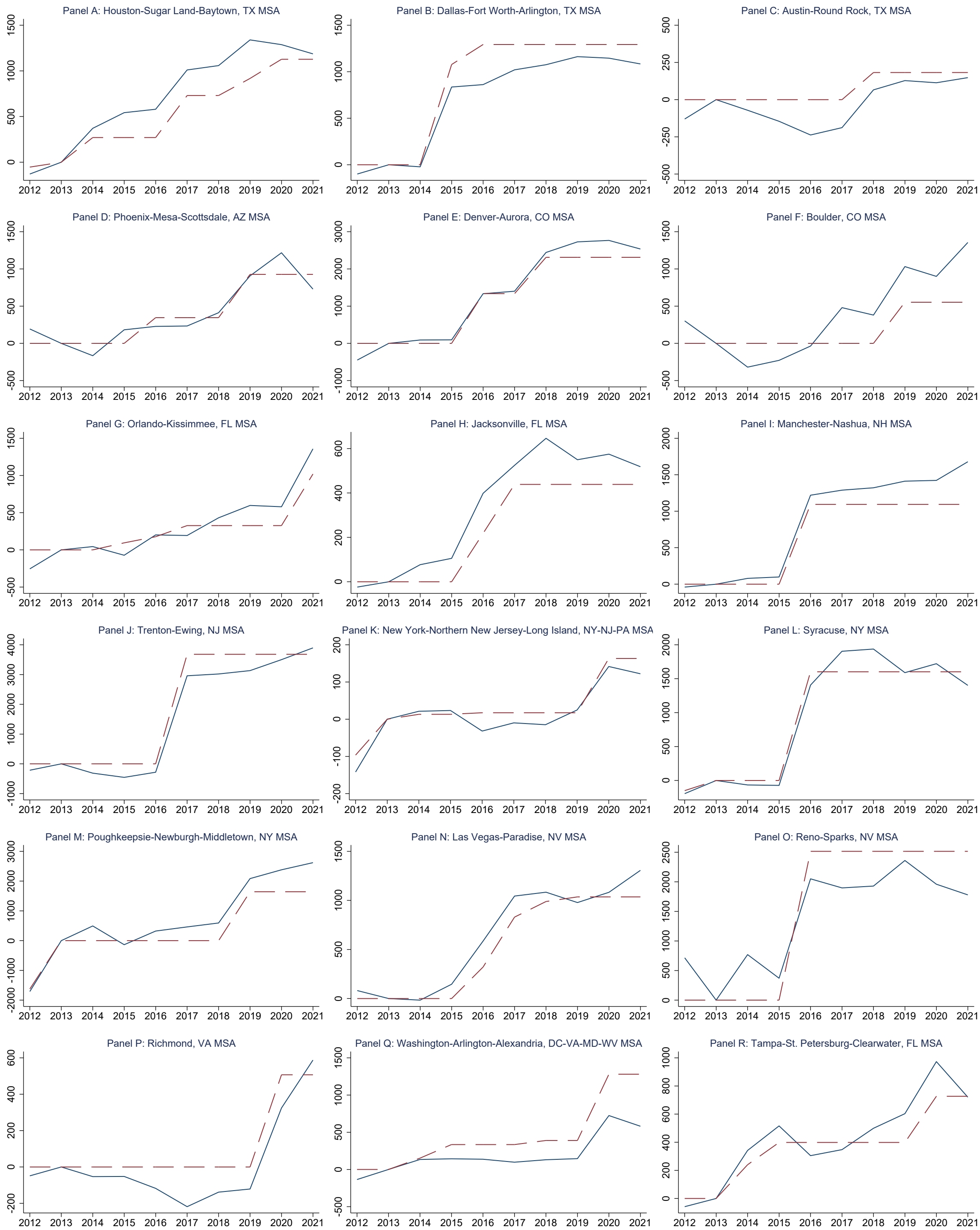

Figure I: *Rollups shape how market structures evolve*

This figure plots HHI changes over time. The unit of observation is a market-year. The solid and dashed line correspond to actual changes and mechanical increases from add-on acquisitions, respectively. See the text for details. (A previous draft erroneously reported a Louisville rollup and omitted one in Tampa. The Louisville transactions were an administrative combination of four affiliated providers that we wrongly believed were sponsor-related. The FL transactions were sponsored by Blackstone.)

nature of anesthesia rollups has limited effects on enforcement.

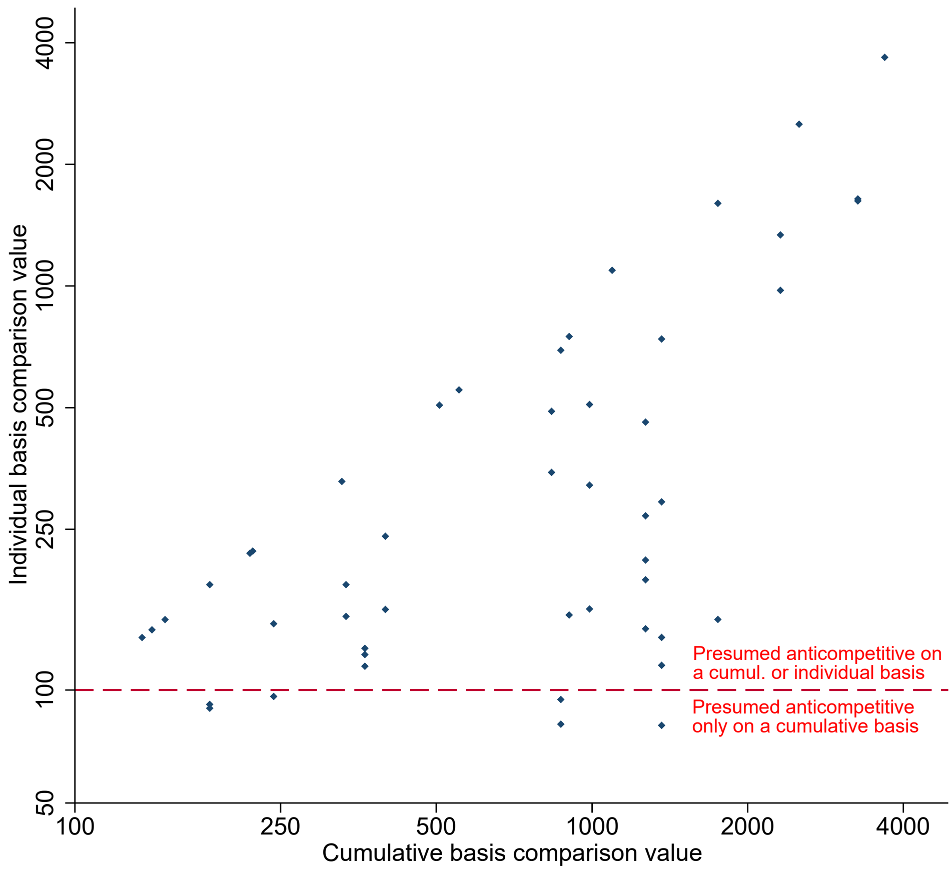

Figure II: *Almost all transactions are presumptively anticompetitive on an individual basis.*

This figure reports comparisons based on US Merger Guidelines. Each point on the graph corresponds to an add-on acquisition, which may be indexed by its target r. We plot $\widehat{\Delta HHI}_r$ along the y-axis. We then sum $\widehat{\Delta HHI}_r$ over add-ons within each rollup and plot the result along the x-axis. A transaction is presumptively anticompetitive on an individual basis if its y-axis value exceeds 100, which is marked by a horizontal dashed line. A transaction is presumptively anticompetitive on a cumulative basis if its x-axis value exceeds 100, which is not marked on the graph, as all x-axis values exceed it.

4.2 Price changes following add-on acquisitions

Next, we ask whether and to what extent prices change following acquisitions. To answer this, we conduct a series of event studies, where each event corresponds to the acquisition of a practice. We index calendar quarters by t and represent the period in which r was acquired using t_r. We index event time using τ, which equals $t-t_r$, and we define y_{rt} equal to the log price charged by r at t. The estimating equation is given by

$$y_{rt} = \sum_{\tau=-16}^{16} \mu^\tau x_{rt}^\tau + \chi_r + \kappa_t + \varepsilon_{rt}, \tag{1}$$

where χ_r and κ_t are target and time fixed effects, respectively, and x_{rt}^τ is an indicator variable that equals one if and only if r is acquired τ periods before t.

Our research design applies the logic of Gentzkow et al. (2011) to the present setting. Conceptually, our goal is to relate events and outcomes, but unobservable factors that determine acquisitions could at least partially determine equilibrium objects such as price. Our solution lies in the discrete, irreversible nature of acquisitions. These events are induced by comparatively small, marginal changes in the market environment but produce large, discontinuous changes in firms' incentives and/or operations. As a consequence, in the absence of pre-event trends, on-impact changes can be attributed to the acquisitions.[15]

We estimate equation 1 separately for platform and add-on acquisitions.[16] Keeping with convention, we set τ=-16 if τ<-16 and τ=16 if τ>16. Likewise, we set μ^τ=0 for τ=-1 (i.e., we normalize the coefficients relative to the quarters immediately preceding the transactions). We then plot μ^τ against τ.

Figure III reports the results. The dashed line corresponds to platform acquisitions. Prices evolve smoothly and evenly through the events. Since these transactions do not consolidate ownership, coefficients obtained from them are informative about the independent effect of sponsors on prices. Our estimates suggest that *sponsors have close to zero impact on prices in US anesthesia markets*.

In sharp contrast, the solid line corresponds to add-on acquisitions. Leading up to these events, prices are stable, but immediately afterwards, they rise sharply. Within four years, prices rise around 35%. Alongside our previous results, these estimates are consistent with claims that add-on acquisitions reduce competition—they suggest that *add-on acquisitions cause firms to internalize more business-stealing externalities and, in turn, raise prices*.

Appendix C addresses robustness. First, to check whether prices rise after add-on acquisitions due

[15]To see this clearly, let a scalar z summarize unobservable factors that determine acquisition. Assume that z follows a random walk and that the process generating y is given by $\mu x + \chi + \kappa + \sigma z + \varepsilon$. The problem is now clear: if $\sigma \neq 0$, then omission of z biases our estimates of μ. However, acquisitions are discrete and irreversible in our setting (i.e., we do not observe firms buying parts of anesthesia practices or "spinning out" ones they have previously purchased in our sample), so acquisition decisions follow a cutoff rule (Dixit and Pindyck, 1994). That is, acquisition occurs when Δz pushes z "just over" some threshold $z^\star$. There are two implications. First, although z completely determines acquisition, at-acquisition changes in z are comparably small. When on-impact changes in unobservable factors are unimportant, bias is limited. Second, on average, as acquisition approaches, z drifts up towards $z^\star$. Hence, if $\sigma \gg 0$ or $\sigma \ll 0$, then y must trend up or down, respectively. Thus, when pre-event trends are absent, $\sigma \approx 0$. Once again, bias is limited. See also Gentzkow et al. (2011) at pp. 1990-5 for a more detailed explanation.

[16]Similar to Brot et al. (2024), we can also construct a control group of practices and estimate price effects using a stacked difference-in-difference design. The results are quantitatively similar for add-on acquisitions. (It is more challenging to construct such a "control" group for platforms.)

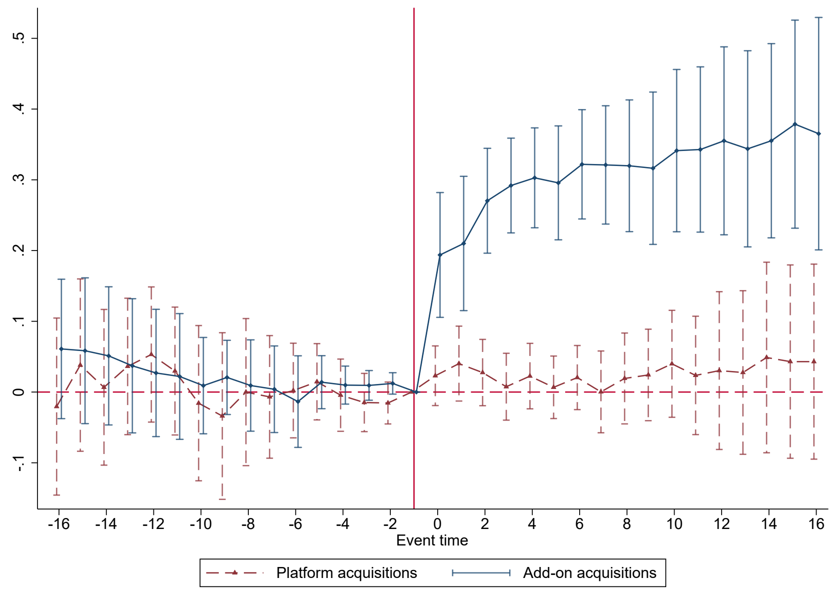

Figure III: *Prices rise following add-on but not platform acquisitions.*

This figure plots estimates of μ^τ on the y-axis against event time in quarters on the x-axis. The solid and red lines correspond to add-on and platform acquisitions, respectively. We normalize μ^τ=0 for τ=-1 and mark this period with a vertical red line. Standard errors are clustered at the target level.

to a compositional change in the hospitals that targets practices serve, we append hospital fixed effects to the right-hand side of equation 1. Second, to ensure our results do not depend on the exclusion of delivery/labor-related anesthesia, we replace our main sample with one comprised entirely of obstetrics. The results of both exercises are quantitatively similar to Figure III—prices are stable through platform acquisitions and exhibit large, on-impact increases following add-on acquisitions.

Our interpretation of Figure III changes if higher anesthesia prices are offset by lower payments to other providers. We replace anesthesia prices with non-anesthesia prices for anesthetized procedures in equation 1 and then display the coefficients in Appendix Figure C.2. Outcomes do not exhibit any appreciable change following either platform or add-on acquisitions, thereby mitigating the concern.

Our interpretation also changes if higher prices coincide with higher quality, which could arise from the spread of "best practices" that make anesthesia safer and more effective. We replace anesthesia prices with four widely agreed-upon measures of anesthesia quality in equation 1 and display the coefficients in Appendix Figure C.5. Again, outcomes move smoothly and evenly through the events, mitigating the concern. The pattern is also consistent with medical professionals' experience, which implies that ownership does not influence clinical determinations. For example, writing for *ASA Monitor*, the official publication of the American Society of Anesthesiologists, Tewfik and Dutton (2021) state that while loss of control over some "business" decisions is reasonable, "In other domains a loss of control is unlikely—day to day clinical care of individual patients remains the responsibility of the clinicians involved, and a [privately backed] investor will not dictate the choice of one medication over another in the operating room." Notably, Dutton was the Chief Quality Officer of USAP when he co-authored the article.

We can also restrict attention to add-on acquisitions and, within this subset of transactions, relate postacquisition price changes to preacquisition market structure. For each add-on acquisition, indexed by its target r, we define Δy_r equal to the difference between the weighted average log price charged by the merging parties between τ=5 and τ=8 and between τ=-4 to τ=-1. We plot the resulting "long difference" against $\widehat{\Delta HHI}_r$, described above. The two measures are positively related through changes in competition and, under slightly stricter conditions than apply here, the relationship is approximately linear.[17]

Figure IV reports the result. Postacquisition price changes are positively correlated with HHI changes predicted using preacquisition shares. Moreover, if we extrapolate the best-fit line to small values of $\widehat{\Delta HHI}$ (and put aside the fact that no microfounded model produces an exactly linear relationship between the axes' values), then we obtain Δy close to zero. Such findings conform with internal WCAS communications and are consistent with bargaining leverage rather than differences in bargaining power driving our main result.[18]

The final question is how firms are able to raise prices so quickly. The answer involves two common features of payor-provider contracts in the anesthesia industry. First, terms of the agreements are usually fixed for a year or more. (Consistent with Cooper et al. (2019), we "see that the main contract prices are stable for extended periods (usually one year).") Second, practices can typically add or remove clinicians at will.

Because of the first contractual feature, in the absence of any workarounds, postacquisition prices cannot immediately adjust to their new, higher, equilibrium levels. In other words, a gap forms between what firms *can charge* and what they *would charge* were all contracts immediately renegotiated. However, by exploiting the second contractual feature, firms can circumvent most of the issue. Preacquisition prices charged by platforms are often much higher than those charged by add-ons,[19] so newly merged firms can immediately raise the price charged by target practice clinicians by clerically transferring them to acquirer practices. Although the clinicians only move "on paper," the rate increases are nonetheless real. Moreover, while such increases may appear "mechanical" (i.e., unrelated to the competitive process and outside the scope of US merger law), such an interpretation conflates the *economic reason for a price increase* and the *way it was administratively implemented*.

Consistent with this explanation, most of the price increases that immediately follow add-on acquisitions

[17]See Section 5 of Nocke and Schutz (2025). In our setting, no convenient closed-form relationship has been derived.

[18]Practitioners familiar with payor-provider negotiations distinguish between bargaining "leverage," which depends on how easily parties can compete parties against each other, and bargaining "power," which depends on ability and determines how surplus is split (see, e.g., *FTC v. ProMedica Health Sys.* ¶ 77,395 (N.D. Ohio Mar. 29, 2011)). In the complaint, we observe WCAS equate its "anesthesia consolidation strategy" with improving "negotiating leverage" (p. 27). In the data, we observe patterns that are inconsistent with large target-acquirer differences in bargaining ability. To see this, suppose that some firms are skilled negotiators while others take payors' offers and that sponsors' initial acquisitions target the former while subsequent ones target the latter. In this case, $\Delta y \gg 0$ even when $\widehat{\Delta HHI}$=0. This is not what we observe. We thank Leemore Dafny and Matt Grennan for calling our attention to this issue.

[19]This occurs for two reasons. Presumably, it is much easier to integrate many small firms into a large one than the the other way around, so practices involved in platform acquisitions are larger than average, all else equal. Also, as most platforms complete multiple acquisitions, their preacquisition prices commonly reflect recapture effects accumulated from prior acquisitions.

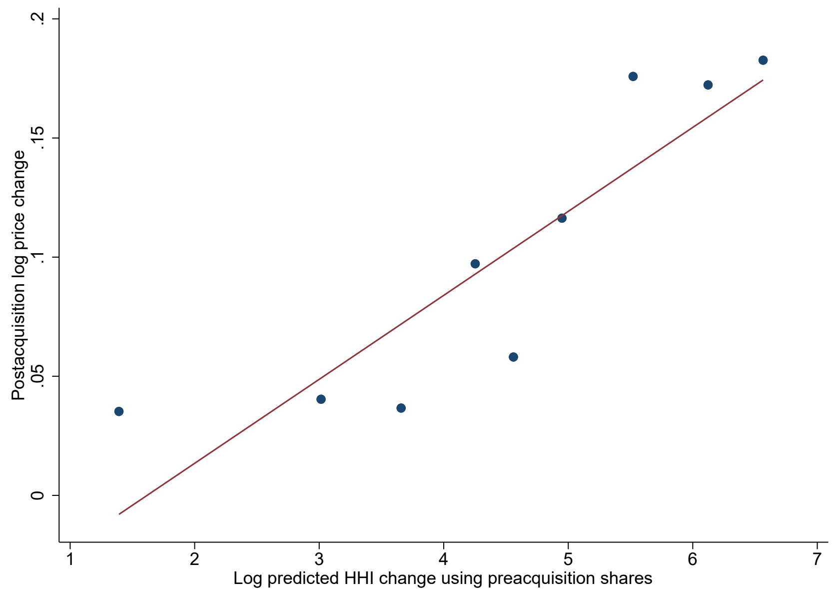

Figure IV: *Preacquisition market structure predicts postacquisition price changes.*

This figure relates postacquisition price changes to preacquisition market structure. On the y-axis, we plot Δy, the difference between the weighted average log price charged by the merging parties τ=5 and τ=8 and between τ=-4 to τ-1. On the x-axis, we plot $\widehat{\Delta HHI}$, the amount by which concentration would increase, holding all other behavior fixed. The unit of observation is an add-on acquisition. For legibility, observations are binned according to x-axis values, and means within the bins are reported.

reflect the newly merged firm applying the acquirer's reimbursement rate to the target's clinicians. To illustrate how preacquisition acquirer-target price differences make this possible, we display the distribution of these values. For each add-on acquisition, indexed by its target r, we define $p_r^{\tau=-1}$ and $p_{\alpha(r)}^{\tau=-1}$ equal to the average price charged by all practices owned by the target and acquirer, respectively, just prior to the transaction. Next, we calculate the percentage price difference, which equals $p_{\alpha(r)}^{\tau=-1}/p_r^{\tau=-1}$-1. Finally, we plot the density of these differences.

Figure V reports the result. Two features are noteworthy. First, all but one of the differences are positive—as expected, prior to their acquisition, target practices charge lower prices than acquirer practices. Second, the average difference is 28%, which is very close to the price increase we observe between τ=-1 and τ=3 in Figure III.[20]

Of course, the outcomes we measure above are equilibrium objects. Each is a complicated function of the parameters governing supply and demand, so accurately predicting their response to environmental changes requires a detailed model of behavior. We present it in the following section.

[20]Consistent with La Forgia et al. (2021), we find no evidence of increased OON billing for obstetric or non-obstetric procedures.

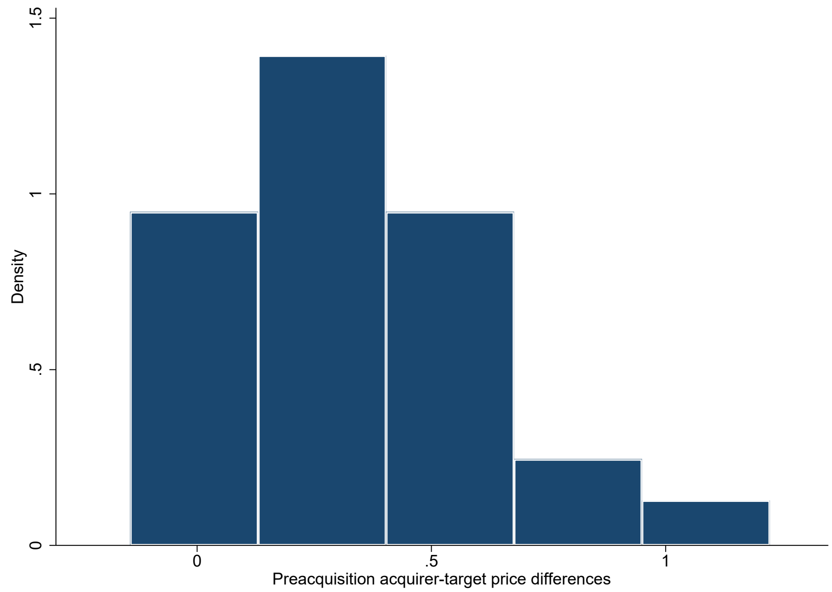

Figure V: *Preacquisition acquirer-target price differences*

This figure plots the density of preacquisition acquirer-target price differences ($p^{\tau=-1}_{\alpha(r)}/p^{\tau=-1}_{r}$*-1). The unit of observation is an add-on acquisition.*

5 Model

In this section, we present a model of the supply and demand for anesthesia. For notational simplicity, we characterize equilibrium in a single market and period. (These details are added back later in the paper as they become relevant.) We begin by introducing the players and the timing of their actions.

5.1 Setup

Privately insured patients periodically require anesthetized surgeries, such as a gallbladder removals and hip replacements. The surgeries are performed at a set $\mathcal{H}$ of hospitals, who are responsible for arranging anesthesia. The anesthesia is provided by a set $\mathcal{A}$ practices or *locum tenens*. The practices are owned by a set $\mathcal{F}$ of firms, while reimbursements are paid by a set $\mathcal{J}$ of insurers. We index the elements of these sets by h, a, f, and j, respectively, and we define $\mathcal{A}_f$ equal to set of practices owned by f.

We employ standard timing assumptions. First, firms and insurers simultaneously Nash bargain with each other (Horn and Wolinsky, 1988). If f and j reach an agreement, then f charges an "in-network price" equal to p_{fj}. If not, f charges "out-of-network price" equal to $\bar{p}$. To characterize the relationships between firms and insurers, we define N_{fj} equal to one if f is in j's network and zero otherwise. Second, demand is realized. Each hospital observes the outcomes of firm-insurer bargaining and then selects an anesthesia provider.

Below, we provide additional details, specify payoffs, and characterize equilibrium, emphasizing the role of competition. To ease exposition, we do so in reverse chronological order, starting with demand.

5.2 Demand

In every market and period, each hospital issues a "request for proposals" to exclusively staff its facility. These requests emphasize group size and payor relationships,[21] as does the complaint (pp. 20-22), so both practice characteristics enter hospital utility in our model.

While group size, which facilitates around-the-clock coverage, is straightforward, payor relationships deserve more detailed discussion. Insurers fully reimburse in-network charges but only partially reimburse OON charges, leaving the balance to be paid by patients, who are aggrieved by these bills. According to Cooper et al. (2020), "balance billing" reduces hospitals' payoffs in at least three ways. One is that the patient often "blames the hospital for the balance bill so the hospital suffers harm to its reputation." Another reflects altruism, as hospital clinicians and administrators may place at least some weight on patient financial well-being. Yet another is contractual. Some hospitals pay penalties when they arrange for OON care.

Hospital payoffs must reflect patient flows. To see this clearly, notice that if j insures all of the patients on whom h operates, then h must pay close attention to whether practices are in j's network but can safely ignore other payor relationships. To reflect this, we specify per-patient payoffs and then weight patient flows accordingly.

Formally, we denote network-independent practice characteristics by X_a, and we represent hospital-practice unobservable taste differences using ϵ_{ha}. We define Q_{hj} equal to the number of patients insured by j that are treated by h and assume these values are determined outside the model. This assumption not only makes the model tractable but is also reasonable to impose. Anesthesia plays a supporting role in operations, complementing the primary (surgical) procedure, and while it accounts for \$26 billion in annual US expenditures, it usually only represents a fraction of all clinician and facility charges (Weill Cornell Medicine, 2022). Moreover, the data support this assumption (see Appendix C).

Hospitals' choices maximize their payoffs, which are additively separable on a per-patient basis in practice attributes, an indicator for whether the practice is in the network of the patient's insurer, and the (h, a)-specific disturbance term. If h chooses a, then it earns

$$\check{U}_{ha} = \sum_{j \in \mathcal{J}} Q_{hj} \left(X_a \beta + \theta N_{f(a)j} + \epsilon_{ha} \right), \tag{2}$$

[21] See, e.g., "Clinical Service Requirements" in the RFP published by Lewis Gale Medical Center. Putting aside boilerplate performance, licensing, and malpractice assurances (items B1, B4-5, and B6, respectively), the document requires billing, staffing, and "educational, regulatory . . . and professional standards" information. With respect to billing in particular, the document states,

> Participation with any and all insurance programs that the hospitals are currently participating with may be required. Exception to the above may be granted on a case-by-case basis if, for example, reimbursement offered by any commercial payor is significantly less than the competitive market rate.

See https://www.yumpu.com/en/document/read/36897977/o-19dsg4dnq1shk11pvniq4pq1sk4apdf at 7 (accessed July 28, 2024).

where θ and β reflect preferences for in-network practices and other observable attributes, respectively. If h selects its outside option, then it receives $\check{U}_{h0} = \sum_{j \in \mathcal{J}} Q_{hj} \epsilon_{h0}$. We can divide $\check{U}_{ha}$ and $\check{U}_{h0}$ by $\sum_{j \in \mathcal{J}} Q_{hj}$ to obtain

$$U_{ha} = X_a \beta + \theta N_{f(a)h} + \epsilon_{ha} \tag{3}$$

and $U_{h0} = \epsilon_{h0}$, respectively, where $N_{f(a)h} \equiv \sum_{j \in \mathcal{J}} (Q_{hj} N_{f(a)j}) / \sum_{j \in \mathcal{J}} Q_{hj}$. The normalization highlights that "average networks" determine hospitals' choices.

5.3 Bargaining

5.3.1 Payoffs

Firms and insurers bargain with one another. To describe the process, we begin by characterizing prices and payments. Consider a patient who is insured by j and treated at h. There are three possibilities. First, the practice may be in the insurer's network. If h selects $a \in \mathcal{A}_f$ and N_{fj}=1, then f charges p_{fj}, which j pays in full. Second, the practice may be outside the insurer's network. If h selects $a' \in \mathcal{A}_{f'}$ but $N_{f'j} = 0$, then f' charges $\bar{p}$. j only pays a fraction γ of this amount, with the balance billed to the patient. Third, the hospital may opt for *locum tenens*, in which case j pays $\tilde{p}$.

When bargaining occurs, neither f nor j know what values of ϵ will be drawn. Each integrates out over possible values. For computational convenience, we assume that these draws are i.i.d. Type 1 Extreme Value. The probability that h chooses a is then given by

$$D_{ha}(N_{1h}, ..., N_{Fh}) = \frac{e^{X_a \beta + \theta N_{f(a)h}}}{1 + \sum_{a' \in \mathcal{A}} e^{X_{a'} \beta + \theta N_{f(a')h}}}, \tag{4}$$

where $N_h \equiv \cup_a \{N_{ah}\}$. Similarly, the probability that h chooses the outside option is given by

$$D_{h0}(N_{1h}, ..., N_{Fh}) = \frac{1}{1 + \sum_{a' \in \mathcal{A}} e^{X_{a'} \beta + \theta N_{f(a')h}}}. \tag{5}$$

Insurers seek to maximize profits. Following Cooper et al. (2020), we abstract away from other revenues and costs of the insurer and define r equal to j's net revenue per patient in the absence of anesthesia costs. Profits take their usual form—they equal the product of market size, market share, and a per-unit markup. Given a network $N \equiv \cup_{fj} \{N_{fj}\}$, out-of-network price $\bar{p}$, and vector of prices $p_j \equiv \cup_f \{p_{fj}\}$, insurer j earns

$$\pi_j(N, \bar{p}, p_j) = \sum_{h \in \mathcal{H}} Q_{hj} \Bigg[\underbrace{\sum_{a \in \mathcal{A}} N_{f(a)j} D_{ha}(\cdot)(r - p_{f(a)j})}_{\substack{\text{j's per-enrollee profit if h} \\ \text{chooses an in-network practice}}} + \underbrace{\sum_{a \in \mathcal{A}} (1 - N_{f(a)j}) D_{ha}(\cdot)(r - \gamma \bar{p})}_{\substack{\text{j's per-enrollee profit if} \\ \text{h chooses an OON practice}}} + \underbrace{\Big(1 - \sum_{a \in \mathcal{A}} D_{ha}(\cdot)\Big)(r - \tilde{p})}_{\substack{\text{j's per-enrollee profit if} \\ \text{h chooses } \textit{locum tenens}}} \Bigg]. \tag{6}$$

Equation 6 shows that insurer profits are a sum of three sets of terms whose relative weights depend on which practices hospitals choose and, in turn, on which practices are in-network. Since the multiplicands on r within the bracketed terms sum to one, we can rewrite equation 6 as

$$\pi_j(N,\bar{p},p_j) = \sum_{h\in\mathcal{H}} Q_{hj}\left[r - \underbrace{\sum_{a\in\mathcal{A}} N_{f(a)j} D_{ha}(\cdot) p_{f(a)j}}_{\substack{\text{j's per-enrollee payouts}\\ \text{to in-network firms}}} - \underbrace{\sum_{a\in\mathcal{A}} (1-N_{f(a)j}) D_{ha}(\cdot)\gamma\bar{p}}_{\substack{\text{j's per-enrollee payouts}\\ \text{to OON firms}}} - \underbrace{\left(1-\sum_{a\in\mathcal{A}} D_{ha}(\cdot)\right)\bar{p}}_{\substack{\text{j's per-enrollee payouts}\\ \text{for } locum\ tenens}}\right]. \quad (7)$$

That is, for the insurer, maximizing profit is equivalent to minimizing cost.

Firms also seek to maximize their profits. Given N, $\bar{p}$, and vector of prices $p_f \equiv \cup_j\{p_{fj}\}$, firm f earns

$$\pi_f(N,\bar{p},p_f) = \sum_{a\in\mathcal{A}_f}\sum_{h\in\mathcal{H}}\sum_{j\in\mathcal{J}} Q_{hj}\left[\underbrace{N_{fj} D_{ha}(N_{f(a)h}{=}1,\cdot)\left(p_{fj}-mc\right)}_{\substack{\text{f's per-patient profits from}\\ \text{in-network arrangements}}} + \underbrace{(1-N_{fj}) D_{ha}(N_{f(a)h}{=}0,\cdot)\left(\bar{p}-mc\right)}_{\substack{\text{f's per-patient profits from}\\ \text{OON arrangements}}}\right], \quad (8)$$

where mc denotes the marginal cost of anesthetizing a patient.

5.3.2 Equilibrium

We assume that anesthesia prices are determined via simultaneous bilateral Nash bargaining. Holding all other prices and the rest of the network fixed, each pair agrees on prices that maximize the product of their gains from trade, raised to the parties' respective bargaining powers, under the assumption that gains for both parties exist. Firms may have uncertainty about what gains will be realized, so we represent their subjective expectations of them using $\mathcal{E}(\cdot|\mathcal{I}_{kk'})$, where $\mathcal{I}_{kk'}$ denotes k's information set when bargaining with k'. Each pair (f,j) agrees to an in-network price given by

$$\begin{aligned} p^\star_{fj} = \arg\max_p \Big\{ & \left[\mathcal{E}(\pi_f(N_{fj}{=}1,\bar{p},p_{fj}{=}p,\cdot)|\mathcal{I}_{fj}) - \mathcal{E}(\pi_f(N_{fj}{=}0,\bar{p},\cdot)|\mathcal{I}_{fj})\right]^b \\ & \times \left[\mathcal{E}(\pi_j(N_{fj}{=}1,\bar{p},p_{fj}{=}p,\cdot)|\mathcal{I}_{jf}) - \mathcal{E}(\pi_j(N_{fj}{=}0,\bar{p},\cdot)|\mathcal{I}_{jf})\right]^{1-b} \Big\}, \end{aligned} \quad (9)$$

so long as

$$\mathcal{E}(\pi_f(N_{fj}{=}1,\bar{p},p_{fj}{=}p^\star_{fj},\cdot)|\mathcal{I}_{fj}) - \mathcal{E}(\pi_f(N_{fj}{=}0,\bar{p},\cdot)|\mathcal{I}_{fj}) > 0$$

and

$$\mathcal{E}(\pi_j(N_{fj}{=}1,\bar{p}),p_{fj}{=}p^\star_{fj},\cdot)|\mathcal{I}_{jf}) - \mathcal{E}(\pi_j(N_{fj}{=}0,\bar{p},\cdot)|\mathcal{I}_{jf}) > 0,$$

where b and $1-b$ denote the firm's and insurer's bargaining power, respectively. Otherwise, they fail to reach an agreement, in which case they expect f to charge $\bar{p}$. Implicitly, this solution concept maintains that when negotiations break down, the parties cannot renegotiate other arrangements in the current period. For tractability, we assume that all parties have equal bargaining weights, which implies that all in-network prices set the parties' gains from trade equal to one another. This seems reasonable to impose, given that both sides employ sophisticated negotiators (see Appendix A.3) and, perhaps because of this, differences in bargaining ability are small (see Section 4.2). Finally, we assume that each agent's expectations about its gains from trade are, on average, correct. To be precise, for all $(k, k') \in \{(f, j), (j, f)\}$, the difference between $\mathcal{E}(\pi_k(N_{fj}{=}1, \bar{p}, p, \cdot)|\mathcal{I}_{kk'})$ and $\mathcal{E}(\pi_k(N_{fj}{=}0, \bar{p}, \cdot)|\mathcal{I}_{kk'})$ equals the true difference plus an i.i.d. disturbance, ν_{fj}, which is mean-zero, given k's information set.

With some additional notation, we can concisely and intuitively characterize equilibrium prices and networks. We define $D_{ha}(N_{f(a)j}{=}1, \cdot)$ equal to the probability that h chooses a given that $f(a)$ reaches an agreement with j and the rest of the network is in equilibrium. For convenience, we define $D_{f,j,in}$ equal to the sum of those probabilities over $a \in \mathcal{A}_f$ such that $D_{f,j,in} \equiv \sum_{a \in \mathcal{A}_f} D_{ha}(N_{f(a)j}{=}1, \cdot)$, and we define $D_{f,j,out}$ analogously. Likewise, we define $D_{f',f,j,in}$ equal to the probability that a hospital selects one of the practices owned by f' given that f is in j's network, and we define $D_{f',f,j,out}$ analogously. Last, we define $Q_j \equiv \sum_{h \in \mathcal{H}} Q_{hj}$, $\mathcal{F}' \equiv \{\mathcal{F} \backslash f\}$, and $\mathcal{J}' \equiv \{\mathcal{J} \backslash j\}$. We can characterize equilibrium prices charged by f in j's network by rewriting equation 9 as

$$\begin{aligned}
&\underbrace{Q_j\left[\left(p^{\star}_{fj} - mc\right) D_{f,j,in} - \left(\bar{p} - mc_f\right) D_{f,j,out}\right]}_{\text{f's gains from treating more enrollees of j}} + \underbrace{\sum_{j' \in \mathcal{J}'} Q_{j'}\left[\left(p^{\star}_{fj'} - mc\right) D_{f,j,in} - (\bar{p} - mc) D_{f,j,out}\right]}_{\text{f's gains from treating more enrollees of j'}\neq\text{ j}} \\
&= \underbrace{Q_j\left[D_{f,j,out}\bar{p}\gamma - D_{f,j,in} p^{\star}_{fj}\right]}_{\text{j's gains diverting to in-network f}} + \underbrace{\sum_{f' \in \mathcal{F}'} Q_j N_{f'j}(D_{f',f,j,out} - D_{f',f,j,in}) p^{\star}_{f'j}}_{\text{j's gains diverting away from in-network f'}\neq\text{f}} \\
&\quad + \underbrace{\sum_{f' \in \mathcal{F}'} Q_j(1 - N_{f'j})(D_{f',f,j,out} - D_{f',f,j,in})\bar{p}\gamma}_{\text{j's gains diverting away from OON f'}\neq\text{ f}} + \underbrace{Q_j\left(D_{f,j,in} - D_{f,j,out} + \sum_{f' \in \mathcal{F}'}(D_{f',f,j,in} - D_{f',f,j,out})\right)\tilde{p}}_{\text{j's gains diverting away from \textit{locum tenens}}},
\end{aligned} \tag{10}$$

where the sum of the terms on the left- and right-hand sides equal f's gains from trade with j and j's gains from trade with f, respectively.

Although algebraically tedious, the effect of add-on acquisitions on equilibrium prices is conceptually straightforward. To see this, consider a market in which f owns a and f' owns a'. Within this market, consider bargaining between f and j. To determine prices, f will hypothetically threaten to leave j's network. Leaving j's network raises f's price, thereby raising its per-unit markup, but also reduces its attractiveness to hospitals, thereby reducing its quantity—a canonical tradeoff faced by producers in almost any market. In many industrial organization studies (e.g., Berry et al. (1995)), where f is assumed to make take-it-or-leave-it offers, prices equate one effect with the other; however, due to bargaining, f splits the surplus, so equilibrium prices set the difference equal to the right-hand side of equation 10. Analogous hypothetical threats are made throughout the market, determining the whole array of preacquisition network relationships and prices.

Now, suppose f is acquired by f'. Also, for the sake of this example, assume that the firm negotiates separate prices for each practice it owns. The acquisition's effect on the equilibrium price charged for a is transparent. Following the transaction, f' internalizes substitution to a' when it threatens to take a out-of-network by appending a positive recapture term to the left-hand side of equation 10. Holding everything else fixed, the only way to balance the left- and right-hand sides is to raise a's price. In other words, add-on acquisitions raise equilibrium prices—precisely what we observe in Figure III.

6 Estimation and estimates

In this section, we describe our estimation procedure. Briefly, we construct moments from the demand and supply sides of the market and then minimize generalized method of moments (GMM) objective functions. On the demand side, we form a likelihood function given standard logit assumptions. On the supply side, we search for parameters that best match negotiated outcomes we observe in our data to ones predicted by our model. We then report the resulting estimates.

6.1 Demand-side moments

One set of moments is derived from the demand system. We define Y_{ha} equal to one if hospital h chooses an exclusive contract with practice a and zero otherwise. Congruently, we define Y_{h0} equal to one if h chooses *locum tenens* and zero otherwise. Adding market m and year t subscripts, the log of the likelihood function evaluated at the true parameters equals

$$\ell(\beta, \theta; \mathbf{Y}_1, \mathbf{Y}_2, ..., \mathbf{Y}_{H_{mt}}) = \sum_m \sum_t \sum_{h \in \mathcal{H}_{mt}} \left[\sum_{a \in \mathcal{A}_{mt}} Y_{hat} \left(X_{at}\beta + N_{f(a)ht}\theta \right) - log \left(1 + \sum_{a \in \mathcal{A}_{mt}} e^{X_{at}\beta + N_{f(a)ht}\theta} \right) \right], \quad (11)$$

where $\mathbf{Y}_h$ denotes $(Y_{h1}, Y_{h2}, ..., Y_{hA_{mt}})$.

Maximizing the expected value of the function with respect to each of the demand-side parameters provides $K+2$ moments: $\mathbb{E}[\partial\ell/\partial\beta_k] = 0$ for $k = 0, 1, ..., K$ and $\mathbb{E}[\partial\ell/\partial\theta] = 0$. We construct the sample analogs of these moments, which are given by

$$\frac{\widehat{\partial\ell(\cdot)}}{\partial\beta_k} = \frac{1}{MT} \sum_{m,t} \frac{1}{\#_{\mathcal{H}_{mt}}} \sum_{h \in \mathcal{H}_{mt}} \sum_{a \in \mathcal{A}_{mt}} x_{kat} \left[\frac{1}{\#_{\mathcal{A}_{mt}}} Y_{hat} - \frac{e^{X_{at}\beta + N_{f(a)ht}\theta}}{1 + \sum_{a' \in \mathcal{A}_{mt}} e^{X_{a't}\beta + N_{f(a')ht}\theta}} \right] \quad (12)$$

for $k = 0, 1, ..., K$ and

$$\frac{\widehat{\partial\ell(\cdot)}}{\partial\theta} = \frac{1}{MT} \sum_{m,t} \frac{1}{\#_{\mathcal{H}_{mt}}} \sum_{h \in \mathcal{H}_{mt}} \sum_{a \in \mathcal{A}_{mt}} N_{f(a)ht} \left[\frac{1}{\#_{\mathcal{A}_{mt}}} Y_{hat} - \frac{e^{X_{at}\beta + N_{f(a)ht}\theta}}{1 + \sum_{a' \in \mathcal{A}_{mt}} e^{X_{a't}\beta + N_{f(a')ht}\theta}} \right], \quad (13)$$

where # represents the cardinality of the set that subscripts it. Intuitively, minimizing these equations matches predicted choice probabilities as closely as possible to what we observe hospitals actually choose in our data.

We minimize a GMM objective function. We stack the moments described above such that $\xi(\beta,\theta) = [\widehat{\partial\ell(\cdot)}/\partial\beta_0, \widehat{\partial\ell(\cdot)}/\partial\beta_1, ..., \widehat{\partial\ell(\cdot)}/\partial\beta_K, \widehat{\partial\ell(\cdot)}/\partial\theta]'$. Our estimates satisfy

$$\hat{\beta}, \hat{\theta} = \underset{\beta,\theta}{\operatorname{argmin}} \left\{ \xi(\beta,\theta)\xi(\beta,\theta)' \right\} . \tag{14}$$

6.2 Supply-side moments

For estimation purposes, we parameterize marginal costs such that they are additively separable in a constant and time trend (i.e., $mc_t = \lambda_0 + \lambda_t t$), and we assume that prices are measured with error (i.e., $p^{\text{obs.}} = p^{\star} + \eta$, where η is i.i.d. noise).[22] Given a vector of candidate parameters such as $[\lambda_0 \ \lambda_t]$ alongside our demand estimates obtained from equation 14, we can solve for N_{fjt} and p_{fjt}. We then compute moments given by

$$\psi_t(\lambda_0, \lambda_t) = \frac{1}{M}\sum_{m=1}^{M} \frac{1}{\#_{\mathcal{F}_{mt}}} \frac{1}{\#_{\mathcal{J}_{mt}}} \sum_{f\in\mathcal{F}} \sum_{j\in\mathcal{J}_{mt}} p_{fj}^{\text{obs.}} - \frac{1}{M}\sum_{m=1}^{M} \frac{1}{\#_{\mathcal{F}_{mt}}} \frac{1}{\#_{\mathcal{J}_{mt}}} \sum_{f\in\mathcal{F}} \sum_{j\in\mathcal{J}_{mt}} p_{fj}^{\star}(\lambda_0, \lambda_t; \hat{\beta}, \hat{\theta}).$$

for t from 1 to T. We stack the moments such that $\psi(\lambda_0, \lambda_t) = [\psi_1(\cdot), ..., \psi_T(\cdot)]$. Throughout estimation, we maintain that $\gamma = 0.8$.

Our initial estimates satisfy

$$\hat{\lambda}_0, \hat{\lambda}_t = \underset{\lambda_0,\lambda_t}{\operatorname{argmin}} \left\{ \psi(\lambda_0, \lambda_t) \ \mathbb{I} \ \psi(\lambda_0, \lambda_t)' \right\} , \tag{15}$$

where $\mathbb{I}$ represents a $2T$-by-$2T$ identity matrix that weights each moment equally. For efficiency, we then substitute the inverse of the empirical analog of the variance-covariance matrix of the moments evaluated at our estimates for the identity matrix in equation 15—we replace $\mathbb{I}$ with $\hat{\Omega}^{-1}$, where $\hat{\Omega} = \psi(\hat{\lambda}_0, \hat{\lambda}_t)' \ \psi(\hat{\lambda}_0, \hat{\lambda}_t)$. Our final estimates satisfy equation 15 following this substitution.[23]

6.3 Results

Table III reports our estimates. Columns 1-2 cover the full sample period. Data quality improved rapidly over the first two years of the sample period, while the global pandemic may have impacted the final two years, so we excluded these periods and re-estimated the model. Columns 3-4 cover the narrower sample

[22]The purpose of ν and η are to rationalize out-of-network arrangements and prices that the model would not otherwise predict. We could instead specify that, e.g., marginal costs contain an i.i.d. disturbance such that $mc_t = \lambda_0 + \lambda_t t + \omega$, with ω in all agents' information sets. This would require us to assume a distributional form and estimate the parameters that govern it using a method of simulated moments (McFadden, 1989), but this is much more computationally demanding than what we propose here.

[23]Based on results reported in Section 4 and Appendices C.2-C.5 (and for other reasons described in Section 5), the model focuses on changes in competition rather than on differences in negotiating skill or financial sponsor involvement. At least in theory, additional moments (e.g., the relationship between preacquisition market structure and postacquisition price changes reported in Figure IV) could identify precisely how surplus is split.

period. We use the final set of coefficients in our counterfactual equilibria simulations, although this choice does not have a significant impact on figures obtained from those estimates. Also, regardless of which period we consider, the average out-of-network share of practice-insurer pairs is about 17%, while $\bar{p}$ and $\tilde{p}$ are around $123 and $92, respectively.

Panel A displays demand-side estimates of the model. We find that, as expected, hospitals strongly prefer in-network practices, consistent with claims by Cooper et al. (2019). We also find that hospitals prefer larger practices, which conforms with publicly accessible RFPs (see Section 5.2). All coefficients are significant at 1% or less. Only the constant term differs with the sample period.

Table III: *Parameter estimates*

Panel A: Demand-side estimates					
In-network	$\hat{\theta}$	1.5023		1.5920	
		(.1088)		(.1406)	
Size of practice	$\hat{\beta}_1$	.0128		.0140	
		(.0002)		(.0003)	
Constant	$\hat{\beta}_0$	-3.4176		-1.9331	
		(.1196)		(.2020)	
Panel B: Cost-side estimates					
Constant	$\hat{\lambda}_0$	55.3404	30.6039	52.5952	44.3865
		(.878)	(1.620)	(1.069)	(1.867)
Time trend	$\hat{\lambda}_1$		4.9577		3.3570
			(.275)		(.627)
Sample period		All years	All years	2014-2019	2014-2019
Number of markets (M)		18	18	18	18
Number of periods (T)		11	11	6	6
Hosp.-market-year observations		2,771	2,771	1,326	1,326
Firm-market-year observations		2,439	2,439	1,372	1,372

Column 1-2 estimates reflect the full sample period, while column 3-4 estimates exclude the earliest and latest years of the panel. Standard errors are clustered at the practice level.

Panel B corresponds to the supply-side of the model. We find that the mean marginal cost of anesthetizing a patient is around $55 per 15 minute interval of clinician time. This figure is sensible for two reasons. First, it implies an average margin equal to approximately 40%. One large financial sponsor, Mednax, completed an initial public offering prior to the start of our data, so its audited financial statements provide a point of comparison. Over our sample period, the firm's gross profit margin averaged 38%.[24] Second, it

[24]We obtain their cost of services sold (COSS) by adding "Practice salaries and benefits" and "Practice supplies and other operating expenses." We subtract revenue from COSS and divide the result by revenue to obtain an all-payor gross margin. To obtain a private-payor gross margin, we account for the fact that 25% of its payments comes from government sources and that the ratio of government-to-private-payor prices is about 1:1.3. Mednax consolidates pediatric and neonatal operations into these figures, so we must implicitly assume that these specialties have the same revenue-cost structures.

implies a per-hour marginal cost of $220, of which the majority is clinician compensation. Based on federal income tax returns, Gottlieb et al. (2023) report that anesthesiologists earn around $185 per hour.

7 Counterfactual simulations

In this section, we simulate the effects of antitrust remedies and policy changes on equilibrium outcomes.

7.1 Antitrust remedies and competition policy changes

7.1.1 Unwinding completed transactions

Courts may order platforms to divest add-on acquisitions. In many contexts, this form of remedy is impracticable. Shortly after merging, parties may share competitively sensitive information and commingle complicated assets. In these cases, unwinding the consummated transactions might be likened to "unscrambling eggs." Historically, this challenge was appreciated by firms and legislators alike: it induced a wave of "midnight mergers" among businesses between 1950 and 1975 and prompted Congress to establish the US Premerger Notification Program in 1976.

In our setting, however, the costs of unwinding acquisitions are minimal. Concerns that divestitures will disrupt long-term research projects or destroy long-established brands are virtually non-existent. Instead, the main changes involve business activities that are directly related to the behavior we study (i.e., the negotiation of networks and prices) and/or easy to outsource (e.g., procurement and payroll). From an operational standpoint, divestiture merely re-establishes firms whose preacquisition scale and sophistication enabled them to win exclusive contracts with hospitals and attract highly trained medical professionals. Yet, from a consumer welfare standpoint, divestiture eliminates the internalization of business-stealing externalities that add-ons and platforms impose on each other, so prices are expected to fall.

We simulate the effects of unwinding by counterfactually re-establishing acquired firms and assigning clinicians accordingly.[25] We then compute equilibrium networks and prices in the final year of the sample period, denoted $N^{\star}_{mT}$ and $p^{\star}_{mT}$, respectively. Finally, we calculate expected anesthesia expenditures using hospital choice probabilities, given the negotiated outcomes and demand parameters. Baseline expenditures are obtained by repeating this process but using observed market structures (rather than "unwound" ones).

Panel A of Figure VI reports this result. We find that unwinding reduces annual expenditures between $327,000 to $25 million, depending on the market. In total, it saves payors over $96 million, or 4%, each year. If we assume a 10% discount rate and, for the purposes of this exercise, impose that these differences persist for 7.1 years (i.e., the average duration that a private investment fund holds a portfolio company),

[25]Certain platforms administratively subsume some of the practices they acquire, which raises a question of how to assign clinicians who have joined the platform following the first add-on acquisition. Given that turnover among clinicians is low, meaning the assignment mechanism has a small effect our calculations, and since legal considerations will swamp economic ones, we simply assign clinicians to practices in proportion to their preacquisition size.

the present value exceeds \$472 million.[26]

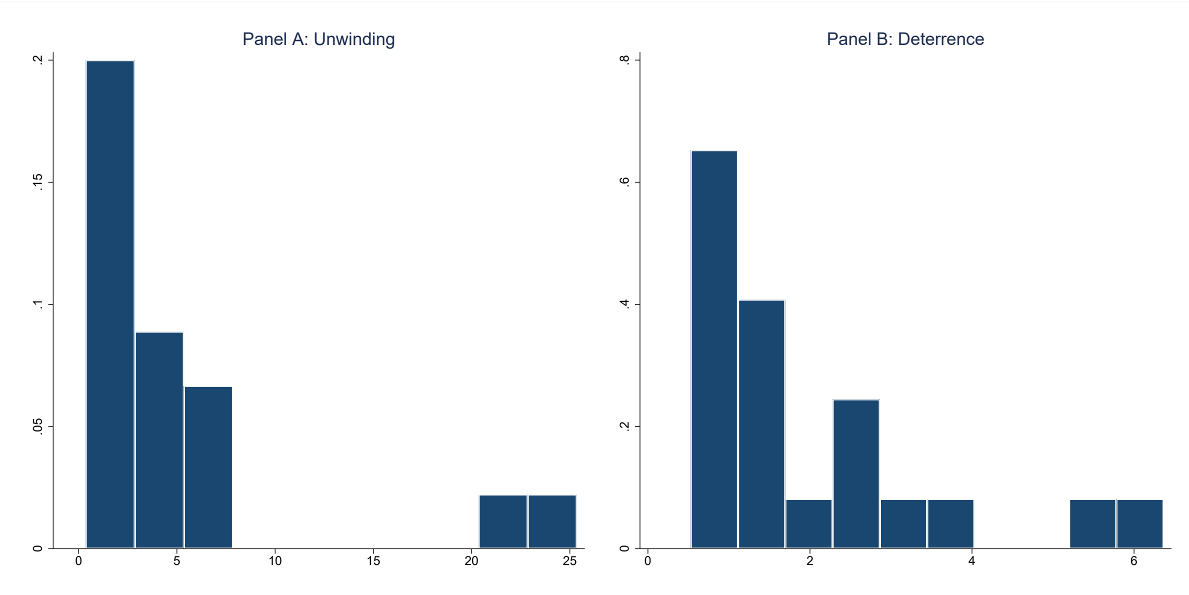

Figure VI: *Effect of unwinding and deterrence on anesthesia expenditures*

This figure plots the distribution of changes in anesthesia expenditures across markets. Panel A corresponds to unwinding completed add-ons, while Panel B corresponds to deterring incipient add-ons. Expenditures are measured in millions of constant 2021 USD. Notice that the vertical axes have different scales.

7.1.2 Deterring incipient transactions

Given the novelty of the case before the court, agents' beliefs may strongly depend on how the litigation is resolved. If the court orders remedies that defendants find costly, then sponsors that would have otherwise formulated and financed additional rollups might be deterred from doing so. In other words, addressing past antitrust violations may reduce future occurrences. The same result may also be reached by recently proposed changes to the US Premerger Notification Program, such as the Notice of Proposed Rulemaking published June 29, 2023, which could require additional disclosures of add-on acquisitions: knowing that these transactions will be reported to and scrutinized by the DOJ and FTC, the parties may not attempt them in the first place.

For this exercise, we turn attention to markets in which a sponsor has acquired a platform but has not, at least by the end of our sample period, completed any add-on acquisitions. Compared to the 18 markets we study in the rest of this paper, the 67 markets we examine here are less affluent, smaller, and have witnessed much more recent platform acquisitions (see Table I). A plausible explanation is that sponsors merely prioritized the 18, suggesting that rollups in at least a subset of the 67 are imminent. To eliminate

[26]Duration is reported by S&P Global (https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/private-equity-buyout-funds-show-longest-holding-periods-in-2-decades-79033309, accessed August 30, 2024). The figure is illustrative, i.e., the true duration of savings is probably longer, as we rarely observe entry in anesthesia markets.

confusion, we call the 18 MSAs studied in the rest of this paper "rollup markets," and we call the 67 MSAs with sponsors but not add-ons "standalone markets," following industry convention.

We simulate the effects of deterrence as follows. First, in the rollup markets, we compute the average market shares of platforms and add-ons at the time of their acquisitions, which are 28% and 9%, respectively (as in Table II). Second, in the same set of markets, we compute the average number of add-ons per platform, which is just over two (again, as in Table II). Third, in standalone markets, if more than one platform exists, we choose the one whose share is closest to 28%. Fourth, in the same set of markets, from the remaining firms, we select the two whose shares are closest to 9% and combine them with the platform. Fifth, we compute equilibria and calculate average market outcomes, i.e., expected expenditures per market. Implicitly, we assume that if the courts impose costly remedies on defendants (or legislators or agencies amend premerger notification statutes and rules, respectively, in a manner described above), then none of these transactions will occur, but if they do not, then all will occur.

Panel B of Figure VI reports this result. We find that deterrence reduces annual anesthesia expenditures between about \$528,000 and \$6 million, depending on the market. In comparison to Panel A, more markets are represented, but the average effects are muted, owing to the smaller size of these markets. In total, deterrence saves payors around \$40 million each year. In one sense, this figure overestimates the remedies' and/or policies' impact. As only a portion of these hypothetical rollups are likely to occur, a more realistic approach might involve assigning each a 50% probability. In another sense, this figure may *grossly underestimate* savings. In recent years, rollups are consolidating other medical specialty markets—radiology, oncology, gastroenterology, to name a few. Antitrust counsel to sponsors and their platforms are undoubtedly closely monitoring *FTC v. USAP* and related, incipient litigation, so add-ons in those industries may also be deterred.

7.1.3 Potential entry

In many industries, high profits attract entrants that undercut existing prices. In this way, entry can safeguard markets against anticompetitive behavior. Moreover, even the mere threat of entry can deter anticompetitive arrangements that are costly to establish.[27] In the anesthesia industry, entry is undoubtedly hard (see Section 2.2), although it may be periodically profitable. Were it to occur, the challenge would presumably arise from a large practice in an adjacent market. Thus, sponsors and their platforms have—putting aside any antitrust considerations—incentives to pay nearby rivals not to enter.

Consistent with these concerns, USAP reached at least one such agreement with a potential competitor (complaint, pp. 59-61). Prior to its acquisition by USAP, Pinnacle had a management/service contract with EmCare, whose parent company, Envision, operated anesthesia practices across the country. In November 2013, BR and KB, on behalf of WCAS and USAP, respectively, negotiated a confidentiality agreement with EmCare and proposed a deal. According to a WCAS employee, "What USAP and Welsh Carson really

[27] See, e.g., p. 30 of Starc and Wollmann (2024).

wanted was 'an agreement [for Envision] *not to compete with us generally in the DFW market*'" (emphasis added but substitution made in original, p. 60). Two months later, the parties agreed that USAP would pay EmCare $9 million each year through 2019 in exchange for which "Envision agreed not to compete against USAP for anesthesiology services in the Dallas-Fort Worth market" (complaint, p. 61).

Following the FTC, we interpret this arrangement as a market allocation agreement. At the present moment, it is unclear whether the 2014 contract—or more precisely, the explicit agreement embodied by the contract—is in force.[28] However, it is reasonable to assume that the court's treatment of these claims will influence whether similar agreements are made in the future. By extension, the court's determination will also affect the frequency at which entry occurs in this industry and others like it.

Motivated by these events, we simulate the effects of entry. To do so, we counterfactually move clinicians from nearby MSAs to create new practices. For each rollup market m', we list potential donor markets by identifying those within 75 miles that do not experience a rollup. From these markets, we list potential donor practices by identifying those whose firms do not currently own a practice in m'. From these practices, we identify the largest, draw ϕ clinicians from it, and form an entrant that will compete in m'. Finally, we compute equilibria outcomes in m' and its corresponding donor market. To assess sensitivity to ϕ, we vary it between 8 and 59, the 10th and 90th percentiles of the size distribution of add-on acquisition targets, respectively.

Table IV reports the result. Entry sharply reduces expenditures in rollup markets by between $6 million and $40 million, depending on the number of clinicians that move. However, as competition intensifies in these areas, it diminishes in nearby ones, where prices rise and hospitals switch to *locum tenens* at the margin. About 40-43% of the reduction is offset by higher expenditures in donor markets. On net, at most, expenditures decline less than $23 million. Conceptually, clinicians are in short supply, so entry entails tradeoffs. Overall, its effects are small when compared to, e.g., unwinding completed add-ons.

Table IV: *Effects of entry*

	Entrant size (clinicians)				
	8	9	22	35	59
Expenditure changes (in millions):					
Rollup markets	-5.8637	-6.5656	-15.600	-24.201	-39.981
Donor markets	2.4381	2.7186	6.1965	9.9911	17.357
All markets (row 1 + row 2)	-3.4256	-3.8469	-9.4040	-14.210	-22.623
Percent reduction by donor markets (row 2 / | row 1 |)	.4157	.4140	.3972	.4128	.4341

Rollup markets experience entry, reducing expenditures. Donor markets cede clinicians from their largest practices, increasing prices. We vary the size of entrants based on the distribution of the size of add-on acquisition targets (see the text for details).

[28]The FTC issued a civil investigative demand requesting contracts between Envision and the defendants executed after January 1, 2018, presumably to ascertain whether the term of the agreement was extended beyond 2019. However, the responses are under seal.

7.2 Healthcare policy

State and federal health policies can affect parameters in our model and, in turn, impact prices. We focus here on balance billing restrictions, which are rapidly evolving due to new legislation. Over the past two decades, more than 30 states enacted statutes that at least partially protect patients from out-of-network charges incurred at in-network facilities.[29] Most are limited (e.g., many apply only to emergency department visits). To provide uniform nationwide protection, Congress passed the No Surprises Act (NSA) in December 2020. The law took effect on January 1, 2022 but its exact contours are unknown at the time of writing, and balance billing persists in many forms.[30]

Cooper, Scott Morton, and Shekita (2020) show that "surprise out-of-network billing is the result of a market failure" and propose reforms that encourage hospitals to more completely internalize out-of-network charges. These changes draw inspiration from "bundled payment" models that have been used in other areas of the healthcare sector to align providers' incentives. In our model, such reforms most closely correspond to raising θ. As θ rises, out-of-network practices see fewer patients. Intuitively, firms' threats to take their practices out-of-network lose credibility with insurers, so prices fall. To quantify how prices respond to changes in θ, we assume that its true value equals our estimate of it and then simulate equilibria given counterfactual parameter values. For each value, we compute the average price across rollup markets in the final year of our sample.

Panel A of Figure VII shows what happens when we vary hospitals' preferences for in-network providers. Prices are falling in θ, in part because greater numbers of firm-insurer pairs reach agreement, meaning the reform works as Cooper et al. (2020) suggest. However, prices decrease at a decreasing rate. Even if policymakers effectively raise θ by one-half, $p^\star$ still exceeds mc by around 20%.

The reforms described above may also correspond to raising γ, whose relationship with equilibrium prices is much less clear. If the network is held fixed, then as γ rises, insurers' gains from trade rise. To ensure the increasing surplus is split with firms, prices will rise as well. However, if the network is not held fixed, then as γ rises, more insurer-firm pairs agree on an in-network price. Since $p^\star < \bar{p}$ in our data, prices will fall. To resolve this ambiguity, we follow the same procedure used above to determine how prices change with hospitals' preferences for in-network providers.

Panel B of Figure VII reports the result of varying insurers' responsibility for out-of-network charges. In the markets we study and a neighborhood around our parameter estimates, higher γ equate to higher rather than lower prices. However, the impact is relatively small. Raising γ by 10% only increases $p^\star$ by around 2%.

[29]For background, most US healthcare patients restrict themselves to in-network providers, so the idea that out-of-network services could be arranged for them without their consent (at a very high price) is, at best, controversial. The canonical case involves patients who arrive at hospitals unconscious, meaning they are physically incapable of ensuring that they receive in-network care. In our setting, a patient may choose an in-network surgeon and facility only to unwittingly receive out-of-network anesthesia.

[30]The contours depend on a growing set of rules issued by the Departments of Health and Human Services, Labor, and the Treasury as well as ongoing litigation. For instance, in August 2023, a Texas court vacated important provisions of the act related to how disputed charges are resolved. Anecdotal evidence that balance billing persists is readily available from, e.g., Google reviews. A large number of negative reviews specifically reference surprise charges for anesthesia administered after the effective date of the NSA.

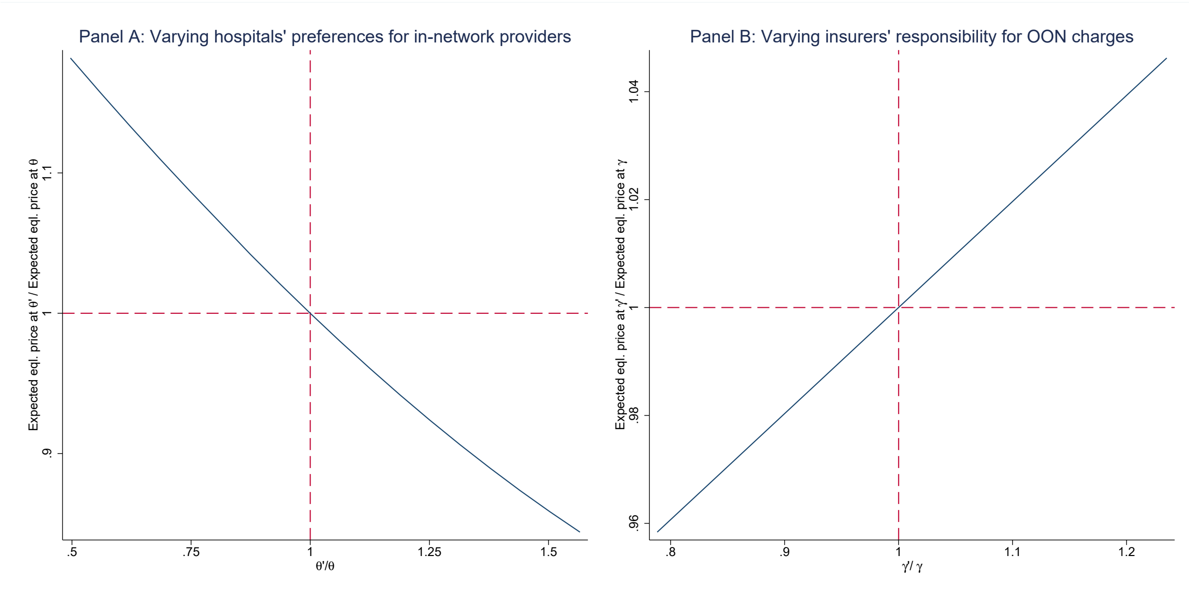

Figure VII: *Comparative statics*

This figure reports the relationships between equilibrium prices and model parameters. Panel A corresponds to variation in hospitals' preferences for in-network providers, while Panel B corresponds to variation in the share of out-of-network charges paid by insurers. θ' *and* γ' *denote counterfactual values of* θ *and* γ*, respectively.*

8 Conclusion

We study the economic consequences of rollups among healthcare service providers in the US anesthesia industry. We find that serial acquisitions of clinician practices backed by investment funds have consolidated a geographically dispersed set of markets, consistent with the characterization of the rollup as a "buy-and-build" strategy. Prices increased by approximately 35% following add-on acquisitions. A host of other patterns in the data indicate that the increases reflect the internalization of business-stealing effects—less competition—rather than other explanations, such as changes in quality, negotiating ability, or pricing tactics employed by sponsors. We use the descriptive facts to inform a structural model. We estimate the model and use the estimates to simulate counterfactual equilibria. We considered various remedies and policies that are especially likely to be ordered or implemented in the near future.

We reach three broad conclusions. One is that while health policy research focuses on differences between *types of providers* (e.g., for-profit vs. not-for-profit, physician-owned vs. corporate-owned, public vs. private capital), we find that *competitive considerations* can swamp those concerns. In short, negotiated prices can exhibit exceptionally steep price increases following acquisitions by competing providers. Our second conclusion is that the techniques offered by industrial organization economics may suffice to make sense of many price changes precipitated by rollups. In turn, we find that remedies available through antitrust law may suffice to correct them. Our third conclusion is that the deterrence of subsequent rollups may reduce healthcare expenditures as much as unwinding completed ones. This could arise from an adverse judgment against USAP. Alternatively, it may result from rule and law changes that directly address stealth consolidation, complemented by negotiated settlements, such as WCAS's recent agreement with FTC to obtain prior approval before completing certain transactions with hospital-based physician practices.

Much more work is needed in this area. There is no "clearing house" for private contracts like acquisitions, so the full extent of rollups in healthcare service industries is still unknown. Carefully constructed datasets are needed to uncover sector-wide consolidation. Moreover, follow-on research could provide a more complete picture of their non-price effects, including their clinical consequences for patients. Longer-term impacts—including subsequent consolidation—are also likely to affect markets for physician services (Berquist et al., 2025). Finally, prices may respond differently to sponsor-backed consolidation in other markets, inside and outside the healthcare sector.

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Supplementary (Online) Appendix

A [Supplementary Appendix] Additional institutional details

A.1 Novelty of case

Federal Trade Commission vs. US Anesthesia Partners and Welsh Carson Anderson & Stowe represents "novel" and "groundbreaking" federal antitrust litigation.[31] The suit is perhaps best summarized by Greenberg Traurig, an established multinational law firm, which states,[32]

> The FTC's recently filed lawsuit has, for the first time, focused enforcement action on the so-called "roll up" strategy often employed by private equity firms investing in the space . . . as a potentially anticompetitive scheme and one that has to this point escaped review.

The lawsuit *challenges a series of sponsor-backed completed transactions under US merger law*. It resembles, but nonetheless differs from, previous federal antitrust litigation, which are summarized below.

One set comprises seminal "trust-busting" lawsuits from the turn of the twentieth century. For instance, in 1890, James Buchanan Duke created the American Tobacco Company by merging the five largest cigarette manufacturers. That same year, Congress passed the Sherman Act to address precisely these types of arrangements. In 1911, The Supreme Court ordered the dissolution of the combination under the Sherman Act in the same month that it required the breakup of John D. Rockefeller's Standard Oil.[33] In both cases, the defendants were convicted (under the Sherman Act) of engaging in arrangements that restrained trade and monopolized the market rather than being found in violation of merger laws (i.e., the Clayton Act, which was passed three years later in 1914).

The government also challenged Grinnell's controlling ownership in three companies, which collectively controlled more than 87 percent of the fire and burglary alarm services market, alleging monopolization in violation of the Sherman Act.[34] In 1966, the Supreme Court ordered Grinnell to divest its holdings in the three companies. Additionally, the court required ADT, the largest provider controlling 73 percent of the market, to divest certain assets. Once again, the challenges were brought under the Sherman Act, which prohibits unreasonable restraints of trade and monopolization, rather than the Clayton Act, which makes mergers that substantially reduce competition illegal.

In 2011, the DOJ and several state attorneys general required Dean Foods to divest a milk processing plant and notify the agencies before acquiring any other plants whose purchase price would exceed $3 million. The DOJ states that the notification requirement was intended to "prevent serial acquisitions." However, the litigated transaction was itself not a serial acquisition (i.e., part of any rollup). Likewise, in 2020, the DOJ and two state attorneys general required Dairy Farmers of America to divest three milk processing plants and notify the agencies before acquiring any other plants. Once again, the DOJ indicates that the notification requirement was intended to prevent "serial acquisitions," but the "serial" adjective did not refer to the litigated transaction.

[31] See Holland & Knight and Shearman & Sterling (https://www.hklaw.com/en/insights/publications/2023/09/ftc-sues-private-equity-firm-portfolio-company-over-anesthesiology and https://www.aoshearman.com/en/insights/antitrust-focus-on-private-equity-funds-and-serial-acquisitions, respectively, accessed August 10, 2024).

[32] See https://www.gtlaw.com/en/insights/2023/10/ftc-sues-private-equity-fund-and-us-anesthesia-partners-over-alleged-roll-up-acquisitions-anticompetitive-scheme (accessed August 10, 2024).

[33] United States v. American Tobacco, 221 U.S. 106 (1911); Standard Oil Co. of New Jersey v. United States, 221 U.S. 1 (1911).

[34] United States v. Grinnell, 384 U.S. 563 (1966).

In 2022, the FTC required JAB Consumer Partners to divest specific veterinary clinics and inform the agency about any future clinic acquisitions as a prerequisite for approving its acquisition of Ethos and Sage (FTC (2022a), FTC (2022b)). JAB is a financial sponsor and the consent agreements mention "serial" acquisitions; however, the litigation addressed standalone, incipient transactions. In other words, the FTC challenged individual deals before the parties consummated them, not any sequence of transactions that the target or acquirer may have alleged completed in the past. (Due to this confusion, some have mistakenly referred to the lawsuit as addressing a rollup.)

A.2 Regulatory environment

A.2.1 Noncompete Agreements

Texas state statutes permit noncompete agreements. In fact, U.S. District Court for the Northern District of Texas recently enjoined the Federal Trade Commission from enforcing its ban on noncompetes. Nonetheless, Texas law mandates that noncompete agreements for physicians include a buyout provision. Similarly, New York and New Jersey do not have statutes that ban noncompete agreements. Instead, these states leave it up to the courts to decide whether a noncompete agreement is reasonable and therefore enforceable.

The only exceptions are noncompete agreements for domestic workers, which are banned in New Jersey, and those for broadcast employees, which are banned in New York. In Nevada, noncompete clauses are permitted, except for hourly employees. In Colorado, while covenants that restrict a physician's right to practice medicine are banned, agreements with such covenants are permitted to require the physician to pay damages in case of termination. In contrast, states like California, North Dakota, Minnesota, and Oklahoma completely prohibit noncompete agreements. Meanwhile, other states, including New Mexico, Missouri, Georgia and Florida enforce specific bans on noncompete agreements involving medical professionals.

A.2.2 Balance Billing Restrictions

As of 2024, Texas state law ensures that consumers with state-regulated health plans are not subject to balance billing for emergency services or for services at in-network facilities when patients cannot choose their doctors. Similarly, Colorado state law prevents consumers with state-regulated health insurance plans from being balance-billed if they unknowingly receive care outside of their insurance network. In Nevada, state laws prohibit balance billing in certain emergency situations. In New York, which was the first state to enact a ban on surprise medical bills, state laws protect consumers from unexpected charges for emergency services and for treatments by an out-of-network provider at healthcare facilities within their plan's network. In New Jersey, state laws prevent the practice of balance billing patients that have insurance policies subject to the state's protections. The ban applies to emergency care as well as non-emergency care when a patient is treated by an out-of-network provider without their knowledge. In contrast, many states, such as Wyoming, Idaho, North Dakota (except for air ambulance bills), South Dakota, Wisconsin, and Kentucky, do not have local statutes that ban surprise billing.

A.2.3 Corporate Practice of Medicine Laws

Colorado, Nevada, New York, New Jersey, and Texas have regulations that prohibit physicians from being employed by non-physicians to provide healthcare services. However, physicians in these states are allowed to enter into independent contractor agreements with non-physicians, as long as the physician's medical decision-making is not controlled by the non-physician. Indeed, the Management Service Organization ("MSO") model, which involves an independent contractor relationship between physicians and non-physicians for the provision of a broad set of services, is commonly employed and widely accepted.

A.3 Outsourced payor negotiations

The following list details outsourced contract negotiations described in Section 4.

1. Dallas-based Pinnacle utilized EmCare Anesthesiology Services.
   (complaint at 61)
   EmCare Anes. Services offers clients "managed care contracting expertise."
   (https://web.archive.org/web/20150801092334/https://www.emcare.com/SOLUTIONS/ANESTHESIOLOGY)
2. Anesthesia Consultants of Dallas and Excel utilized Abeo.
   (https://web.archive.org/web/20121017063406/http://www.excelanesthesia.com/practical_info.html and https://web.archive.org/web/20130723200541/http://anesthesiadallas.com/contact2.html))
   Abeo's services are described in the main text.
3. Greater Houston utilized iMed.
   (https://web.archive.org/web/20131230172804/http://nhanesthesia.com/patient-center/billing/)
   iMed specializes in "contract negotiation" with "managed care organizations"
   (https://web.archive.org/web/20101007225723/http://imedgroup.com/Services/managed_care/managed_care.htm)
4. North Houston utilized Deerwood MSO.
   (https://web.archive.org/web/20131230172804/http://nhanesthesia.com/patient-center/billing/)
   Deerwood MSO offers "contracting and credentialing with payer groups."
   (https://web.archive.org/web/20110202154108/http://deerwoodmso.com/)

All websites were accessed October 3, 2024.

B [Supplementary Appendix] Sample construction

Table B.1 reports the number of observations eliminated by sample restrictions.

Table B.1: *Sample construction*

Total number of HCCI inpatient and outpatient claims with anesthesia charges:	67,748,541
Enrollees over 65, non ESI and not primary coverage	7,373,129
Missing facility location or billing NPI	9,079,037
Negative or zero anesthesia units/allowed amount	4,397,193
Claims that seem duplicated in both inpatient and outpatient data	1,274,684
Missing provider billing NPI, patient characteristics or facility MSA	985,234
Admissions with more than one anesthesia procedure	6,600,275
Collapse physician and CRNA's claims into a single observation	4,657,998
Facility is out of network	744,542
Collapse physician and CRNA's claims into a single observation	4,657,998
Keep only most frequent billing NPI used by providers in a quarter	3,792,786
Patient-episodes with any comorbidity	2,045,915
Nonstandard insurance products, i.e., not EPO, HMO, PPO, or POS	56,280
CPT codes with less than 1,000 episodes	696,981
Quarters where providers have ten times or less observations than their average	32,299
Length of stay exceeds the 99th percentile of its distribution	201,889
Facility or anesthesia allowed amounts below the 1st or above the 99th percentile of its distribution	909,973
Anesthesia units below the 1st or above the 99th percentile of its distribution	675,557
MSA's with less than 10,000 admissions	1,671,821
Total number of claims in the sample:	22,552,948

Ambulatory surgical centers and on-campus outpatient hospital services each account for around 45% of claims in our sample. Inpatient procedures account for the remaining 10%. For each claim, we compute total allowed amount, which includes the insurer's payment and the member's cost share in dollars (i.e., co-insurance, co-pay, and deductible). We then compute total units by multiplying HCCI's "base" unit measure by its "mod" factor, which adjusts for the complexity of the procedure and health of the patient, and then dividing through by its "time" factor, which ensures prices are in terms of 15-minute intervals. We compute quantity and price at the practice-quarter level using the procedure described in the main text. The result constitutes our main sample.

To assess robustness, we later employ an alternative, obstetrics-only sample. To construct it, we restrict attention to CPT codes related to labor/delivery. Primarily, these comprise epidurals. In obstetrics, clinicians typically bill on a per-procedural rather than per-time-unit basis (Vaidyanathan, 2022), so we disregard the stated number of units and set them equal to one for each claim. We then compute quantity and price using the procedure described in the main text.

C [Supplementary Appendix] Additional tables and figures

C.1 Actual vs. predicted HHI changes

To summarize the 18 panels that comprise Figure I, we pool market-year observations and plot all actual and predicted HHI changes against one another. Figure C.1 reports the result. See the body of the text for a summary.

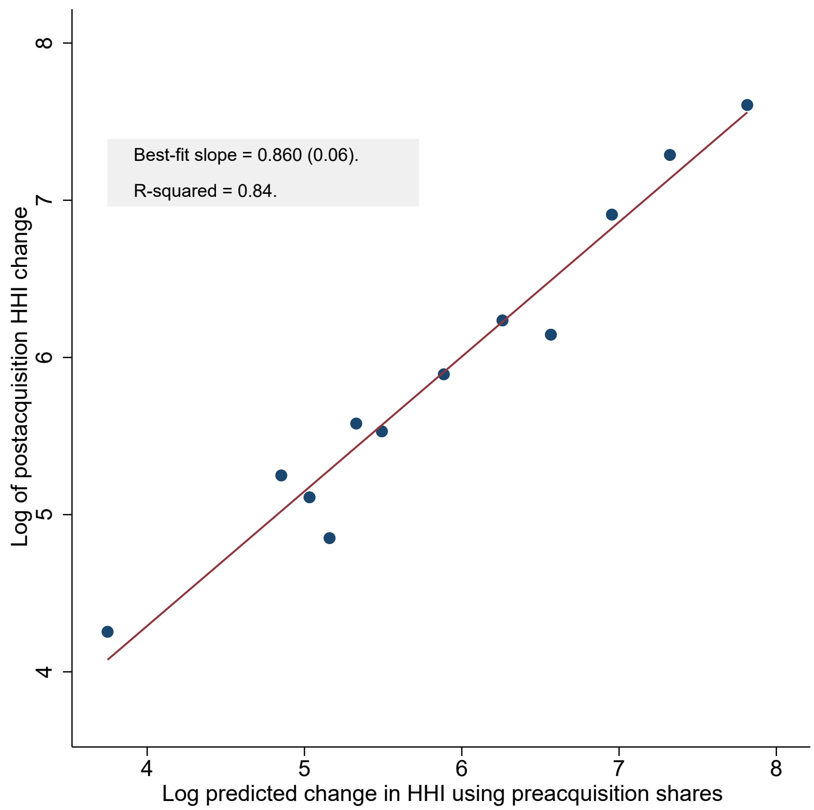

Figure C.1: *Actual vs. predicted HHI changes*

This figure plots the log of $\widehat{\Delta HHI}$ on the x-axis against the log of ΔHHI on the y-axis. Due to right skew in the distribution of both measures, we display log values. The unit of observation is a market-year. For legibility, observations are binned according to x-axis values, and means within the bins are reported.

C.2 Incorporation of hospital fixed effects

To further assess robustness, we append hospital fixed effects to equation 1. Figure C.2 reports the result, which closely resembles the preceding graph.

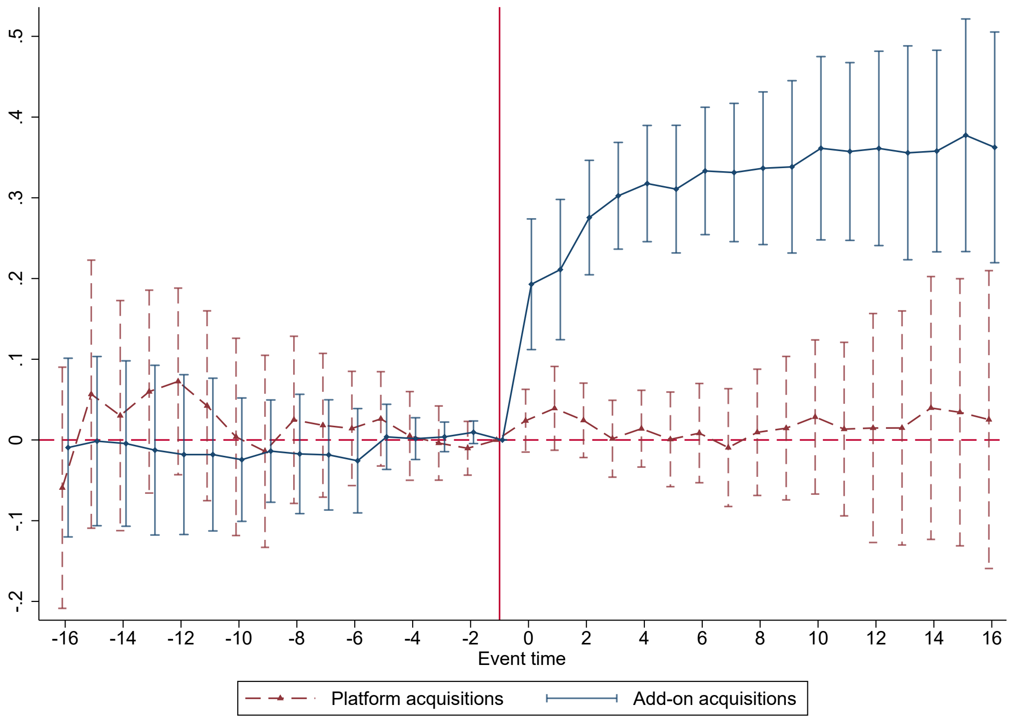

Figure C.2: *Prices rise following add-on but not platform acquisitions.*

This figure reports the result of estimating equation 1 with hospital fixed effects. The solid line corresponds to add-on acquisitions; the dashed one corresponds to platform acquisitions (i.e., the first acquisition by a sponsor in a market). We normalize μ^{τ}=0 for τ=-1 and mark this period with a vertical red line. Standard errors are clustered at the target level.

C.3 Obstetrics

Since anesthesia for obstetrics is priced differently than anesthesia for other procedures, we exclude these procedures from our main sample to maintain comparability across observation units. To assess robustness of our main descriptive results to this exclusion, we construct an alternative sample that consists only of obstetrics-related anesthesia and then repeat the process used to generate Figure III in the main text. Figure C.3 reports the results, which very closely resemble the ones obtained from the main sample: prices are stable leading up to add-on acquisitions; prices rise abruptly following add-on acquisitions; and prices do not respond to platform acquisitions.

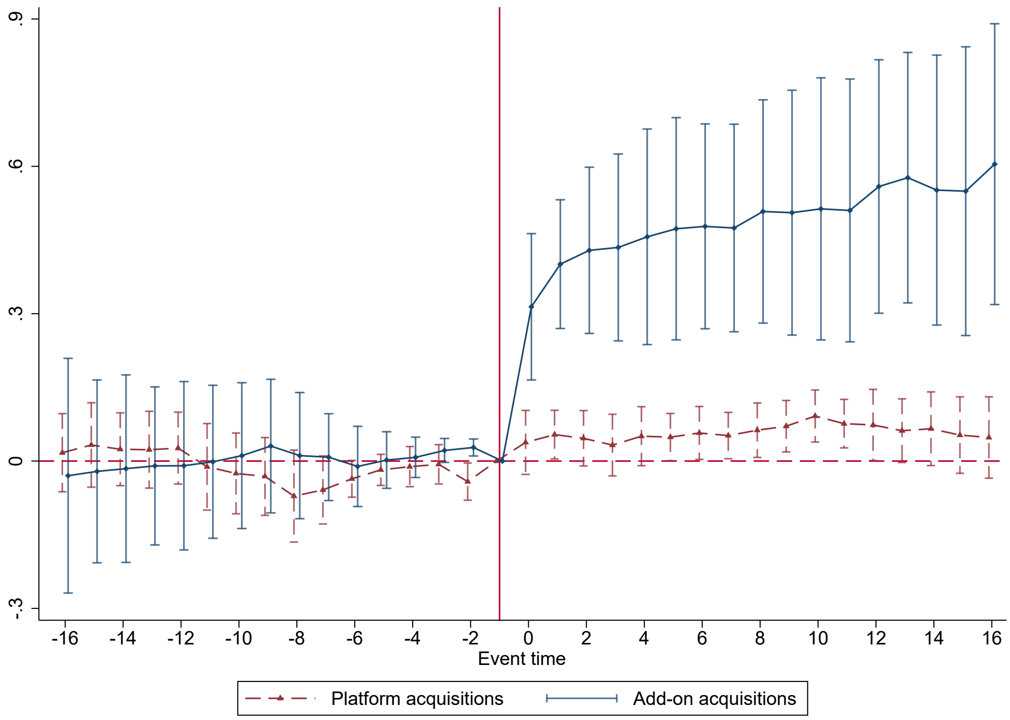

Figure C.3: *Estimates based on obstetrics yield very similar results.*

The process used to produce this figure is identical to the one we used to produce Figure III in the main text except that we restrict attention to an entirely different sample, which covers obstetrics. The y-axis measures the average price per procedure, while the x-axis measures event time. We normalize μ^{τ}=0 for τ=-1 and mark this period with a vertical red line. The solid line corresponds to add-on acquisitions; the dashed one corresponds to platform acquisitions (i.e., the first acquisition by a sponsor in a market). Standard errors are clustered at the target level.

C.4 Non-anesthesia prices for anesthetized procedures

We replace anesthesia prices with non-anesthesia prices for the same set of procedures on which Figure III is based. We then re-estimate equation 1. Figure C.4 reports the results. Non-anesthesia prices do not exhibit any appreciable response to either platform or add-on acquisitions.

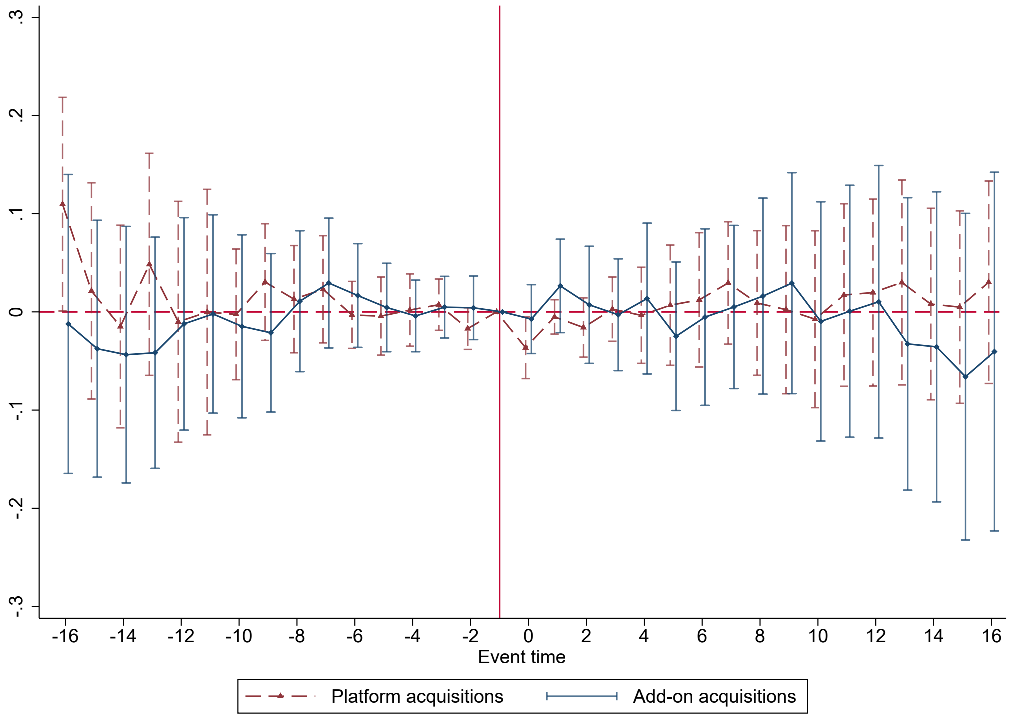

Figure C.4: *Non-anesthesia prices for anesthetized procedures are unchanged following acquisitions.*

The process used to produce this figure is identical to the one we used to produce Figure III except that we replace anesthesia prices with non-anesthesia prices. The y-axis measures the average price per anesthetized procedure, while the x-axis measures event time. We normalize $\mu^{\tau}=0$ for $\tau=-1$ and mark this period with a vertical red line. The solid line corresponds to add-on acquisitions; the dashed one corresponds to platform acquisitions (i.e., the first acquisition by a sponsor in a market). Standard errors are clustered at the target level.

C.5 Quality

We obtain a comprehensive set of best-practice quality measures from the COMPAC initiative Boney et al. (2022). To develop it, researchers (a) systematically reviewed randomized control experiments published in "high-impact journals to describe current outcome reporting trends," (b) "surveyed patients, carers, researchers, and perioperative clinicians about important outcomes," and (c) arrived at "a core outcome set." These include mortality (typically at 30 days), anesthetic complications, unplanned readmission within 30 days, discharge destination, length of hospital stay, level of dependence, and "longer-term recovery (overall health-related quality of life)."

To measure anesthetic complications, we use unintentional dural punctures (UDPs). They are not only among the most common problems arising from anesthesia but also easily measured in our data, as the treatment requires a separate claim. Other outcomes, such as readmission rates, are equally easy to compute. Three are unavailable: we cannot compute mortality rates due to our data use agreement, and we cannot measure dependence and recovery without very detailed patient surveys, which are unavailable.[35] Finally, we also measure staffing changes. Specifically, at the practice-year level, we compute the ratio of CRNAs to the sum of CRNAs and clinicians.

We replace prices in equation 1 with each quality measure and re-estimate the event study coefficients. Figure C.5 reports the results. Regardless of how it is measured, quality does not exhibit any appreciable on-impact change following either platform or add-on acquisitions.

[35]CMS recently started surveying patients about their experiences with clinicians and practices under their *Consumer Assessment of Healthcare Providers and Systems* program (CAHPS). In the future, this might give at least some indication as to how anesthesia providers performed along these dimensions.

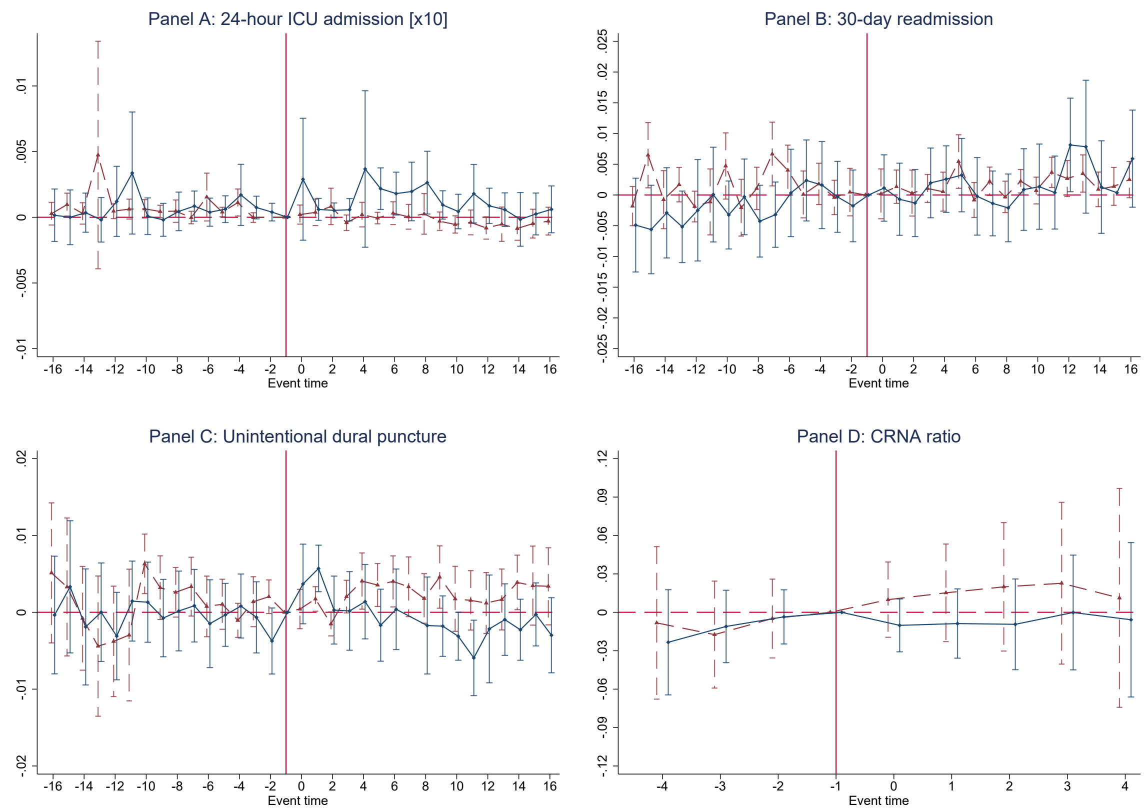

Figure C.5: *Quality is unchanged following platform and add-on acquisitions.*

This figure report the result of replacing price with best-practice quality measures and re-estimating equation 1. Such measures include unintentional dural puncture rates, 30-day readmission rates, 24-hour ICU rates, and CRNA ratios. The solid line corresponds to add-on acquisitions; the dashed one corresponds to platform acquisitions. We normalize μ^{τ}=0 for τ=-1 and mark this period with a vertical red line. Standard errors are clustered at the target level.

C.6 Stipend Payments

We compare stipends across hospitals with different payor mixes, using data from Garthwaite et al. (2022). Privately insured patients are typically better reimbursed, while hospitals with publicly insured and uninsured patients need to offer financial stipends to ensure coverage. As predicted, the higher the share of privately insured patients, the lower the stipend. (Note that this data is available only for California, so we cannot measure pre-/postacquisition changes in stipends. Also note, though, that stipend changes are not at issue in antitrust litigation surrounding anesthesia rollups, so we have abstracted away from them throughout this paper.)

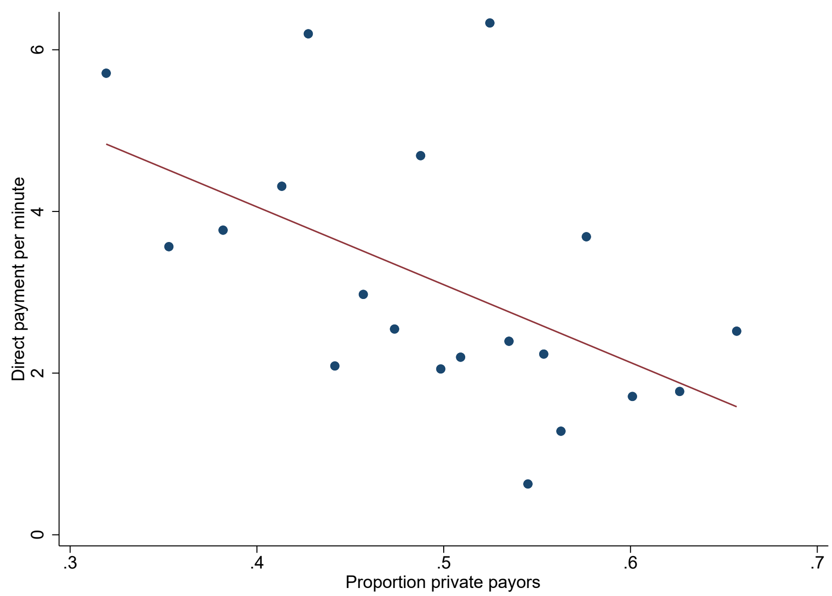

Figure C.6: *Stipends decline with the share of private payors.*

This figure plots the per-minute practice stipend on the y-axis against the proportion of private payors on the x-axis. The unit of observation is a hospital. The measures are created using a sample of the 2018 hospital financial reports from the California Office of Statewide Health Planning and Development. The sample is selected based on an assessment of which hospitals were likely to employ third-party anesthesia groups. See O'Connell et al. (2019) for more specific information on the sample exclusion criteria and Garthwaite et al. (2022) for estimates of private payor shares for each hospital. Standard errors are clustered at the target level.

D Contract terms, billing codes, and price changes

Payor-provider contracts in the anesthesia industry have two features that make it easy to conflate the *reason why prices change* with *how price changes are implemented*. Section 4 describes precisely how this occurs. To summarize it here, we start with four facts.

(1) All else equal, equilibrium prices charged by target and acquirer clinicians will increase following add-on acquisitions. This statement derives from (a) the definition of an add-on acquisition, which ensures that the acquirer has positive market share in the target's market and (b) the equilibrium relationship between preacquisition market shares and pre-to-postmerger price changes, described at the end of Section 5, which is positive. This statement implicitly assumes that synergies are negligible. Synergies must be small, at least in comparison to incremental recapture effects, or else we would not observe the price changes reported in Section 4.2.

(2) Due to the nature of rollups, recapture effects, and other features of this industry, acquirer clinicians frequently charge higher prices than target clinicians prior to add-on acquisitions. The statement derives from two features of the setting. Add-on acquisitions raise equilibrium prices (see the first statement), and add-on acquisitions are often preceded by other add-on acquisitions (see, e.g., the USAP case description in Section 2.3 or summary statistics reported in Section 3), so prices charged by acquirers' practices exceed, on average, those charged by the target practice. Also, it is presumably easier to merge many small firms into one large one than vice versa, so if the market is characterized by a distribution of practice sizes prior to any rollups, then larger practices, on average, will serve as platforms.

(3) Contracts between insurers and firms have, in most cases, a term of one year or more. This statement derives from how frequently we we observe prices change more than once per year.

(4) Contracts between insurers and firms allow practices to add clinicians at will. This statement derives from the mere occurrence of this in our data.

We then combine these facts. (1) and (2) imply that there is some period between the closing of the transaction and the renegotiation of merged firm's prices when prices would rise were it not for the target's and acquirer's existing contracts not yet having expired. However, (3) and (4) indicate that the newly merged entity can close much of the gap between the prices that would be charged were renegotiation immediate and the prices that are actually charged. Specifically, it can, for the purposes of billing, administratively transfer clinicians from the acquirer to the target. Moreover, when the target and acquirer are highly asymmetric, most of the acquisition's ultimate effect on prices occurs through these means.

To illustrate, consider a consumer products market, such as one for ready-to-eat cereal. Abstract away from bargaining and instead assume prices are posted. Suppose there are 50 products, of which General Mills (GM) owns 30 (e.g., Cheerios, Chex, Cookie Crisp, and others). Also, suppose there is another product, Brand X, which is independently owned. For simplicity, assume that each consumer draws an i.i.d. taste shock for each product but that the mean utility derived from each product is the same.[36] Likewise, assume constant marginal costs that are the same for all products. Further, assume that, due to the many products in the GM portfolio, substitution patterns are such that they charge \$15.00 per case of cereal while Brand X charges just \$10.

Now suppose GM acquires Brand X and that costs and quality are unaffected by the transaction. The

[36] In the widely-known notation employed by Berry et al. (1995), consumers draw ϵ_{ij}, and all δ_j are the same.

impact on the prices of products previously owned by GM is small. For example, the price of Cheerios already reflected the fact that when GM contemplated a price increase (and a loss of share), many consumers would "spill over" to its 29 other brands. The acquisition merely changes that first order condition to reflect 30 other brands. Conversely, the impact on the price of Brand X may be very large—prior to the acquisition, its price did not reflect any recapture, whereas after it, it will resemble that of Cheerios. For illustrative purposes, assume that, all else equal, following the acquisition, GM would charge $15.25 per case for any of the 31 cereals it offers. Were they to charge this, what is the effect of the loss of competition on price for Brand X? Clearly, it is $5.25.

Finally, assume that (a) the merger occurs on June 30, (b) the manufacturer's contracts with wholesalers are renegotiated annually on December 31, and (c) contracts charge a single price for all the parent company's products. Assumptions (a) and (b) imply a period of time—from around July 1 to January 1—when GM would reset all cereal prices to $15.25 but cannot because existing contracts stipulate that it must charge $15 per case for the 30 products it originally owned and $10 per case for Brand X. However, assumption (3) lets it move Brand X under the GM product "umbrella," thereby raising the price of Brand X products from $10 to $15 per case during this period. Of course, at the end of this period, all of its cereal prices will rise to $15.25 per case.

Notice that the logistical means by which the prices increased are irrelevant to the economic substance of the problem. That is, the entire price change from $10 to $15.25 per case occurs due to weaker competition, i.e., greater recapture—the most studied force in industrial organization economics. While an analysis of the contours of the Clayton Act are beyond the scope of this paper, in our view, one would be hard-pressed to interpret the rise in Brand X's price as stemming from anything other than "substantially lessen[ed] competition." Of course, to read this directly off patterns in the data, one requires additional assumptions and that the conditions stated here hold. For an application to our setting, see, again, Section 4, the references therein, and the structural model that follows in Section 5.

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