NBER WORKING PAPER SERIES

HOW TO GET AWAY WITH MERGER: STEALTH CONSOLIDATION AND ITS REAL EFFECTS ON US HEALTHCARE

Thomas G. Wollmann

Working Paper 27274
http://www.nber.org/papers/w27274

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
May 2020

I thank Jimmy Roberts for suggesting the setting, Paul Eliason for helping navigate the data, and Fiona Scott Morton (NBER discussant), Judy Chevalier (ASSA discussant), John Asker, Dave Balan, Dennis Carlton, Thom Covert, Austan Goolsbee, Neale Mahoney, Ariel Pakes, Chad Syverson, Haris Tabakovic, and seminar participants at Harvard University, the Federal Trade Commission, Duke University, KU Leuven, Northwestern University, Columbia University, Chicago Booth, the NBER Winter IO Meeting, the ASSA Annual Meeting, Microsoft Research, Charles River Associates, the Hal White Antitrust Conference, the ASHEcon Annual Conference, and the Midwest IO Conference for thoughtful comments. Credit for the title belongs with Mike Sinkinson. (Note that the title was suggested and adopted before the paper contemplated mortality and is not intended to make light of that outcome.) Excellent research assistance was provided by James Kiselik, Paulo Henrique Ramos, Divya Vallabhanen, and Jason Yang. Financial support from the Becker Friedman Institute's Health Economics Initiative is gratefully acknowledged. The data reported here have been supplied by the United States Renal Data System (USRDS). The interpretation and reporting of these data are the responsibility of the author and in no way should be seen as an official policy or interpretation of the US government. The views expressed herein are those of the author and do not necessarily reflect the views of the National Bureau of Economic Research.

How to Get Away with Merger: Stealth Consolidation and Its Real Effects on US Healthcare
Thomas G. Wollmann
NBER Working Paper No. 27274
May 2020
JEL No. D4,D43,I11,K21,L0,L1,L11,L13,L4,L40

ABSTRACT

Most US mergers are not reported to the government on the basis of their size, which can effectively exempt them from antitrust scrutiny, thereby leading to anticompetitive behavior. This paper studies premerger notification exemptions in the US dialysis industry. Over two decades, dialysis providers attempted over 4,000 facility acquisitions, half of which were not reported to the nation's competition authorities. I estimate the effect of premerger notification exemptions on antitrust enforcement rates, and then I estimate the impact of the resulting market structure changes on patient health outcomes. First, I find that exemptions severely limit enforcement. Most striking, proposed facility acquisitions that would result in monopoly are blocked more than 80% of the time when apart of reportable mergers but less than 2% of the time when apart of exempt ones. Second, I find that the resulting market structure changes reduce the quality of care, evidenced by higher hospitalization rates and lower survival rates.

Thomas G. Wollmann
Booth School of Business
University of Chicago
5807 South Woodlawn Avenue
Chicago, IL 60637
and NBER
Thomas.Wollmann@chicagobooth.edu

1 Introduction

Most governments require firms interested in merging to notify them in advance and then wait a predetermined amount of time, which allows the relevant authorities to evaluate the competitive effects of the deals prior to their completion. In other words, firms file premerger notifications, and governments conduct prospective merger reviews. While mergers transfer trillions of dollars in cash flow and control rights globally each year, the vast majority are *exempt* from this process on the basis of their size. Exemptions mostly rely on precedent established between the 1950s and 1970s, which in turn reflects an assumption that only large deals have meaningful competitive effects.[1] In segmented industries, however, where products are differentiated to serve heterogeneous consumers, the premise often fails. Even minor deals can result in major changes to market structure and behavior.

To illustrate, suppose that in a particular country there are exactly two hospitals in each city competing with one another for patients. Further, suppose that individual hospitals are valued at about $80 million and that the legislature sets an exemption threshold of $90 million, meaning that acquisitions valued below that amount are not be reported to the government. If notifications are critical to enforcement, then one hospital in each city could propose acquiring the other, resulting in nationwide mergers to monopoly, all in the absence of a single premerger filing. I call this "stealth consolidation"—anticompetitive deals that would otherwise have been blocked but for premerger notification exemptions, which allow them to effectively avoid government scrutiny. This need not be what actually happens, however. Competition authorities can learn about transactions in other ways and are typically free to investigate any deal, regardless of its size or completion status, so the effect of exemptions is an empirical question.

Very recent work provides initial, economy-wide evidence that premerger notifications are essential to enforcement [Wollmann, 2019], though its broad scope precluded precise market definitions and estimates of real effects. This paper narrows the analysis to a single industry and studies US dialysis providers. This allows me to link ownership changes, agency actions, and welfare-relevant outcomes at an establishment-year level. The setting has several convenient features. First, since patients require multiple treatments per week, they cannot travel far for care, so the industry comprises many geographically separated markets. Second, regulation makes entry into areas occupied by incumbent firms costly, thereby limiting potential entrants' ability to dissipate acquisition-induced rents. Third,

[1] The 1975 Hearings before the US Senate Subcommittee on Antitrust and Monopoly contain several examples. For one, "[lowering] the pre-merger notification requirement to include companies with a hundred million dollars in sales or assets would cover literally thousands of transactions which have no legally significant anticompetitive impact." *Senate Hearings Part II 573* (statement of A. G. W. Biddle).

dialysis witnessed sharp within-market and industry-wide consolidation [Cutler et al., 2016, Eliason et al., 2019, Eliason, 2018], most of which resulted from mergers. Fourth, these transactions range in size from purchases of single facilities to acquisitions of large chains operating hundreds of locations, offering terrific variation in exposure to the Premerger Notification Program. In particular, half of all proposed facility acquisitions were not reported to the antitrust authorities, since they were apart of mergers that fell short of the size thresholds set forth in the Hart-Scott-Rodino Antitrust Improvements (HSR) Act. Finally, the Federal Trade Commission (FTC), which has de facto responsibility for dialysis deals, frequently blocked these acquisitions—hundreds over the last two decades.

Due to its social and economic importance, dialysis merits careful study even beyond what one can learn with respect to antitrust enforcement. Facilities provide treatments representing life-saving care for persons suffering from a loss of kidney function, called end stage renal disease (ESRD). To survive, persons with ESRD require either transplantation of a donor organ, for which there are typically long waiting lists, or dialysis, which involves a machine filtering toxins and excess fluids from the blood for them. Dialysis requires frequent, long treatments. Patients are typically dialyzed three times per week, four hours each time. Even so, mortality rates are very high. ESRD patients on dialysis face nearly 150 deaths per 1,000 person years. Moreover, the disease costs the US over $100 billion annually and is paid for primarily with public funds [USRDS, 2017].

My data consist of detailed facility-year level observations that cover the universe of US providers from 1996 to 2017. They mainly rely on forms, reports, and records collected by Medicare, which covers the vast majority of dialysis treatments, and documents published by the Federal Trade Commission (FTC), which has de facto responsibility for prosecuting dialysis mergers. I observe the name, address, and owner of each location as well as the number dialysis machines, nurses, patients treated, and treatments completed. For each facility's patient population, I observe hospitalization and survival rates. Ownership changes often in the data, so precise terms are required to avoid confusion over these developments: I define one firm's attempt to acquire facilities from another as a *merger*, each of which includes one or more *proposed facility acquisitions*. I observe whether each proposed facility acquisition was part of a *reportable merger*—one requiring agency notification—or an *exempt* one. I also observe whether each proposed facility acquisition was *blocked* or *completed*.

First, I estimate the effect of premerger notifications on the likelihood of being blocked. To do so, I rely on two sources of variation. One is the exemption status of the merger with which the proposed facility acquisition is associated. When a merger's transaction value meets or exceeds the thresholds stipulated by the HSR Act, all proposed facility acquisitions apart of it require agency notification.

When the value falls short, none are. Crucial to the research design, exemption status is a purely procedural matter—it "in no way alters the substantive legal standard" applied to any acquisition.[2] Thus, it does not directly affect enforcement. The other source of variation is premerger market structure. Market shares of the facilities in the year just prior to the proposed facility acquisition offer a prediction about how much concentration will increase were the deal completed. Critically, these "pro forma" HHI changes do not depend on the (endogenous) postmerger behavior of the agents. Moreover, there are substantive as well as legal reasons why these changes should influence the probability that the merging parties face an enforcement action.[3] The estimation strategy follows the logic of a difference-in-difference research design. I estimate the relationship between market structure changes and enforcement actions for proposed facility acquisitions apart of reportable mergers, and then I contrast this relationship with one estimated on proposed facility acquisitions apart of exempt mergers.

Second, I estimate the effect of the resulting market structure changes on providers and patients. Since Medicare effectively sets the price for the majority of US dialysis treatments, facilities mainly compete on quality. When rival facilities merge, incentives to provide quality fall. Merely observing a decline in quality-related inputs, though, is insufficient evidence of anticompetitive behavior, especially along a dimension that physically harms patients. Thus, my outcome measures comprise not only the number of dialysis machines and nursing staff but also the hospitalization and survival rates of the patients treated at the facilities. I rely on the two sources of variation, described immediately above, as well as in the timing of mergers. To ease exposition, at least initially, I define horizontal proposed facility acquisitions as those associated with higher-than-average pro forma HHI increases. The estimation strategy follows the logic of a triple-difference research design. I estimate the difference in premerger-to-postmerger outcome changes between horizontal and non-horizontal proposed facility acquisitions apart of reportable mergers, and then I contrast this difference with one estimated on exempt mergers.

I find that premerger notifications are critical to antitrust enforcement. Especially striking is the close relationship between predicted market structure changes and agency actions for proposed facility acquisitions apart of reportable mergers. Among these transactions, the FTC never challenges a transaction in which the target and acquiror facilities do not compete, yet it aggressively challenges deals involving pro forma HHI changes exceeding, say, 500 points. Equally striking, though, is the

[2] *House Comm. on the Judiciary, Report on the Antitrust Premerger Notification Act,* H.R. Rep. No. 94-1373, 94th Cong., 2d Session.

[3] As an illustration of the first reason, the US agencies generally target deals likely to reduce consumer welfare, and most models of competition provide, for example, that a merger of two among three rivals reduces it more than a merger of two among ten. As an illustration of the second reason, agency guidelines explicitly mention HHI levels and changes as a factor in enforcement. See Section 4 for a more detailed discussion.

absence of this relationship for proposed facility acquisitions apart of exempt deals. *The FTC effectively never pursues an exempt transaction, regardless of the market structure change it is likely to induce.* Providing the clearest comparison, proposed facility acquisitions that would result in monopoly are blocked more than 80% of the time when apart of reportable mergers but less than 2% of the time when apart of exempt ones.[4] Note, however, this divergence is unlikely to be any fault of the agencies—it's unclear how anyone could learn about private transactions in their incipiency without being notified.[5]

Then, I find that resulting market structure changes reduce facility quality and compromise patient health. Premerger notification exemptions result in 6.0 and 10.0 percentage point declines in dialysis machine and nurses staff for horizontal proposed facility acquisitions (relative to non-horizontal ones). Most importantly, they result in 3.1 percentage point higher hospitalization rates and 1.6-2.0 percentage point lower survival rates for horizontal proposed facility acquisitions (relative to non-horizontal ones). The findings highlight the "at-risk" nature of ESRD patients, imply market power outweighs other considerations, and indicate that competition-induced changes in care are not merely medically-insensitive amenities.

While premerger notifications exemptions have largely gone unstudied by economists, practitioners have long been acutely aware of their importance. Evidence is found in virtually every major legal reference devoted to antitrust. To illustrate, consider the The Merger Review Process, an American Bar Association publication so popular that the FTC relies on it to establish whether certain procedural matters are "well-established and widely known."[6] In a section titled "Deciding Whether to Notify the Agencies of a Nonreportable Transaction," it states that the first among three "risks of alerting authorities" is "counsel bringing attention to a matter that might have otherwise *escaped the agencies' notice*" (emphasis added) [Gotts, 2001]. The authors then reference the Antitrust Adviser for further detail. That text, in turn, states, "If a merger clearly violates the guidelines, it is reasonably likely to be challenged *if* the government learns of the acquisition *and* discovers the potential violation" (emphasis in original) [Hills, 1985]. Many legal experts venture further. They advise clients not to raise prices or eliminate products in the immediate wake of an nonreportable transaction, lest they upset buyers who

[4]The 80% figure rises further still with a small number of uncontroversial changes to the market definitions, e.g., treating each of the Hawaiian islands as distinct markets. (Maui and Lanai reside in the same market, even though residents of one island would require a 45 minute boat ride to facilities in the other.) A previously circulated draft reflected such changes; to avoid ad hoc restrictions, this one does not.

[5]This concern was, after all, precisely what motivated Congress to establish the premerger notification program. As one of the bill's sponsors stated, "The only method the Division and FTC had to be aware of pending mergers and acquisitions was to read the general and trade press. In other words, if the *Wall Street Journal* missed one, so well may the FTC and the Division." ("Division" here means the Antitrust Division of the US Department of Justice.)

[6]See *Pharmaceutical Research & Manufacturers of America (PhRMA) v. FTC* (D.C. Cir.) Brief for the FTC, 14-5182 at 6.

could inform the agencies about the existence of such an acquisition.[7]

Nonetheless, on their own these findings cannot determine the optimal notification policy. Broadening reporting requirements can raise costs on private firms in ways that discourage some welfare improving mergers, but the size and salience of these costs remain open questions.[8] Moreover, lower thresholds could burden the agencies with additional reviews, drawing staff away from other enforcement matters. Yet, little is known about the production function of the agencies. Partially offsetting this cost is a deterrent effect: egregious deals will not be attempted in the first place if the merging parties know that they will be discovered and therefore blocked with a high degree of certainty.[9] Clever implementation would reduce costs even further. As just one example, parties involved in below-the-current-threshold mergers could be required to report only the most basic transaction details, and the agencies could capture this information in ways that facilitate screening the transactions, thereby lowering public as well as private sector expenses associated with casting a wider net [Scott Morton, 2019].[10]

This paper contributes to several areas of research. Alongside recent work [Wollmann, 2019], it introduces and provides evidence of stealth consolidation. The prior paper used economy-wide merger and enforcement data to study an abrupt increase in US thresholds in 2001, which led to a sharp decline in notifications and enforcement and increase in mergers between rivals. Its broad scope, however, limited its measure of competition to whether the target and acquiror occupied the same four-digit SIC industry group and precluded estimates of "real" effects. The present work differs in measuring competition in a way that's relevant to market participants and directly estimating effects on welfare-relevant outcomes. Together they suggest premerger notification program changes contributed, at least in part, to secular trends in economy-wide concentration [Furman and Orszag, 2015]. Motivated partly to explain a fall in the otherwise historically stable labor share of output [Elsby et al., 2013, Karabarbounis and Neiman, 2013], various papers have related rising concentration to that decline [Barkai, 2016, Autor et al., 2017] as well as to falling private investment [Gutiérrez and Philippon, 2016], rising price-cost markups [De Loecker and Eeckhout, 2017], and rising "profit shares" [Barkai, 2016], though few have attempted to explain rising concentration itself.[11]

[7] See, e.g., Hemli et al. [2016] and similar anecdotes in Wollmann [2019] at 79.

[8] See the discussion in De Loecker et al. [2008] at 2.

[9] For deterrent effects of premerger notifications, see Wollmann [2019]. See also Clougherty and Seldeslachts [2013], who relate past investigation and enforcement rates to subsequent merger activity.

[10] See Scott Morton's testimony before the House Judiciary Committee and in particular her discussion of lower thresholds. She points out that most transaction details can be recorded in standardized formats—lines of business reported using "drop-down" menus, locations entered using numeric ZIP codes, etc. This not only simplifies the firms' reporting process but also facilitates the agencies' screening process, automating the earliest stages of the enforcement process.

[11] An exception is Autor et al. [2017], who document that productive "superstar" firms have grown their share of output over

This paper also relates closely to prior work on the industrial organization of the healthcare sector and dialysis industry in particular. Cutler et al. [2016] carefully document the sharp rise in dialysis industry concentration, showing that the share of all facilities owned by the top two firms climbed from just over one-quarter in 1998 to nearly two-thirds in 2009, and study the effect of mergers among large providers. (Their findings are described in much more detail in Section 5.7, as are the results of the next two papers.) Eliason et al. [2019] study how large firms transfer their operational strategies to the independent facilities they acquire. They find that national chains are able to boost reimbursements while cutting quality, effectively raising healthcare costs while jeopardizing patients. The authors thereby establish that industry consolidation presents concerns beyond its effects on competition—a potentially serious problem given the secular trends described in the preceding paragraph. Eliason [2018] estimates a structural model of spatial competition among dialysis providers. He provides compelling evidence that local market power harms consumers—even to the point that subsidizing ESRD patients to travel further for care meaningfully improves survival rates. Rapid consolidation has occurred among providers outside dialysis as well, ranging from hospitals to physicians groups,[12] with concentration broadly associated with higher prices.[13]. These concerns extend beyond static concerns to effects on innovation, with Cunningham et al. [2017] finding that acquisitions of rival drug developers enable incumbents to "buy and kill" innovation that might later compete with them. Notably, many of the transactions they study fall below the HSR thresholds.

The paper proceeds as follows. Section 2 summarizes the relevant antitrust considerations and key features of the industry. Section 3 describes the data. Sections 4 and 5 study the effect of premerger notification exemptions on enforcement actions and the quality of care, respectively. Section 6 concludes.

2 Institutional details

2.1 Merger reviews and premerger notifications

Changes in ownership that affect domestic commercial activity are subject to US competition law. Most critically, they must comply with Section 7 of the 1914 Clayton Act, which prohibits transactions where

past decades, which they argue may reflect the effect of increasing price sensitivity on firms with low production costs. Another exception is Peltzman [2014], who proposes the shift towards more permissive merger policy that followed the 1982 *Merger Guidelines* and work of Robert Bork.

[12] In the latter case, Capps et al. [2017] show that markets often consolidate just a few doctors at at time, so the transactions are so incremental that even if premerger notification were required, reported concentration increases would typically not merit further review under the current *Horizontal Merger Guidelines*.

[13] See Gaynor et al. [2015] for a review.

the effect "may be substantially to lessen competition, or to tend to create a monopoly."[14] Though it is regarded today as the cornerstone of merger-related enforcement [Baer, 2014], the Clayton Act proved flawed as originally written for reasons that are central to this paper. Even after most substantive loopholes were closed in 1950,[15] many direct competitors found that they could still successfully merge. To avoid scrutiny, these firms negotiated quietly and combined their operations covertly, telling as few parties as possible that they were doing so. Then, when the agencies eventually learned of these deals, it was too late to unwind them: since information was already shared and assets were already commingled, doing so would prove as hard as "unscrambling eggs" [Baer, 1996]. Thus, while the 1914 legislation provided the means to arrest anticompetitive deals prior to their completion, it did not provide the means to learn about these deals in their incipiency.

This practice abated in the late 1970s when Congress provided bicameral and bipartisan support for the HSR Act, thereby establishing the US premerger notification program. The act requires parties to all proposed ownership transfers—unless explicitly exempt—to notify the agencies of their intentions, provide relevant details, and wait up to thirty days.[16] During this time, filings are initially reviewed and, in the event they raise concerns, one (but not both) of the agencies would be prompted to seek "clearance" to investigate. Notably, the act bars firms from structuring transactions in ways that intentionally avoid reporting requirements and stipulates significant penalties for non-compliance.[17]

Exemptions are based mainly on size. For most mergers, the criteria are straightforward and can be summarized as follows. Under the act as it was originally written, transactions require notification only when the target has $10 million or more in domestic assets (or has $10 million or more in domestic revenue, in the event the target is engaged in manufacturing).[18] Under the act as it was amended effective 2001, transactions require notification only if the aforementioned asset test is met *and* the deal involves consideration of $50 million or more. Further, all thresholds have nominally increased with gross national product since 2004. As a result, at present, the act exempts most transactions valued below $90 million. For many segmented industries, these thresholds absolve all but the largest

[14] Other laws provide standing to sue but either rely on similar standards or are utilized far less frequently. As an example of the former, the FTC typically also sues under Section 5 of the FTC Act, which bars "unfair methods of competition in or affecting commerce." As an example of the latter, the DOJ, state attorneys general (AGs), and private plaintiffs can also sue under Section 1 of the Sherman Act, which bars arrangements "in restraint of interstate or foreign trade or commence," or Section 2 of the Sherman Act, which bars monopolization of, or attempts to monopolize, "any part of interstate or foreign commerce." In some cases, other federal agencies will weigh in or even have jurisdiction. Examples include mergers involving banks, airlines, motor carriers, or entities for whom a change in control might jeopardize national security. Provided the transactions affect residents or resident businesses, state AGs can also sue under state statutes (e.g., California's Unfair Competition Law).

[15] Most notable are the Celler-Kefauver amendments. Prior to them, for example, Section 7 did not address asset sales.

[16] Waiting periods depend on attributes of the deal (e.g., the consideration offered) and have been amended since the original legislation, but the details are unimportant for this paper's purposes.

[17] Penalties for willful avoidance can exceed $42,000 per day. See also Footnote 32.

[18] This pared-down description is far from comprehensive but nonetheless covers most transfers of control. Supporting this claim are tight links between mergers, notifications, and enforcement actions (Wollmann [2019], Section 4).

transactions from reporting responsibilities.

To be clear, the act does not provide any party safe harbor from prosecution or affect the legality of any transaction. The congressional report on the act explicitly states, "[The] bill in no way alters the substantive legal standard of Section 7." This echoes earlier remarks of one of its sponsors, who said, "Let me emphasize one thing ... this bill ... merely provides for an effective *procedural* mechanism" (emphasis added). In other words, legislators are clear that anticompetitive deals should be challenged irrespective of their exemption or completion status. Moreover, if a nonreportable deal is discovered and raises initial concerns, then the review and enforcement procedures that are followed very closely resemble the ones applied reportable transactions.[19]

Which mergers are challenged in practice, however, is a separate issue. Agency officials appear to disagree—or at least obfuscate—about this key question. For example, in 2014, an FTC Commissioner stated, "We don't have control over the mergers that are brought to us. They walk in the door. We're generally challenging HSR-reportable mergers. Sometimes we do pursue consummated deals, including ones that are under the HSR threshold. But for the most part, mergers are what come through the door for us" [Ohlhausen, 2014]. Yet in the same year, a Justice Department official stated, "The HSR reporting thresholds ... are not synonymous with the contours of antitrust enforcement" [Overton, 2014]. Recent work provides at least preliminary evidence that the prior view holds [Wollmann, 2019]. To more completely resolve the issue as well as study its implications, I turn to merger activity and enforcement actions within the dialysis industry, which is described immediately below.

2.2 Kidney disease and treatment providers

The dialysis industry treats people suffering from a loss of kidney function. The kidneys are organs in the human abdomen that remove toxins and excess fluids from the body, but they gradually deteriorate with prolonged exposure to conditions such as diabetes and high blood pressure.[20] When their filtration capacity—known as renal function—reaches as low as 10-15% of normal levels, patients are said to have end stage renal disease (ESRD). At this point, survival requires immediate care, with treatment regiments supervised by specialized physicians called nephrologists. One option is to receive a healthy kidney via a transplant, though these are suitable for only a small portion of the population and often involve long waiting lists, so they treat less than 3% of persons with ESRD.[21] The other option is

[19] For example, Hills [1985] writes that "non-HSR merger investigations will be very similar to HSR investigations" and "the scope of investigation is also identical." However, some procedural differences do exist. See Scher and Martin [2015] for examples.

[20] They serve other functions, too, such as synthesizing erythropoietin, a hormone that stimulates red blood cell production.

[21] This figure reflects the efficiency of the exchange mechanism. Economists are working to improve their design. See, e.g., Agarwal et al. [2019] and the literature cited therein.

dialysis, which involves diffusing a solution in the blood, passing the mixture across a semipermeable membrane, and filtering out unwanted substances.

Hemodialysis accomplishes this process outside the human body, with a machine serving as an external kidney.[22] Patients typically receive three four-hour treatments each week, during which time they may engage in sedentary activities (e.g., reading or watching television). Hemodialysis is the most common form of dialysis worldwide and by far the most common in the US, serving 90% of the nation's half-million dialysis patients. (Given its prevalence, the remainder of this paper refers to hemodialysis simply as "dialysis.") The number of these patients have grown over time alongside the prevalence of ESRD. While the proportion of the population receiving treatments, adjusted for age and comorbidities, has remained mostly flat since the mid-1990s, the unadjusted proportion has risen by one-quarter, reflecting older and more obese Americans. Mortality rates among patients fell 30% by 2012, with little consensus around the cause(s), have not moved much since then, and are still quite high. Persons on dialysis face 130 deaths per 1,000 person patient years.

Outpatient facilities host the vast majority dialysis treatments, with nearly 7,000 locations housing roughly 120,000 HD machines [USRDS, 2017]. The large number of facilities follows from the frequency of treatments: since they require multiple visits each week, ESRD patients cannot feasibly travel more than thirty minutes or miles from their home for care.[23] Ownership of these facilities has consolidated rapidly over the past two decades. An industry once populated by independent owners and small changes is now dominated by two large multinational corporations.

Although geographic coverage has expanded apace with demographics, entry into markets with an incumbent provider is often expensive if not impossible. Many areas of the country require that entrants prove that the community "needs" additional capacity, creating large entry barriers. Kaiser's attempt to enter the Hawaiian island of Maui, where Liberty Dialysis had a monopoly, provides an illustration. Kaiser filed a Certification of Need application in September 2009, which was granted in May 2010 (subject to several preconditions including, among other things, a guarantee to provide service to particular communities for up to ten years). Nonetheless, Liberty requested and was granted reconsideration. After four pre-hearing conferences, one public hearing, and one private hearing, the state granted Kaiser's application in February 2011. Even so, Liberty successfully filed an appeal. After briefs, other submissions, and multiple rounds of oral arguments, the state again granted Kaiser's

[22] Peritoneal dialysis accomplishes this within the human abdomen, often while the patient is at home, asleep. Hemodialysis is ten to twenty times more prevalent over most of the panel, so I ignore peritoneal dialysis for the remainder of the paper. The reasons for its unpopularity are debated but beyond the scope of my analysis.

[23] For example, the FTC states, "As a general rule, ESRD patients travel no more than thirty miles or thirty minutes to receive dialysis treatment." *In the Matter of DaVita Inc.*, FTC Docket No. C-4152, FTC File No., 0510051 (Oct. 4, 2005) (Complaint).

application in December 2011. Remarkably, Liberty successfully filed a secondary appeal. After additional litigation, Kaiser was eventually granted the certificate in June 2013—nearly four years later.[24]

2.3 Antitrust enforcement amid dialysis consolidation

Dialysis providers proposed thousands of facility acquisitions over the past two decades, and preliminary investigations into many of these raised serious competitive concerns (as the subsequent section shows). When this happens, almost irrespective of the industry, the US merger review process proceeds in two steps: the agency cleared to investigate the transaction requests additional information to assess the competitive effects and, in the event concerns persist, formally challenges. The merging parties and agency typically find mutually agreeable terms under which the deal can proceed, but when they cannot, the case goes to trial.

Precisely how this all plays out—the venue, timing, tactics employed, etc.—depends on a host of procedural factors, although these idiosyncrasies can often be ignored when the analysis is confined to a single industry. This is true in dialysis, where merger enforcement is highly uniform. First, all cases are brought by the federal government and in particular the FTC, which has de facto responsibility for healthcare sector reviews (with a sole exception being a small transaction unwound by the Minnesota Attorney General). Second, substantially every transaction involves a buyer whose principal business is to operate dialysis facilities and whose size exceeds that of its target.[25] Relatedly, vertical considerations are limited. Third, as a "local" service industry, imports and exports play little role in determining market structure and behavior. Fourth, each suit settles before going to trial and results in the merging parties making concessions. All of these can be understood as market level enforcement decisions that result in divestitures of facilities.[26] (For simplicity, I refer to this scenario as the FTC "blocking" their acquisition. To be precise, the agencies cannot unilaterally block deals, only challenge them. If the merging parties elect to try the case in court, then a judge or jury will decide their fate.)

Though mergers among dialysis providers are straightforward to study, they are not especially unique in this regard. Federal agencies bring nearly all merger challenges. State AGs may join suits but

[24] *Liberty Dialysis-Haw., LLC v. Rainbow Dialysis LLC*, SCAP-12-0000018 (June 27, 2013).

[25] There are a small number of potential exemptions related to entry by private equity, depending on how one views interactions between their portfolio businesses. The acquisition of Innovation Dialysis Systems by Ambulatory Services of America presents one potential example.

[26] In one small merger, the target competed closely with the acquiror in all markets in which it operated. The FTC blocked all the proposed facility acquisitions, and the target continued to operate them. If one assumes that the mere act of transferring ownership does not affect operations, then without loss of generality one can treat this a divestiture to the target.

often rely on national resources.[27] Also, procedural differences exist between investigations originating at the DOJ and FTC, but these are second order considerations in nearly all cases. Further, agency actions mostly address horizontal combinations, and the legal standard of Section 7 of the Clayton Act applies. Finally, enforcement actions are typically market level rather than merger level decisions, with divestitures comprising the vast majority of remedies.[28]

3 Data

3.1 Sources

The Centers for Medicare & Medicaid Services (CMS) combines data from their regional offices to form Provider of Service (POS) files. They mainly reflect form CMS-1539, which surveys providers at events such as certifications, re-certifications, on-site visits, and changes of ownership. Annual files contain an individual record for each Medicare-approved facility. Since 1973, Medicare covers almost all persons with ESRD, so the dataset amounts to full coverage of the industry. For each facility I extract the unique Medicare provider number, name, address, opening and closing dates, parent company and recorded dates of any ownership changes. Together these provide a panel of facility-year observations spanning 1996-2017. (The Online Appendix provides more detail.)

The United States Renal Data System (USRDS) collects and analyzes detailed operational and clinical data related to chronic kidney disease and ESRD and it provides access to interested investigators. For each facility I observe basic attributes (e.g., the Medicare provider number) as well as the number of machines and staff available to treat patients. For each ESRD patient, I observe an extensive list of demographic and baseline health variables: age, race, gender, body mass index (BMI), and renal function at the onset of treatments; dates of diagnosis, first dialysis session, and Medicare coverage; facility, modality, and dates of treatment; dates of hospitalizations; and date of death [USRDS, 2017]. To construct the dataset, I first standardize hospitalization and survival rates.[29] Then, following Eliason [2018], I assign patients to their modal dialysis provider in each calendar year. Finally, I collapse the data to the facility-year level.

[27] "The number of mergers investigated by state attorneys general is small in comparison to the number investigated by the federal agencies" (although the author also mentions that the number is growing) [Gotts, 2001].

[28] For instance, a retrospective study by the FTC in 2015 of enforcement from 2006 to 2012 revealed that divestiture-only remedies accounted for 85% percent of relief. Remedies with some structural (i.e., divestiture-related) component accounted for 91%. Behavioral remedies accounted for less than 7% [FTC, 2015].

[29] Control variables used to standardize rates are race, age, sex, BMI, and baseline kidney function, the latter of which is measured by glomerular filtration rate (GFR). The NIH states that the two most widely-used equations for estimating GFR are the CKD-EPI equation and the MDRD Study equation, so I include both measures.

CMS also combines data from its Healthcare Cost Reporting Information System (HCRIS), which rely on annual surveys that are mandatory for all certified institutions. This source serves to supplement the prior two. From facility-year level records I extract the Medicare provider number, which provides a link to the aforementioned data, as well as chain affiliation and the numbers of machines and staff available to treat patients.[30] To be specific, HCRIS provides timely information about ownership changes in years when facilities did not complete form CMS-1539 and hence did not update chain affiliation details. It also provides employment information in the first half of the panel, during which time USRDS was not collecting this data.

Finally, the FTC summarizes each enforcement action and publishes the associated legal documents. Consent orders, in particular, list the names and addresses of each facility for which the parties and the agencies agree must be divested for the deal to close. Often, Medicare provider numbers are also provided. Complaints are also informative. Beyond merely identifying the parties, they describe their operations, enumerate the relevant geographic markets, and discuss the entry conditions. FTC data help identify facility acquisitions that would have been completed but for an enforcement action.

3.2 Summary

Table I documents industry growth from 1996 to 2017. Over this period, facilities more than double from about 2,700 to 6,300. The principal inputs to these facilities, dialysis machines and nursing staff, expand at slightly faster rates, as do the number of patients treated. By the end of the sample, approximately 33,000 nurses and 115,000 hemodialysis machines treat nearly 250,000 patients.

[Table I about here.]

As have many large US industries, dialysis has consolidated over the past two decades. Ownership by large chains, defined here as firms owning at least 250 facilities, has grown swiftly, expanding from about 400 to 5,000 locations. While hundreds of independent and regional operators populate the start of the panel, just two account for over 75% of facilities by the end (not explicitly shown).

National consolidation need not be informative about changes in market concentration. Since patients require frequent treatments, its infeasible to travel far for care, so providers compete locally. However, facility ownership consolidated at this level as well. Mean market-level HHI—defined as the sum of the squared market shares, averaged across markets each year and weighted by the number of

[30] In about 10% of observations, though, the cost reports suffer from aggregation across affiliated, co-located providers (e.g., outpatient dialysis facilities associated with and located adjacent to hospitals).

patients per market—rises from 2,290 to 4,133 over the panel. As a point of comparison, the current *US Horizontal Merger Guidelines* consider a market "highly concentrated" at 2,500.[31]

To better understand these patterns, I will turn to the summary of mergers and enforcement activity. Before doing so, though, it is prudent to verify that the agency-provided data is congruent with Medicare's. I compare the number of target and acquiror facilities reported in FTC complaints as well as the number of divested facilities reported in FTC orders with tabulations of my sample. In the Online Appendix, Figures VI and VII report the firm-by-merger comparisons. The datasets agree with one another. Fresenius's 2005 purchase of Renal Care Group provides an illustration. Here, the FTC reported that the acquiror and target owned 1,155 and 450 facilities at the time of the merger, respectively, and that 103 facilities would be divested to National Renal Institute. The ownership counts are within three percent, and the divestiture count is exact. Close inspection of a small sample of the data suggests the minor discrepancies between the sources reflect timing differences. FTC ownership snapshots are taken at the time of the merger, while CMS tabulations are taken at the year's end.

Table II summarizes facility acquisitions. Providers propose more than 4,400, spread evenly over the panel. As the middle columns indicate, about half of all proposed facility acquisitions fall outside the purview of the HSR Act. Put differently, over 2,000 establishment level ownership transfers were never reported to the US agencies. As the final columns indicate, the FTC nonetheless blocked about 270 proposed facility acquisitions.

[Table II about here.]

Note that the confidentiality of HSR filings precludes the existence of a comprehensive database of transactions subjected to premerger notification, though in many industries, exemption status is easily ascertained, and public sources permit verification. In dialysis, exemptions depend on the merger's transaction size falling short of the thresholds set forth in the act. I directly observe the purchase price, i.e., transaction size, in thirty mergers involving about 2,500 facility acquisitions. From these I construct an empirical distribution of per-facility prices, which are reported in the Online Appendix (Figure IV) and reveal that facilities typically sell for $3.5–5.5 million. Then, I impute the remaining transaction sizes at the extreme values of this range and compare to the thresholds. I find almost no ambiguity over which mergers are reportable and which are exempt: uncertainty persists about only 5 mergers associated with 17 proposed facility acquisitions (out of over 4,000 total).

[31] US Department of Justice and Federal Trade Commission, Horizontal Merger Guidelines (2010), available at http://www.justice.gov/atr/public/guidelines/hmg-2010.pdf.

To resolve this uncertainty and verify the accuracy of the process, I compare my list of reportable mergers with public disclosures of HSR filings. HSR filings are commonly disclosed to the public for two reasons. First, firms can request an expedited prospective review but forfeit anonymity when doing so. Shortly afterwards, the Premerger Notification Office publishes an Early Termination Notice in the Federal Register indicating the date of the transaction and identity of the parties. Second, press releases published by the merging parties will indicate the existence of an HSR waiting period when applicable. Leaving aside the five aforementioned cases, I locate HSR filings for every merger that I predict is exempt, and I predict exemptions for every merger in which I locate an HSR filing. Together these facts provide a very high degree of confidence that the exemption status is measured accurately.

4 Effects on the enforcement of competition law

4.1 Empirical framework

This paper asks two main questions. First, do premerger notification exemptions affect the enforcement of competition law? Second, do the resulting market changes, if any, affect provider choices and patient health? This section addresses the first of these. In particular, I estimate the effect of exemptions on the likelihood that the FTC blocks a proposed facility acquisition in the dialysis industry. To do so, I rely on variation in the transaction sizes of mergers relative to the thresholds imposed by the HSR Act.[32] When a merger transacts at a value at or above the threshold, all proposed facility acquisitions apart of the deal are reported to the FTC; below the threshold, none are. For example, if firm A proposes to buy firm B for $40 million and firm C for $60 million in 2003 when the threshold stood at $50 million, then A and C are required to notify the agency of their intentions, but A and B can remain entirely silent about theirs.

US law clearly stipulates that neither the size of a merger nor its exemption status directly affect its legality.[33] Nonetheless, small and large mergers can systematically differ in ways that do, in fact, determine whether or not they are permissible. For instance, if all reportable mergers involve close competition between target and acquiror facilities while all exempt mergers do not, then proposed

[32] Given steep fines that can exceed $42,000 per day ($15 million per year) for intentionally structuring a deal to avoid an HSR filing, I assume transaction values are determined independent of premerger notification considerations. Consistent with the assertion, I don't observe bunching of transaction values at the threshold. Moreover, only about 10% of proposed facility acquisitions are partial sales of the targets, so if acquirors are buying rivals in chunks to thwart detection, the practice is at least unlikely to drive my conclusions. However, as Fiona Scott Morton points out, my results suggest intentional avoidance is tough for the FTC to spot but profitable for the firms when it goes undetected. Interestingly, and consistent with her remarks, the roughly 20 cases of single facility sales from one large chain to another involve disproportionately large pro forma HHI changes.

[33] See Section 2.1 for more details.

facility acquisitions apart of reportable mergers would face higher enforcement rates even in the absence of a direct relationship between notifications and enforcement. Thus, I rely on additional variation provided by premerger market structure. For each proposed facility acquisition, I compute a pro forma HHI change equal to the difference between (a) HHI in the prior year at the observed market shares and (b) the same figure under the condition that the transaction were complete. For procedural as well as underlying economic reasons, large concentration changes are more likely to provoke enforcement actions. For example, if firm A faces ten rival facilities in market B and two in market C, and if it proposes to acquire one competing facility in each, it is more likely to be blocked in A than B.

For simplicity, I collapse observations to the merger-market level. For example, if a target firm operates one facility in Market A but two in Market B, then this merger provides two, not three, observations. To compute pro forma HHI changes, I assume all proposed facility acquisitions associated with a particular merger in a given market are completed, and to assess the effect on enforcement, I ask whether the FTC blocked any of these. This simplification ignores the possibility that the parties might not divest all the target facilities in a market or divest acquiror facilities instead, though instances of either are very rare in practice, and this modeling choice does not affect the results.[34]

The estimating equation is given by

$$I_{im}^{Block} = \beta_0 + \beta_1 I_i^{Reportable} + \beta_2 \Delta HHI_{im}^{\star} + \beta_3 I_i^{Reportable} \Delta HHI_{im}^{\star} + \epsilon_{im}. \quad (1)$$

i denotes a merger and m denotes a market. I_{im}^{Block} takes a value of one when any proposed facility acquisition at the merger-market level is blocked and equals zero otherwise. $I_i^{Reportable}$ takes a value of one if the merger was reportable and equals zero otherwise. $\Delta HHI^{\star}$ denotes the change in pro forma HHI.

β_0 represents a "baseline" enforcement rate for exempt proposed facility acquisitions (i.e. the likelihood of being blocked when $\Delta HHI^{\star} = 0$ when the proposed facility acquisition is apart of an exempt merger). β_1 represents the additional enforcement that reportable mergers face at the baseline. β_2 denotes the relationship between pro forma HHI changes and enforcement for exempt proposed facility acquisitions, while β_3 denotes the additional slope of that relationship for reportable proposed facility acquisitions.

[34] I observe that when the target divests at least one facility in a market, they typically divest all their facilities in that market, which suggests that the agency treats the merger-market as the relevant unit of enforcement. Language in FTC complaints also supports this interpretation. Thus, divestitures of only part of the target or acquiror facilities in a market is likely to reflect differences between our market definitions. I also observe cases where acquiror rather than target facilities are divested, but these are rarer still.

Given the paucity of work on de facto enforcement of antitrust law, all parameters are informative, though the last is especially important. $\beta_3 > 0$ equates to "stealth consolidation." Acquisitions of competitors that would otherwise be blocked by the FTC but for exemptions to the premerger notification program, which allows the transactions to slip past the agencies undetected. This interpretation requires that the relationship between pro forma HHI changes and unobservable factors determining enforcement for reportable proposed facility acquisitions is the same as the one for exempt proposed facility acquisitions. The restriction is discussed alongside the results, which are presented immediately below.

4.2 Estimates

Figure I reports enforcement rates faced by proposed facility acquisitions. The x-axis measures the pro forma HHI changes, and the y-axis measures enforcement rates. Data are binned according to x-axis values. The dashed line plots the proportion of *reportable* proposed facility acquisitions that are blocked. Towards the left of the figure, where pro forma HHI changes are at or near zero, enforcement rates are exactly zero. In other words, benign transactions where the target and the acquiror overlap are never blocked. Enforcement rates rise sharply, however, as one shifts attention to pro forma HHI changes of 500 to 1,000 points. At the extreme right, enforcement rates average almost 90%, which reflects the FTC blocking nearly all proposed facility acquisitions that would result in monopoly.

[Figure I about here.]

The solid line plots an analogous proportion of *exempt* proposed facility acquisitions. Its striking divergence with the prior line represents perhaps the most important result in this paper. Compared with predictable—even aggressive—enforcement among reportable mergers, the FTC blocks almost no proposed facility acquisitions apart of nonreportable ones. The latter group includes dozens of deals resulting in local duopolies and even monopolies. Pro forma HHI changes often exceed 1,000 points and often each 2,000 points or more.

As a point of comparison, the *Horizontal Merger Guidelines* state that "moderately concentrated markets that involve an increase in the HHI of more than 100 points" as well as "highly concentrated markets that involve an increase in the HHI of between 100 points and 200 points" both "potentially raise significant competitive concerns and often warrant scrutiny." Moreover, "Mergers resulting in highly concentrated markets that involve an increase in the HHI of more than 200 points will be presumed to be likely to enhance market power." Juxtaposed with the figures above, it is clear that

premerger notification exemptions enable market structure changes in the dialysis industry that are more than an order of magnitude higher than what the agencies presume to be anticompetitive.[35]

The divergence reported in Figure I is unlikely to reflect the agency simply pursuing larger deals, since the data also indicate enforcement is independent of merger size. To see this, I restrict the sample to reportable mergers and plot enforcement rates, conditional on premerger market structure, against merger size. I report the result in Panel A of Figure V in the appendix. There is no apparent relationship. Mergers involving, for example, twenty target facilities face the same likelihood of enforcement as those involving over five hundred. This divergence is equally unlikely to reflect the agency pursuing larger acquirors. To see this, I replicate the aforementioned exercise, replacing target size with acquiror size, and report the result in Panel B of the same figure. Again, there is no relationship.

To quantify this divergence, Table III reports coefficients obtained from estimating Equation 1. Despite inevitable right-hand side measurement error in the timing of mergers, market definitions, and output shares, this simple specification explains about two-thirds of the variation in enforcement rates. The coefficient on the interaction between I^{Report} and ΔHHI is 0.2, while the remaining ones are near zero. Going from one extreme of $\Delta HHI = 0$ (i.e. no premerger competition between target and acquiror locations) to the other extreme of ΔHHI = 5,000 (merger to monopoly among equally sized firms) shifts the likelihood that the proposed facility acquisition is blocked from about zero to 100 percent. In short, while Figure I and Table III rely on very different data and variation than Wollmann [2019], they reach the same conclusion: exempting a transaction from the US premerger notification program effectively exempts it from antitrust scrutiny altogether.

[Table III about here.]

5 Effects on the quality of care

5.1 Empirical framework

This section addresses the other key question in this paper, which is whether market structure changes induced by premerger notification exemptions affect provider decisions and patient health. With prices set by Medicare, firms compete on quality. Acquisitions of competitors reduce the incentives to do so: newly merged facilities recognize that when they add costly inputs to attract patients, many of the individuals they gain may be substituting away from facilities they also now own. With the de facto

[35] See Footnote 31.

objective of seeking to preserve competition and consumer welfare, the US competition authorities aim to enjoin these transactions. However, as the prior section shows, their ability to do so hinges on receiving premerger notifications. Thus, I estimate the degree to which horizontal nonreportable facility acquisitions identified in the prior section lead providers to reduce quality-related facility inputs. Following prior work, I focus on the number of dialysis the analysis considers the number of nurses and machines available to treat patients.

However, fewer dialysis stations and clinical staff do not necessarily equate to sicker patients. Competition for patients may have previously driven machines and nurses up to the point where marginal changes represent differences in medically insensitive amenities. Hypothetical, albeit extreme, examples might include patients never needing to wait for a machine or always having the undivided attention of a nurse. As a result, I focus greater attention on patient health, which I measure in hospitalization and survival rates.

To obtain these estimates, I rely on the prior sources of variation as well as on the timing of mergers. Around each proposed facility acquisition I study a period covering a three year window on each side of the transaction. Since an analysis of pre-acquisition trends informs the interpretation of the results, I narrow the sample to proposed acquisitions of facilities that have been operating for at least three calendar years prior to the transaction. When facility characteristics (i.e., nurses and stations) and patients are the outcomes of interest, this restriction suffices. When machines per patient, nurses per patient, hospitalization rates, and survival rates are the outcomes of interest, I further narrow the sample to facilities that operate for at least three calendar years after the acquisition as well.[36]

The estimating equation is given by

$$y_{at} = \gamma X_{at} + \theta_1 I_t^{Post} + \theta_2 I_t^{Post} I_a^{Exempt} + \theta_3 I_t^{Post} I_a^{Horizontal} + \theta_4 I_t^{Post} I_a^{Exempt} I_a^{Horizontal} + \eta_{at}. \quad (2)$$

Observations are at the facility-year level. a indexes the proposed facility acquisition, and t denotes the year in event time. Three year windows around each transaction equate to six observations for each acquisition "event." I_t^{Post} represents an indicator for $t > 0$. I_a^{Exempt} represents an indicator for whether the proposed facility acquisition is part of an exempt merger.[37] X_{at} represents a vector of control variables, which always include fixed effects at the level of the proposed facility acquisition.

[36]Balancing the panel reduces the sample by only 7% proposed facility acquisitions so it is unlikely to adversely influence interpretation of the resulting coefficients. The directional effect of this restriction are, in theory, ambiguous. On the one hand, consolidation reduces survival rates and could deplete the patient population to the point where the firm finds it profitable to close the facility. Omitting these observations lead me to underestimate the true effects. On the other hand, firms may close only the facilities whose patients are healthy enough to endure to a further or less desirable location.

[37]To be clear, $I_a^{Exempt} = 1 - I_a^{Reportable}$.

The term absorbs all others that do not depend on t and ensures that estimates do not depend on differences across firms.[38]

To ease exposition, the estimating equations initially consider a discrete measure of competition. $I^{Horizontal}$ indicates a proposed facility acquisition will result in a pro forma HHI change exceeding its mean value across transactions—roughly 500 points. This restriction is later relaxed. Regardless of the specification, though, and critical to the research design, pro forma HHI changes depend only on observed market shares just prior to the merger, i.e., at $t = -1$. This ensures that estimates do not depend on any endogenous postmerger decisions by providers or patients.

$\theta_4 \neq 0$ represents the effect of "stealth consolidation." Market structure changes that would otherwise be blocked by the FTC but for premerger notification exemptions affect the quality of care provided to dialysis patients. This interpretation requires assumptions on the timing of mergers (e.g., that certain transaction types are not timed to coincide with factors that determine patient health) as well as on the operations of the acquirors.[39]

5.2 Estimates

To assess how providers adjust quality-related facility inputs, columns 1-2 in Table IV report coefficients obtained from estimating Equation 2 where y represents the number of dialysis machines and nursing staff available to treat patients. Two patterns in the data emerge. First, dialysis mergers reduce, on average, both inputs' use. Second, these declines vary by transaction type and are by far the steepest for horizontal nonreportable deals. That is, among proposed facility acquisitions involving large pro forma HHI changes, exemptions to the US premerger notification program reduce machines and nurses by 5.9 and 6.7 percentage points, respectively. Consistent with a model of competition on quality, the estimates indicate acquisitions by rival providers lead firms to reduce costly inputs. Moreover, this offers at least an initial indication that market structure changes which have "slipped past" the antitrust authorities undetected over the past two decades were not irrelevant.

[Table IV about here.]

[38] For this reason, Equation 2 omits terms that depend solely on I_a^{Exempt}, $I_a^{Horizontal}$, or their interaction.

[39] Attorneys and bankers who advise sellers indicate that the timing of exempt mergers depend on a host of factors that are random with respect to market structure. They state that these factors include a desire to step back from day-to-day operations (e.g., "with an eye to retirement," due to "burnout", or because of "interest in a new challenge") or liquidity (e.g., due to divorce, a partnership dispute, or tax/estate reasons) [Riley and Walsh, 2013, Hollis, 1998, Dresner, 2008]. Reportable mergers—especially those involving public targets—are delayed due to prolonged negotiations, regulatory approvals, and financing. Moreover, these deals involve large numbers of geographically dispersed facilities, offering little scope for selection.

Patients treated by acquired facilities fall, on average, as well. The sign and size of the coefficients again depends on transaction type (column 3), although the decrease in volume does not fully offset the decline in staff (column 5). Providers stretch nurses thin, especially following horizontal nonreportable transactions. For this subset of proposed facility acquisitions, patient-to-nurse ratios rise by 0.31—3.7% of the mean ratio across observations in the sample.

Hospitalization and survival rates provide much more direct assessments of the response of patient health, so the remaining analysis focuses on these measures. Columns 1-3 of Table V report the coefficients obtained where y represents standardized one year hospitalization rates and standardized one and two year survival rates. Most striking, horizontal proposed facility acquisitions apart of exempt mergers harm patients irrespective of which health measure is considered. Hospitalization rates rise by 3.1 percentage points while survival rates fall by 1.6 to 2.0 percentage points.

[Table V about here.]

The size and significance of these estimates underscore the "at risk" nature of the patient population. One reason for their poor health is that primary contributing factors to kidney function loss often persist as comorbidities. In the data, diabetes, for example, coexists with ESRD in 30% of cases and hypertension is nearly as common. Another reason is that as renal function deteriorates, excess fluids and the accumulation of various compounds in the bloodstream lead to conditions ranging from lethargy and muscle loss to cardiac arrhythmias and heart disease. The estimates equally highlight how sensitive adverse medical outcomes are to dialysis provider decisions. In the data, infections are the primary cause of 13% of deaths and a contributing factor in an additional 4%.

These findings echo large quantity-quality tradeoffs recovered by Grieco and McDevitt [2016], who study this balance directly and provide clear examples. For instance, the authors state, "A center can treat more patients if it spends less time cleaning machines after each use, although doing so increases the risk of patients acquiring infections." They further argue that "because dialysis sessions require up to one hour of preparation and cleaning, the centre has considerable control over its targeted infection rate." Their broadest finding—one that likely extends far beyond dialysis—is that by ignoring differences in the quality of care, researchers misattribute patient harm to higher productivity.

5.3 Pre-acquisition trends

Preceding results may overstate θ_4 if certain types of mergers are timed differently than others. For example, estimates will be biased away from zero if horizontal exempt transactions happen to coincide

with changes in patient health that are unrelated to competition (and not fully controlled for by observable risk factors). However, so long as unobservable risk factors evolve smoothly over time, one can evaluate this concern by looking for pre-acquisition trends in the outcomes of interest.

For this exercise, I group proposed facility acquisitions by whether or not they are horizontal as well as whether they are apart of exempt or reportable mergers. I then plot one year hospitalization rates and two year survival rates, averaging across facilities within the four groups. These averages depend on *exactly* the same observations as the estimates found in Table V (with the exception that this exercise includes observations at $t = 0$).

Figure II reports the result of this exercise with respect to hospitalization rates. Panel D reflects exempt horizontal proposed facility acquisitions. Rates do not exhibit an obvious trend between $t = -3$ and $t = -1$ but climb sharply at $t = 0$, consistent with mergers between rival firms compromising quality and jeopardizing patients. Panels A-C reflect reportable non-horizontal, reportable horizontal, and exempt non-horizontal proposed facility acquisitions, respectively. As in Panel D, no premerger trends are immediately apparently. Unlike Panel D, though, hospitalization rates do not discontinuously rise at $t = 0$.

[Figure II about here.]

Figure III reports analogous results for survival rates. It supports the same conclusion. Horizontal exempt proposed facility acquisitions exhibit no obvious pre-acquisition trends, and rates rise decline abruptly at $t = 0$. Other transaction types also lack premerger trends, but rates do not change abruptly around the date of the acquisition.[40]

[Figure III about here.]

5.4 Patient selection

A second concern is that θ_4 might be overstated due to changes in the mix of patients that the facilities treat. Estimates will be biased away from zero if facilities involved in horizontal exempt acquisitions shift towards patients that are relatively unhealthy in ways not captured by observable risk factors. On the one hand, there are no immediate reasons why consolidation would affect selection this way. Also,

[40]Death represents a tail event, so survival rates are noisier than hospitalization ones. Also, there is a large, one period drop in survival rates among reportable horizontal transactions evident in Panel B, which appears to reflect idiosyncratic reporting by one of the chains. Note, though, that omitting this set of observations or attempting to reconcile/correct them would lead to larger estimates (in absolute value terms) of θ_4, since it would result in higher survival rates among these transactions. At the potential risk of underestimating the main effect, I ignore this issue.

at least with respect to new patients, the screen might be hard to implement—it requires admitting and turning away individuals on health outcome residuals after controlling for baseline renal function, age, BMI, and other risk factors included in the standardization of the hospitalization and survival rates. Moreover, prior work has failed to detect any selection on unobservables [Eliason et al., 2019]. On the other hand, changes in the patient mix are hard to rule out a priori and would lead me to conclude provider choices jeopardize patients when in reality certain providers merely choose patients already in jeopardy, so I consider this possibility.

If providers select on unobservable risk factors, then they probably select on observable ones as well. Thus, to evaluate this concern, I compare the main coefficients with those obtained from re-estimating Equation 2 using raw rather than standardized hospitalization and survival rates. If selection is limited, then coefficients will not change. Table VIII in the Online Appendix reports the results of this exercise. (It is relegated to an appendix only because it is a near-facsimile of Table V.) The magnitude and precision of the coefficients are all very similar to the previously reported ones. For example, whereas estimates of θ_4 are 3.2, -1.6, and -2.0 percentage points when outcomes are measured in raw one year hospitalization, one year survival, and two year survival rates, respectively, they are 3.1, -1.6 and -2.0 percentage points when standardized rates are used.

Note that this is not to say observable risk factors are unimportant determinants of hospitalization and survival rates. The one place where Tables V and VIII differ are in reported model fit. For example, R^2 values increase for one and two year survival rates from 28% to 38% and 39% to 51%, respectively, which reflects the facility fixed effects absorbing time-invariant differences in the patient populations. In other words, certain locations have persistently older and more obese inhabitants than others, meaning they suffer higher mortality rates. This variation is explained by facility fixed effects in the raw rates, but it has already been expunged from the standardized rates.

5.5 Divested facilities acquirors

A third concern is that θ_4 may reflect mean differences between independently run and chain owned facilities.[41] Recent work finds that chains systematically provide low quality care [Eliason et al., 2019]. Horizontal reportable transactions are blocked most often, so if blocking an acquisition preserves independent ownership, then changes in patient health outcomes that may reflect aforementioned mean differences in equality, not an exercise of market power. Enforcement actions, however, do not preserve independent ownership—instead, they merely transfer it from one large provider to another.

[41] I thank Judy Chevalier for pointing this out.

There are two underlying reasons. First, reportable mergers by definition involve large target firms, which already qualify as chains. In other words, the acquirors as well as targets involved in reportable mergers facing enforcement actions are all identified as "chain" organizations by the USRDS.[42] Second, most divested facilities are either sold to existing chains or spun off together to form new chains, which subsequently acquire large numbers of independent facilities for themselves. To be more precise, just under 95% of divested facilities are sold to firms the USRDS identifies as "chain" organizations.

To illustrate, consider the acquisition of Gambro Healthcare in 2005. At the point it was acquired, it was among the very largest US providers—clearly a chain organization in form and substance. Gambro's value far exceeded the HSR thresholds, so the parties reported the merger, and several of its facilities competed with those of its acquiror, so the agency blocked the sale of seventy locations, which were spun off together (to form Renal Advantage). The newly formed entity nearly doubled its facility count, reach over 130 locations, with more than half of the growth coming from acquisitions, not de novo operations.

5.6 Continuous concentration indices

To ease exposition, preceding results relied on a binary measure of competition. Columns 4-6 of Table V report results obtained from estimating Equation 2 but replacing the indicator for whether $HHI^{\star}$ exceeds 500 points with $HHI^{\star}$ itself. Coefficients are similar in sign and significance to those reported in the prior three columns. Their magnitudes indicate medically relevant anticompetitive behavior. For each 1,000 point change in pro forma HHI, proposed facility acquisitions apart of exempt mergers result in 1.0 percentage point higher hospitalization rates and 0.7-0.8 percentage point lower survival rates as compared to ones apart of reportable mergers. For perspective, a merger to duopoly among three equally sized local competitors equates to a 2.156 percentage point change in hospitalization rates, and a merger to monopoly among two equally sized rivals equates to a nearly 4.95 percentage point change.

5.7 Comparisons to prior work

Eliason et al. [2019] (hereafter EHMR) study acquisitions of independent providers by large chains, which they show transfer their strategies to acquired locations. The authors find that this involves not only increasing expenditures on treatments but also cutting costs in ways that compromise the quality

[42]These include Renal Advantage, Satellite, Diversified Specialty, Fresenius, DSI ("Newco"), and National Renal Institute.

of care. As the authors point out, the effectiveness of these strategies imply that competition does not perfectly discipline provider behavior. My estimates are consistent with their main result, and I reach the same broad conclusion about imperfect competition. Further on in their analysis, however, the authors find no evidence that competition impedes the strategies firms employ, which appears, at least at first, at odds with my findings. There are two main reasons for the discrepancy, which is easy to reconcile.[43]

One relates to our competition measures. Whereas I define horizontal acquisitions as ones that increase HHI more than average, EHMR's initial specification defines them as acquisitions that increase HHI at all. Right skew in the distribution of concentration changes means that their definition includes many deals that amount to trivial HHI increases. Also, whereas I define HHI changes at (approximately) the county level,[44] EHMR's initial specification defines them with respect to health service areas, which are larger than counties.[45] Finally, my estimates reflect comparisons with proposed facility acquisitions apart of reportable mergers—they represent "triple-differences" rather than "differences-in-differences." This amounts to a small, statistically insignificant adjustment to the rates but one that must nonetheless be accounted for in comparing magnitudes.

To arrive at estimates comparable to my own, I begin with EHMR's supplementary tables, which report results based on alternative market definitions. When they base HHI changes on a geographic unit closer in size to a US county, the authors finds that horizontal mergers increase one year hospitalization rates by 1.53 percentage points. [46][47] Then, I adjust their estimate to reflect horizontal acquisitions defined by $\Delta HHI^{\star} > 500$ instead of $\Delta HHI^{\star} > 0$.[48] Finally, I adjust their estimate to reflect differences between reportable and exempt mergers. With these adjustments, EHMR predict that one year hospitalization rates increase 2.75 percentage point following horizontal transactions—within 0.5 standard errors of the 3.0 percentage point change I report in the top right cell of Table V. (Again, this does not change any of EHMR's main results. The authors require only imperfect competition, not zero competition.)

The second reason relates to the outcomes we study. While EHMR's main result applies to a diverse set of operational and clinical measures, their other competition-related results pertain mostly

[43]Other reasons exist but are quantitatively less important and economically uninteresting. For one, my panel is slightly longer. However, when I shorten the panel, most estimates increase in absolute value terms.

[44]The vast majority of markets are defined by county borders. See Section 3 and the Online Appendix for details.

[45]There are less than 300 health service areas but over 3,000 US counties. See also Footnote 46.

[46]See EHMR Online Appendix Table I5, which reflect markets based on ten mile radii. This is the next smallest geographic unit that they consider after the health service area and translates to an area of 314 square miles. This is also close in size to the median inhabited US county, which occupies less than 500 square miles.

[47]EHMR observations are at the month rather than year level. Equating monthly to yearly rates requires scaling up by 4.85.

[48]Based on comparisons of coefficients obtained on my sample, this requires scaling up by 45%.

to the administration of anemia medications and their therapeutic consequences.[49] Dispensing these drugs to ESRD patients consistently ranks among Medicare's largest prescription drug expenditures, so its relevance cannot be understated. However, dosing decisions mainly affect reimbursements, which are mostly irrelevant to patients and unrelated to local market power. As a clear illustration, EHMR point out that the two leading drugs, Ferrlecit and Venofer, are "essentially substitutable" but for idiosyncrasies in how they are reimbursed, which makes the latter much more profitable to administer.[50] They show that when large chains acquire independent facilities, they shift swiftly to Venofer, while market structure changes induce no change in dispensing behavior. Theory predicts the latter result, and the data confirm it.

Cutler et al. [2016] instead study mergers between national chains. They find that the ensuing consolidation does not meaningfully impact providers or patients. Again, on the surface, it may appear that the authors and I reach different conclusions. Yet, we do not. I also find that pro forma HHI changes *associated with large mergers* lack anticompetitive effects—these are exactly the deals in my data that are reported to the agency and subsequently face aggressive enforcement. (This is evident from, for example, coefficients reported on the second and fourth rows of Table V.) As I argue above, the facilities for which providers would otherwise cut quality and jeopardize patients the most are precisely the ones whose acquisitions are blocked by the FTC. In fact, if one takes competition between the providers as given, then by recovering near-zero coefficients on acquisition-induced concentration changes, Cutler et al. [2016] present the empirical puzzle that my paper attempts to solve.

Eliason [2018] estimates a structural two stage model of competition among providers. In the first stage, firms choose whether to enter and what capacity to provide, and in the second stage, they compete on quality (since prices are mostly fixed by the government). This approach allows for detailed counterfactual simulations that incorporate endogenous provider behavior. He tackles the fiercely contested issue of whether higher reimbursements would raise quality. He finds that 90% of such an increase would be captured by providers as profits. Travel subsidies turn out to be much more cost effective, because increased willingness of patients to substitute between facilities not only intensifies competition but also reduces congestion.

[49]The urea reduction ratio (URR) is an exception; however, while EHMR state that URRs are unaffected by horizontal acquisitions, they also state that URRs yield estimates that run counter to their main findings as well. Given the robustness of their central result, I think these facts merely reflect idiosyncrasies in how URRs are reported. For instance, only patient-month averages are reported, and only the ranges into which the averages fall are published. Also, top-coding and bottom-coding may exist, observations are often missing, and the ratio must be inferred from a volume-denominated measure towards the latter part of the sample.

[50]Ferrlecit and Venofer come in 62.5 and 100 mL vials, respectively, and are reimbursed similarly on a per-mL basis. EHMR describe how providers shift between drugs to raise revenues: if four patients each require 25 mL doses, facilities can bill Medicare for 400 mL of Ferrlecit but only 250 mL of Venofer.

His findings highlight two important features of the industry that drive my results as well. Frequent travel limits patients' willingness to travel, making competition a very "local" phenomena, and fixed costs are relatively high.[51] Thus, markets are concentrated to begin with, and subsequent entry is rare. His estimates of how competition improves patient outcomes square with mine as well: removing a rival firm from the market leads to sharply higher hospitalization rates and lower survival rates.

6 Conclusion

Applying competition law to even the largest domestic mergers proved challenging prior the HSR Act. Firms transacted quietly and covertly, limiting the ability of the agencies to arrest anticompetitive deals in their incipiency. Even after its passage, though, most US mergers were not reported to the agencies due to exemptions based on size. The reasons legislators gave for these exemptions reflected an assumption that only large deals have meaningful anticompetitive effects. However, this premise often fails for differentiated product markets. Some non-tradable services, for example, may be so geographically segmented that industries amounting to billions of dollars of output can locally consolidate vis-a-vis mergers valued at only a few million dollars each.

This paper shows this concern is not merely hypothetical. In the dialysis industry, hundreds of deals falling below the premerger notification threshold transferred ownership of thousands of facilities. Many resulted in large concentration changes; several resulted in duopolies and even monopolies. Based on their enforcement record over the roughly past two decades, the FTC would have blocked most to all of the latter group (had they been notified of them). Ensuing *stealth consolidation* limited patients' ability to substitute between competing providers. With prices mostly set by the government, firms responded by cutting quality, which ultimately led to higher hospitalization rates and lower survival rates for persons treated by these facilities.

References

Nikhil Agarwal, Itai Ashlagi, Michael Rees, Paulo Somaini, and Daniel Waldinger. An empirical framework for sequential assignment: The allocation of deceased donor kidneys. 2019.

[51] With respect to the first feature, he finds that the average patient travels only about six miles for treatment. With respect to the second, he estimates baseline fixed costs of $278,000 plus around $42,000 per machine.

David Autor, David Dorn, Lawrence F Katz, Christina Patterson, and John Van Reenen. The fall of the labor share and the rise of superstar firms. NBER Working Paper No. 23396, 2017.

William J Baer. Reflections on Twenty Years of Merger Enforcement under the Hart-Scott-Rondino Act. Antitrust Law Journal, 65:825, 1996.

William J Baer. The American Bar Association Clayton Act 100th Anniversary Symposium, 12 2014. Remarks by Assistant Attorney General Bill Baer.

Simcha Barkai. Declining labor and capital shares. Working paper, 2016.

Cory Capps, David Dranove, and Christopher Ody. Physician practice consolidation driven by small acquisitions, so antitrust agencies have few tools to intervene. Health Affairs, 36(9):1556–1563, 2017.

Joseph A Clougherty and Jo Seldeslachts. The deterrence effects of us merger policy instruments. The Journal of Law, Economics, & Organization, 29(5):1114–1144, 2013.

Colleen Cunningham, Florian Ederer, and Song Ma. Killer acquisitions. Working paper, 2017.

David Cutler, Leemore S. Dafny, and Christopher Ody. How does competition impact quality of care? a case study of the u.s. dialysis industry. 2016.

Jan De Loecker and Jan Eeckhout. The rise of market power and the macroeconomic implications. NBER Working Paper No. 23687, 2017.

Jan De Loecker, Jozef Konings, and Patrick Van Cayseele. Merger review: How much of industry is affected in an international perspective? Journal of Industry, Competition and Trade, 8(1):1–19, 2008.

Stephen Dresner. Our perspective on the dialysis sector. 2008.

Paul Eliason. Market Power in Health Care: Congestion and Spatial Competition in the Dialysis Industry. 2018.

Paul J Eliason, Benjamin Heebsh, Ryan C McDevitt, and James W Roberts. How Acquisitions Affect Firm Behavior and Performance: Evidence from the Dialysis Industry. The Quarterly Journal of Economics, 135(1):221–267, 11 2019. ISSN 0033-5533.

Michael WL Elsby, Bart Hobijn, and Ayşegül Şahin. The decline of the US labor share. Brookings Papers on Economic Activity, 2013(2):1–63, 2013.

Federal Trade Commission. The FTC's Merger Remedies 2006-2012. Technical report, January 2015.

Jason Furman and Peter Orszag. A firm-level perspective on the role of rents in the rise in inequality. 2015.

Martin Gaynor, Kate Ho, and Robert J Town. The industrial organization of health-care markets. Journal of Economic Literature, 53(2):235–284, 2015.

Ilene K. Gotts. The Merger Review Process. American Bar Association., 2001.

Paul L. E. Grieco and Ryan C. McDevitt. Productivity and quality in health care: Evidence from the dialysis industry. The Review of Economic Studies, 84(3):1071–1105, July 2016.

Germán Gutiérrez and Thomas Philippon. Investment-less growth: An empirical investigation. NBER Working Paper No. 22897, 2016.

Daniel E. Hemli, Jacqueline R. Java, and Rebekah T. Scherr. Avoiding the issue: Tips for avoiding antitrust issues in mergers and acquisitions. Recycling Today, 2016.

Carla Anderson Hills. Antitrust Adviser 3rd Edition. 1985.

Brooke Hollis. Dialysis provider mergers and acquisitions: To sell or not to sell. Dialysis & Transplantation, 27(4):214–302, 1998.

Loukas Karabarbounis and Brent Neiman. The global decline of the labor share. The Quarterly Journal of Economics, 129(1):61–103, 2013.

Maureen Ohlhausen. Interview with ftc commissioner maureen ohlhausen. By Joe Tipograph. The Capitol Forum. Conducted on September 30, 2014., 2014.

Leslie Overton. Non-reportable transactions and antitrust enforcement. Transcript of remarks at 14th Annual Loyola Antitrust Colloquium, Institute for Consumer Antitrust Studies, Chicago, April 2014, 2014.

Sam Peltzman. Industrial Concentration under the Rule of Reason. The Journal of Law and Economics, 57(S3):S101–S120, 2014.

James. B Riley and Amber McGraw Walsh. 2006. Nephrology News & Issues, July 2013.

Irving Scher and Scott Martin. Antitrust Adviser 5th Edition. Thomson Reuters, 2015.

Fiona M. Scott Morton. Diagnosing the problem: Exploring the effects of consolidation and anticompetitive conduct in health care markets. Testimony before the House Judiciary Committee, 116th United States Congress, 2019.

United States Renal Data System (USRDS). 2017 USRDS annual data report: Epidemiology of kidney disease in the United States. Technical report, National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2017.

Thomas G. Wollmann. Stealth consolidation: Evidence from an amendment to the Hart-Scott-Rodino Act. The American Economic Review: Insights, 1(1):pp. 77–94, 2019.

Figures

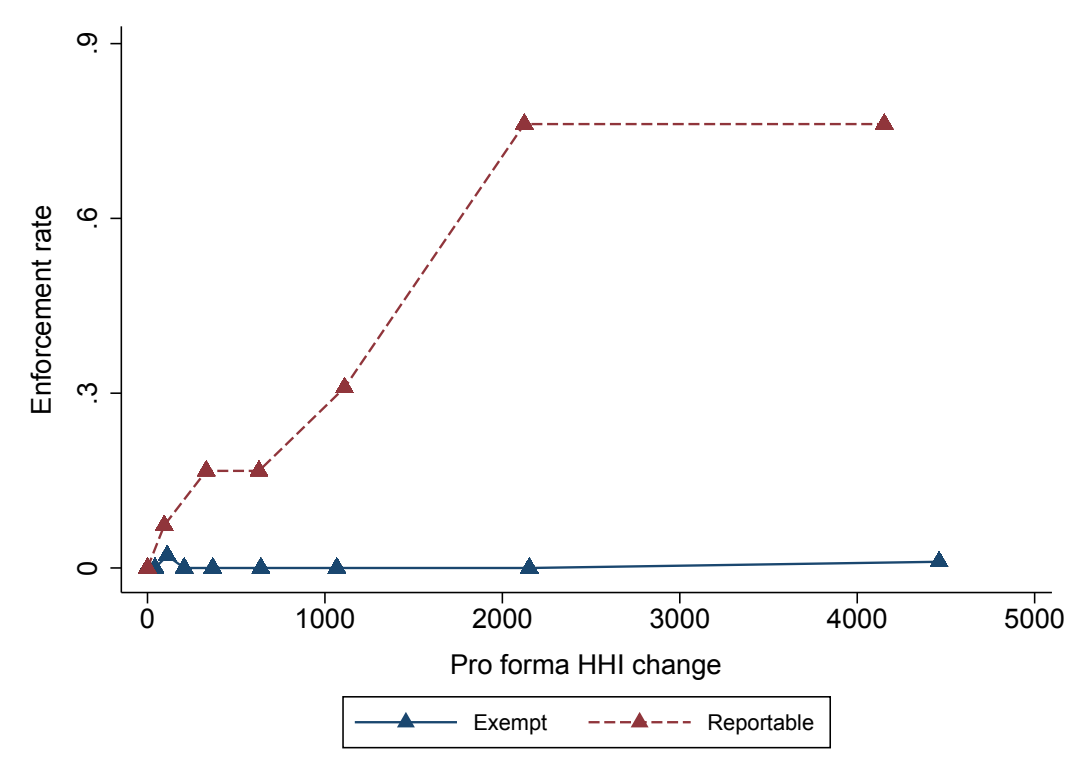

Figure I: *Authorities aggressively block acquisitions of competitors, but only when receiving premerger notifications.*

This graph plots divestiture rates against pro forma HHI changes, i.e., the amount HHI would increase were the proposed facility acquisition completed. The unit of observation is the merger-market (so a target firm operating in, for instance, five markets prior to the merger generates five observations regardless of how many facilities it operates in). Data are binned according to x-axis values, and the average enforcement rates within the cells are measured on the y-axis. Points connected by the top, dashed line reflect reportable mergers; those on the bottom, solid line reflect exempt ones.

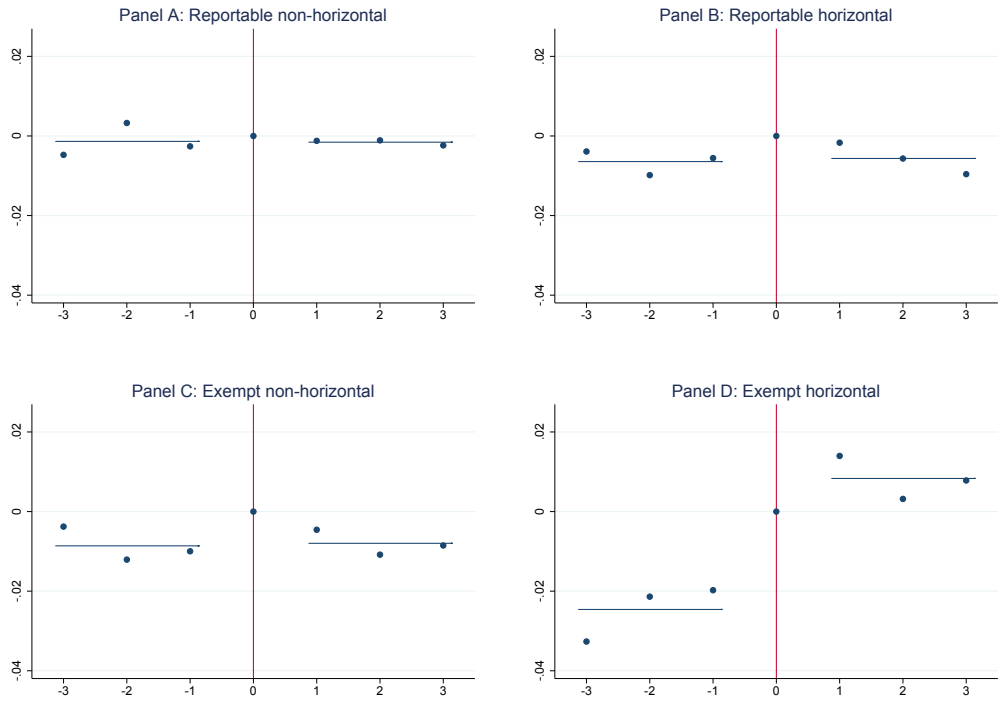

Figure II: *Hospitalization rates around proposed facility acquisitions.*

These graphs plot health outcomes by acquisition type. The x-axis measures event time, with zero corresponding to the year of the acquisition. The y-axis measures average (one year) hospitalization rates rates. "Exempt horizontal" means proposed facility acquisition that were apart of exempt mergers and that are associated with pro forma HHI changes above 500 (the mean pro forma HHI change). Other acquisition types are defined analogously. Solid horizontal lines plot pre-acquisition and post-acquisition survival rates.

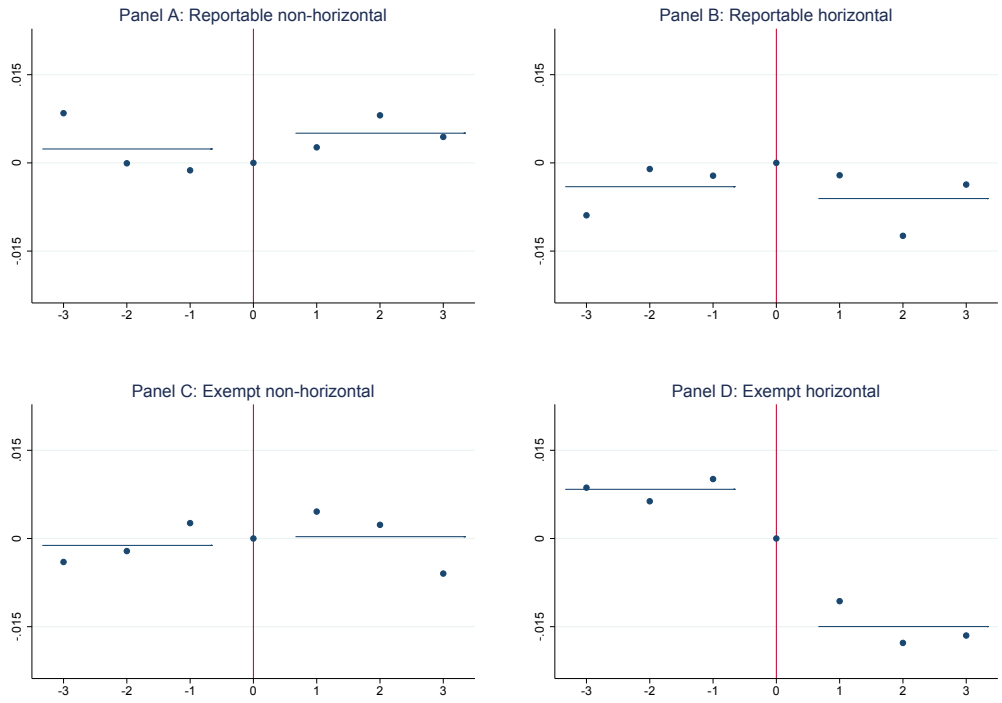

Figure III: *Survival rates around proposed facility acquisitions.*

These graphs plot health outcomes by acquisition type. The x-axis measures event time, with zero corresponding to the year of the acquisition. The y-axis measures average (two year) survival rates rates. "Exempt horizontal" means proposed facility acquisition that were apart of exempt mergers and that are associated with pro forma HHI changes above 500 (the mean pro forma HHI change). Other acquisition types are defined analogously. Solid horizontal lines plot pre-acquisition and post-acquisition survival rates.

Tables

Table I: *Industry summary over time.*

	Facilities					
Year	Total	Large chain	Patients	Machines	Nurses	Market HHI
1996	2749	397	8902*	39602	12170	2318
1997	2989	915	21113*	43450	13381	2548
1998	3206	1373	37965*	48307	14864	2664
1999	3430	1548	61057	52984	16251	2694
2000	3609	1661	85703	57369	16846	2817
2001	3776	1829	102453	61857	18017	3081
2002	3948	2197	118574	65397	17588	3122
2003	4090	2322	132214	69005	17663	3108
2004	4215	2530	144691	71745	17128	3149
2005	4347	2615	155724	74687	18315	3395
2006	4489	2660	163456	78325	18643	3728
2007	4640	2768	170676	80999	19378	3722
2008	4846	2942	178767	85121	20770	3775
2009	5036	3090	183233	88167	21165	3738
2010	5166	3236	193991	91601	21309	3788
2011	5275	3483	201048	94301	21756	3909
2012	5413	3804	207940	97047	22571	3979
2013	5607	4000	210703	99893	23864	4010
2014	5807	4198	216131	104205	25067	4057
2015	5946	4338	218684	107417	26318	4057
2016	6152	4787	222809	112489	29832	4070
2017	6310	4996	–	115457	29116	–

"Large chain" denotes ownership of 250 or more facilities. "Market HHI" equals a weighted average of concentration indices across markets in a given year, with the weights proportional to the number of patients treated in those markets. "Nurses" counts both registered nurses and and licensed nurse practitioners. "–" denotes missing data and reflects that treatment data is complete through 2016. "⋆" denotes observations with incomplete coverage. It reflects that patient profiles, which provide control variables such as baseline renal function, are incomplete in the earliest years of the panel, and patients missing controls are dropped.

Table II: *Facility acquisitions summary.*

	Proposed				
Year	All	Exempt	Reportable	Completed	Blocked
1997	450	181	269	450	0
1998	279	171	108	279	0
1999	154	123	31	154	0
2000	117	99	18	117	0
2001	157	109	48	157	0
2002	101	101	0	98	3
2003	81	81	0	81	0
2004	190	120	70	190	0
2005	683	120	563	612	71
2006	619	134	485	517	102
2007	95	95	0	95	0
2008	106	70	36	106	0
2009	52	52	0	52	0
2010	257	89	168	257	0
2011	262	145	117	237	25
2012	324	48	276	266	58
2013	134	86	48	134	0
2014	65	65	0	65	0
2015	74	74	0	74	0
2016	138	62	76	135	3
2017	89	51	38	82	7
Total	4427	2076	2351	4158	269

"All proposed facility acquisitions" equals the sum of columns 3–4 and likewise equals the sum of columns 5–6. "Reportable proposed facility acquisitions" are those associated with mergers whose transaction size exceeds the HSR thresholds and thus requires the parties to notify the FTC and DOJ. "Exempt proposed facility acquisitions" do not require notification.

Table III: *Enforcement rates depend on exemption status and premerger market structure.*

VARIABLES	(1) All mergers	(2) All mergers	(3) All mergers	(4) Reportable only
Reportable	0.0728***		0.0128***	
	(0.00744)		(0.00386)	
Pro forma HHI change		0.0621***	0.00121	0.216***
		(0.00721)	(0.00156)	(0.0151)
Reportable × Pro forma HHI change			0.214***	
			(0.0152)	
Constant	0.00159*	0.00705***	0.00104	0.0139***
	(0.000919)	(0.00191)	(0.000871)	(0.00376)
Observations	3,148	3,148	3,148	1,264
R-squared	0.043	0.126	0.497	0.491

, **, and * denote significance at the 10%, 5%, and 1% levels, respectively. The dependent variable indicates whether the FTC blocked any proposed facility acquisition at the merger-market level. The first three columns reflect the full sample, whereas the last reflects proposed facility acquisitions apart of reportable mergers only. "Pro forma HHI change" is scaled down by a factor of 1,000 for the sake of readability. Robust standard errors are reported in parenthesis.*

Table IV: *Acquisition effects on stations and staff available to treat patients.*

VARIABLES	(1) Machines	(2) Nurses	(3) Patients per mach.	(4) Patients per nurse	(5) Patients
Post × Exempt × Horizontal	-0.0596*	-0.100**	0.00259	0.517	-0.0812*
	(0.0328)	(0.0402)	(0.0553)	(0.396)	(0.0453)
Post × Horizontal	0.0253	0.0898***	-0.00686	-0.631**	0.0328
	(0.0190)	(0.0273)	(0.0346)	(0.258)	(0.0231)
Post × Exempt	0.0371***	0.0189	0.0327	0.118	0.0561**
	(0.0142)	(0.0192)	(0.0280)	(0.200)	(0.0222)
Post	-0.0232*	-0.0177	-0.0356	-0.0883	-0.0459***
	(0.0132)	(0.0157)	(0.0236)	(0.186)	(0.0177)
Observations	12,828	11,352	12,129	10,919	12,210
R-squared	0.788	0.818	0.794	0.661	0.816
Dependent var. mean	2.8	1.7	2.1	8.8	3.5
Proposed facility acq. FE	X	X	X	X	X
Year FE	X	X	X	X	X

, **, and * denote significance at the 10%, 5%, and 1% levels, respectively. The dependent variables in columns 1-2 and 5 count dialysis stations, nursing staff, and patients at each facility and are expressed in logs. The dependent variables in columns 3-4 are the ratios of patients to dialysis stations and patients to nursing staff, respectively. Standard errors are clustered at the proposed facility acquisition level and reported in parentheses.*

Table V: *Effects on patients' hospitalization and survival rates.*

VARIABLES	(1) One year hospital'n rate	(2) One year survival rate	(3) Two year survival rate	(4) One year hospital'n rate	(5) One year survival rate	(6) Two year survival rate
Post × Exempt × Horizontal	0.0313***	-0.0163**	-0.0201**			
	(0.0110)	(0.00707)	(0.00996)			
Post × Horizontal	0.000988	0.00185	-0.00470			
	(0.00699)	(0.00480)	(0.00676)			
Post × Ex. × Pro forma HHI chg.				0.00968**	-0.00788***	-0.00959**
				(0.00444)	(0.00293)	(0.00384)
Post × Pro forma HHI change				-0.000700	0.00222	0.000936
				(0.00316)	(0.00223)	(0.00299)
Post × Exempt	0.000844	0.00433	-0.00120	0.00324	0.00433	-0.00116
	(0.00555)	(0.00367)	(0.00540)	(0.00535)	(0.00352)	(0.00515)
Post	-0.000207	-0.00219	0.00268	0.000285	-0.00268	0.00128
	(0.00362)	(0.00241)	(0.00352)	(0.00347)	(0.00230)	(0.00336)
Observations	11,214	10,830	10,830	11,214	10,830	10,830
R-squared	0.455	0.280	0.387	0.455	0.280	0.387
Dependent var. mean	0.68	0.84	0.72	0.68	0.84	0.72
Proposed facility acq. FE	X	X	X	X	X	X

, **, and * denote significance at the 10%, 5%, and 1% levels, respectively. The dependent variables are hospitalization and survival rates, averaged across patients in the facility, each year. Standard errors are clustered at the proposed facility acquisition level and reported in parentheses.*

Appendix A: Supplemental tables and figures (ONLINE)

FTC-supplied facility counts and CMS tabulations

To assess whether the FTC and CMS are consistent with one another, I compare the number of acquiring, target, and divested facilities reported by each. Table VI compares agency-provided target and acquiror facility ownership, reported in the complaints filed by the FTC, to tabulations based on the Medicare-provided data.

[Table VI about here.]

Table VII compares the number of divestitures reported by the FTC in consent orders with tabulations based on the Medicare-provided data.

[Table VII about here.]

Transaction values on a per-facility basis

To infer the exemption status of certain deals, I require an estimate of the per-facility transaction value. (See the body of the paper for details.) For thirty mergers associated with over 2,500 proposed facility acquisitions, I directly observe the amount the acquiror paid for the target. Figure IV reports the distribution of purchase prices on a per-facility basis.

[Figure IV about here.]

Enforcement rates by transaction size

To assess whether the FTC disproportionately blocks large deals, I restrict the sample to reportable mergers and collapse the data to the merger-market level (as described in the body of the main text). I regress an indicator of whether the FTC blocked any proposed facility acquisition at the merger-market level on ΔHHI and an indicator for whether the target and acquiror overlapped at all (i.e., whether $\Delta HHI = 0$). Figure V reports the "residualized" enforcement rates by merger size. The figure represents a binscatter, i.e., the data are binned according to x-axis values and their means are plotted.

[Figure V about here.]

Enforcement rates when facilities are assigned equal market shares

Figure VI replicates Figure I in the body of the main text with one exception: instead of using observed market shares in the year prior to the acquisitions, I assign all facilities the same market share (equal to one over the number of facilities active in the market).

[Figure VI about here.]

Raw rather than standardized hospitalization and survival rates

Table VIII replicates Table V but regresses on raw rather than standardized rates of being hospitalized and surviving.

[Table VIII about here.]

Appendix B: Dataset construction (ONLINE)

The core of the dataset relies on the Provider of Service files, created by Centers for Medicare & Medicaid Services. Annual files have been downloaded by NBER staff and conveniently formatted for STATA and other languages.[52] I download and combine all files, and then keep only providers for which prvdr_ctgry_cd=="09", which extracts dialysis providers. The main steps in formatting and organizing this data consist of the following.

(a) Eliminate erroneous observations. Examples include provider numbers 372323 and 442315, which are obvious database errors, as evidenced by their being opened and immediately closed.

(b) Eliminate observations that are duplicates due to, e.g., co-located transplant facilities being given separate provider numbers.

(c) Cross reference providers so that administrative changes in the provider numbers do not appear as facilities that are closed and immediately re-opened. For example, see provider numbers 332618 and 332652.

(d) Correct typographic issues in city names. For example, "Co Bluffs" means "Counsel Bluffs", and "Atl" means "Atlanta." Also, Correct county codes using cities and states. An immediately obvious example is that Hollywood and North Hollywood are not and never have been in Fresno County, CA.

(e) Place unincorporated cities within adjacent or surrounding counties. For example, Chesapeake, VA

[52] The files reside at https://data.nber.org/data/provider-of-services.html.

is unincorporated but effectively inside Portsmouth County.

(f) In rare cases where a facility moves to an adjacent city that is technically in a different county, combine these counties. For example, combine New Mexico counties 171 and 95. (The drive been the locations is less than fifteen minutes.)

(g) Three US counties are heavily populated but are far too large to be treated as a single dialysis market: Los Angeles, San Diego, and Cook (Chicago, IL). Los Angeles and San Diego Counties were split by James Kiselik, my faculty assistant, and a friend of his that grew up near Los Angeles. I split Cook County by simply placing Evanston, Orland Park, and Elk Grove Village in their own markets (since they are geographically far from the downtown market). I also split Navajo County (AZ)—it is five times the size of the state of Delaware. Not knowing the area, and wanting to remain agnostic, I simply placed all cities in their own markets (except for Show Low and Lakeside, which are close). One could enver feasibly travel between these facilities.

(h) Replace each city with the modal city in the zip code. Then, replace each county with the modal county in the city-state unit. (These are not meaningful restrictions.)

(i) Correct and standardize facility and owner names. There are a large number of these. As examples of the first, "diaysis" should read "dialysis" and "lilberty" should read "liberty." As examples of the second, "Renal Treat Centers" and "Renal Trmt Centers" both clearly mean "Renal Treatment Centers," which is a large chain.

(j) Assign owners and ownership dates where missing. For example, "Midtown Macon Dialysis Center" is owned by DaVita.[53] Also for example, DaVita buys the Stonecrest Dialysis facility in 2010; in this case, the Provider of Service files provided the change of ownership date, but the "owner" field did not identify DaVita as the owner as of 2010.

(k) Fill in ownership in cases where missing values are surrounded by the same owner. For instance, if chain X owns a facility in 2010 and 2012 but no owner is listed in 2011, then I fill in chain X for 2011.

(l) Enumerate chain-to-chain mergers and correct ownership based on these. For example, Renal Care Group (RCG) acquires National Nephrology Associates (NNA) in 2004.[54] In the event that a facility was owned by RCG in 2002, 2003, and 2004, and by NNA in 2005, 2006, and 2007, I would replace RCG with NNA in 2004; it would reflect the fact that Provider of Service files are not necessarily updated each year.) Immediately following these corrections, I repeat step (k).

(m) Standardize addresses (and in a small number of cases, correct them for typographical errors). As

[53] See their SEC filing at https://www.sec.gov/Archives/edgar/data/927066/000119312506103733/dex101.htm.

[54] See this announcement https://www.businesswire.com/news/home/20040202005438/en/National-Nephrology-Associates-Acquired-Renal-Care-Group.

an example of the former, I replace " NW " with " Northwest " to create as much continuity in the addresses as possible. As an example of the latter, I replace "Mo0re" with "Moore."
(n) Drop Veteran's Association facilities, locations that are clearly apart of Native American reservations, and any facility in county "071" of Louisiana (where entry, exit, operations, and potentially ownership reflect the effects of Hurricane Katrina rather than any economic forces affecting the rest of the industry). Then, drop facilities that are not outpatient hemodialysis providers. These include pediatric only facilities (including children's hospitals), transplant facilities, peritoneal and/or home therapy only locations.
(o) Create continuity within facilities across Medicare provider numbers. For instance, if a Medicare provider ends on 12/31/2005 and another starts on 1/1/2006 with the same name and/or same phone number (and/or other attributes), then a pseudo Medicare provider number is assigned to make this one facility; otherwise, it would be considered an entry and exit.
(p) Classify all proposed facility acquisition as either reportable and blocked, non-reportable and blocked, reportable and not blocked, non-reportable and not blocked.

USRDS data [USRDS, 2017] are delivered in SAS files. I open the SAS files, export the relevant data to CSV format, and read into STATA. Many readers will be unfamiliar with SAS, so for convenience I illustrate how to extract data from the SAS files below. This code reads in the facility.sas7bdat Standard Analysis File and writes to facility.csv.

```
libname example "directory_goes_here"; run;
proc export data=example.facility
outfile='directory_goes_here/facility.csv'
dbms=csv
replace;
options nofmterr;
run;
```

Note that prior to execution you must replace "directory_goes_here" with the location of your SAS files. (If you are having computational or storage issues using this code, be advised there are almost certainly more efficient ways of extracting the data. I am not fluent in SAS. I merely modified a minimum working example from an online tutorial, and the result did not impose unreasonable demands on my processor/memory.)

USRDS treatment histories (rxhist files) match patients to their modal provider each calendar year and count treatments. Medical evidence (medevid files) measures patient specific risk factors, e.g., BMI. Claims (ic files) count hospitalizations and other outcomes. Patient records (patients files) provide, among other things, basic demographics, e.g., age, and verification of the death records (reported in the "death" core file). I combine information at the patient year level, create standardized one year hospitalization rates and one and two year survival rates, match patients to their modal provider each year, and collapse the data down to the facility-year level. This will be merged into the facility file.

USRDS facility data (extracted in the SAS code example above) provides among other things the location, number of hemodialysis machines available to treat patients, and number of staff by accreditation (beginning in 2004). After extracting the facility data, I format the relevant measures and then merge to the patient data, described in the paragraph immediately above, at the facility year level. This is a one-to-one correspondence. Finally, I merge the USRDS provider identifiers (the provusrd variable) to Medicare provider numbers using provider crosswalks. Note that in rare cases, the facility file intermittently omits observations within a facility, e.g., has an observation for up and including 2001 and for 2003 and afterwards. In these cases, I fill the gap and replace the missing station and employee counts with interpolated counts. (As this does not affect the patient counts or health outcomes, I omit a further discussion of the process.)

HCRIS files mainly provide employee counts prior to 2004.[55] I download the Renal Reports compressed file from the Renal Facility reports page, extract the NUMBER_OF_FTES file, and combine the annual files therein. Note that HCRIS files distinguish between "staff" and "contract" workers, although the differences appear to reflect idiosyncratic reporting as much as any other factor, so I do not maintain that distinction. For example, I obtain registered nurses by combining staff and contract RNs (rn_staff and rn_ctr variables).

The complete dataset comprises the Provider of Service, USRDS, and HCRIS data merged together at the facility-year level (on Medicare provider identifier and calendar year, to be precise).

[55]The files reside at https://www.cms.gov/Research-Statistics-Data-and-Systems/Downloadable-Public-Use-Files/Cost-Reports.

Figures

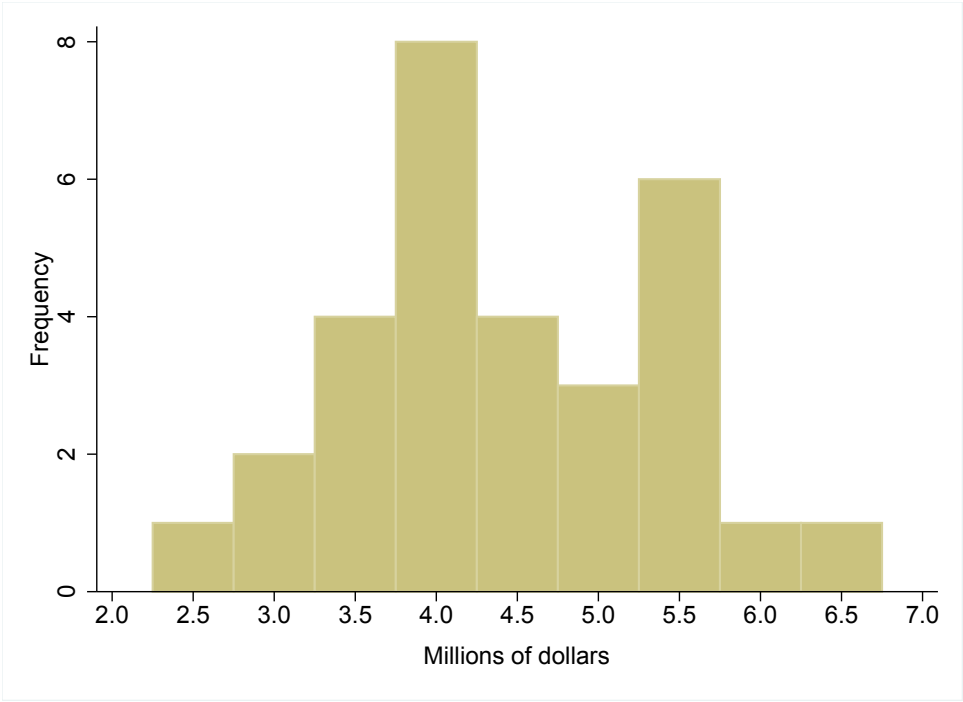

Figure IV: *Facilities are typically valued between $3.5 and $5.5 million.*

The x-axis measures the per facility price paid by buyers in deals for which the transaction value was publicly disclosed. Prices are given in constant 2005 US dollars. The y-axis plots the frequency of occurrence.

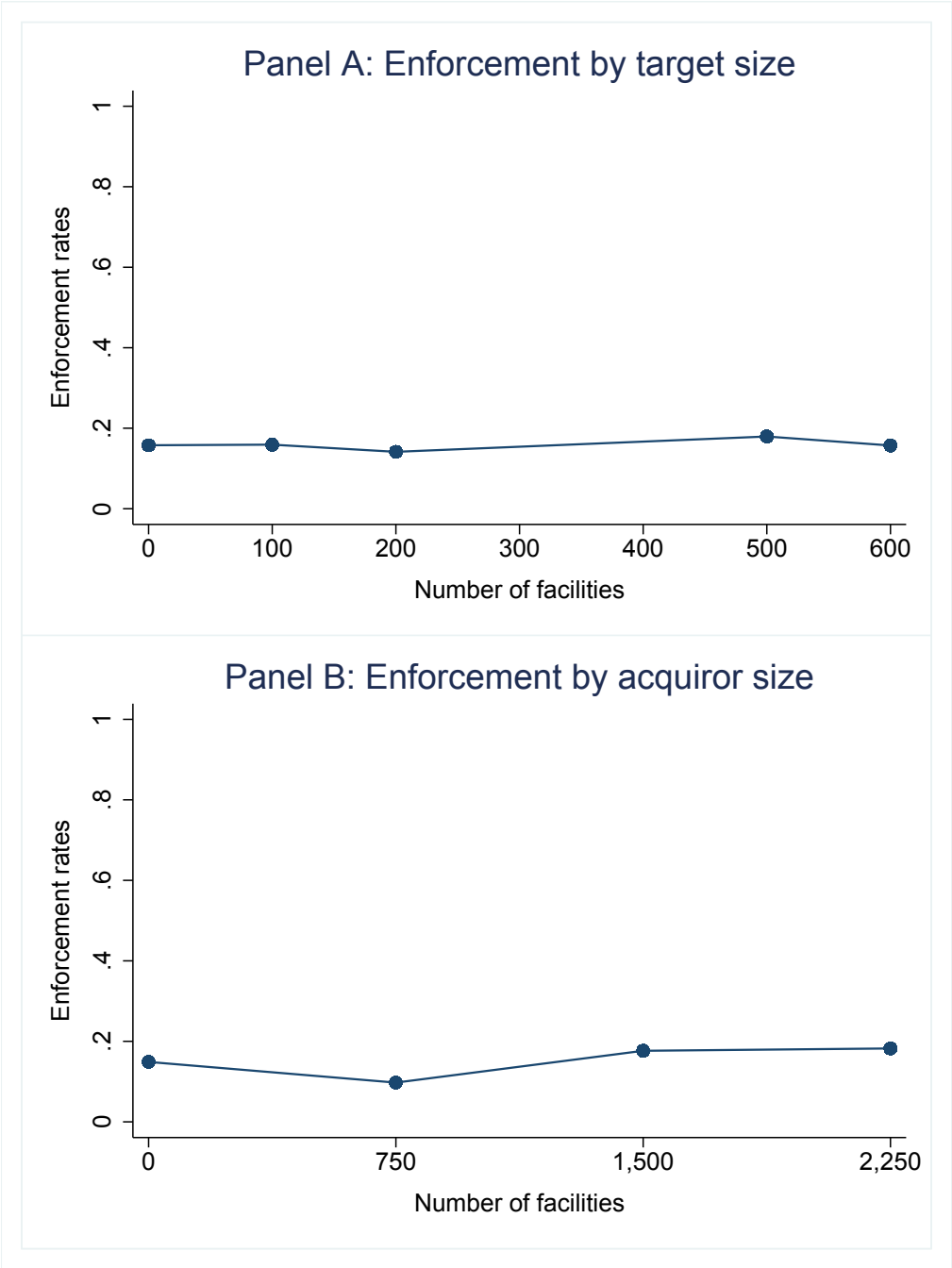

Figure V: *Competition authorities do not target large deals or large acquirors.*

The x-axis measures the number of target and acquiror facilities in Panels A and B, respectively. Observations are binned according to x-axis values. The y-axis measures the average average enforcement rates within the bins.

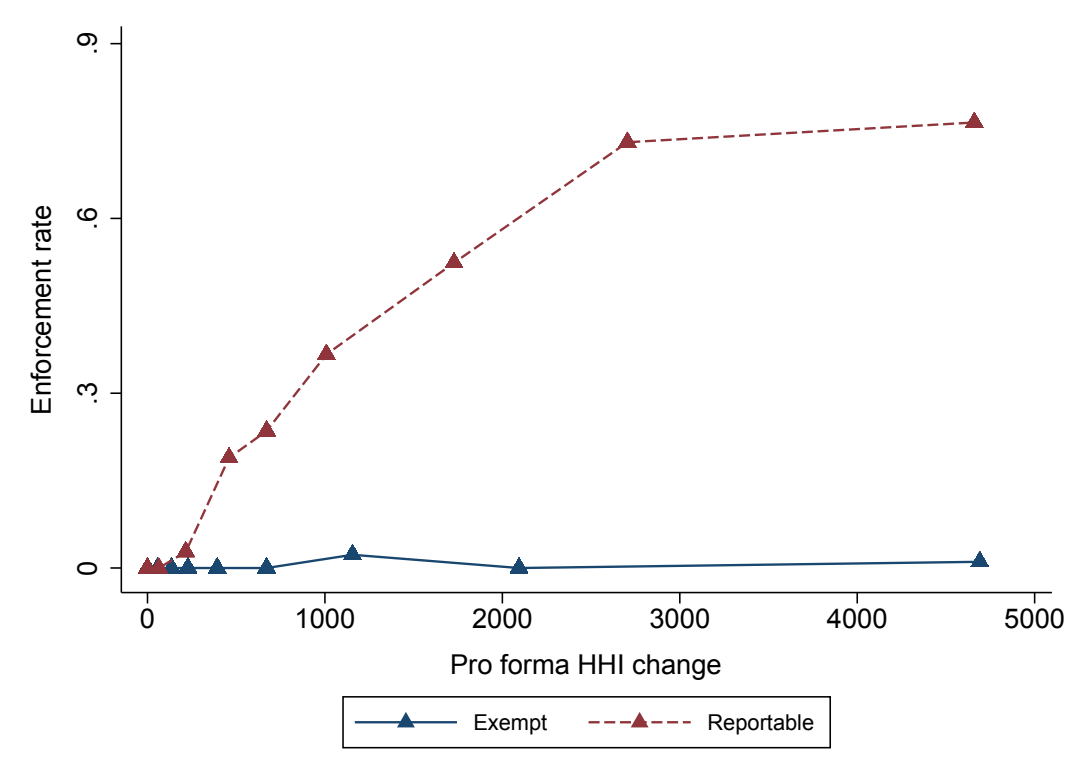

Figure VI: *Main results are robust to assigning facilities equal market shares.*

This graph plots divestiture rates against pro forma HHI changes calculated using even facility weights. In other words, it reflects market shares which equal one over the number of active facilities in the market. The unit of observation is the merger-market. Data are binned according to x-axis values, and the average enforcement rates within the cells are measured on the y-axis. Points connected by the top, dashed line reflect reportable mergers; those on the bottom, solid line reflect exempt ones. This graph plots divestiture rates against pro forma HHI changes. It replicates Figure I in the body of the main text with one exception, which is that facilities receive even weights in the calculation of HHI. That is, instead of relying on observed market shares based on the number of patients treated, this graph relies on market shares equal to one over the number of active facilities in the market.

Tables

Table VI: *Facility counts extracted from FTC complaints closely match those from CMS.*

		Facilities operated		
Target or acquiror	Data year	FTC	Data	Coverage
Gambro Healthcare	2004	565	565	100
DaVita	2004	665	566	85
Fresenius Medical Care North America	2005	1155	1121	97
Renal Care Group	2005	450	462	103
Diversified Specialty	2010	106	115	108
DaVita	2010	1612	1583	98
Fresenius Medical Care North America	2011	1800	1874	104
Liberty Dialysis	2011	260	254	98
Diversified Specialty	2015	100	81	81
US Renal Care	2015	200	190	95
Renal Ventures	2016	36	36	100
DaVita	2016	2251	2493	111

Each FTC complaint counts the number of facilities operated by the target and the acquiror at the time of the merger, providing a benchmark to compare the Medicare data against. Coverage is the ratio of column 4 to 5. Discrepancies reflect timing: FTC snapshots are taken at the merger date, but CMS snapshots are at year end.

Table VII: *Facility counts extracted from FTC divestiture orders closely match those from CMS.*

		Facilities acquired		
Merger	Merger year	FTC	Data	Coverage
PDI from Gambro Western Michigan mergers	2002	3	3	100
Renal Advantage from Gambro Healthcare merger	2005	70	69	99
Satellite from Gambro Healthcare merger	2005	2	2	100
NRI from Renal Care Group merger	2006	103	103	100
Fresenius from Rhode Island/Fall River merger	2006	2	2	100
Dialysis Newco from Diversified Specialty merger	2011	29	25	86
Diversified Specialty from Liberty Dialysis merger	2012	51	50	98
Dallas Renal Group from Liberty Dialysis merger	2012	5	5	100
Satellite from Liberty Dialysis merger	2012	2	2	100
Alaska Investment Partners from Liberty merger	2012	1	1	100
Satellite from Diversified Specialty merger	2016	3	3	100
Physicians Dialysis from Renal Ventures merger	2017	7	7	100

Each FTC divestiture order lists the number of facilities divested and to whom they will be divested, providing a comparison with the Medicare data. Coverage is the ratio of column 4 to 5. Discrepancies reflect that FTC snapshots are taken around the merger announcement date whereas FTC ones are taken at calendar year end. Note that the Michigan AG, not the FTC, is the source on the Gambro Western Michigan transactions.

Table VIII: *Main results are robust to using raw hospitalization and survival rates.*

VARIABLES	(1) One year hospital'n rate	(2) One year survival rate	(3) Two year survival rate	(4) One year hospital'n rate	(5) One year survival rate	(6) Two year survival rate
Post × Exempt × Horizontal	0.0317***	-0.0162**	-0.0198*			
	(0.0111)	(0.00726)	(0.0105)			
Post × Horizontal	0.000718	0.00163	-0.00482			
	(0.00704)	(0.00484)	(0.00695)			
Post × Ex. × Pro forma HHI chg.				0.00989**	-0.00722**	-0.00842**
				(0.00447)	(0.00297)	(0.00393)
Post × Pro forma HHI change				-0.000866	0.00179	0.000235
				(0.00321)	(0.00223)	(0.00300)
Post × Exempt	0.000310	0.00363	-0.00260	0.00271	0.00337	-0.00302
	(0.00563)	(0.00380)	(0.00571)	(0.00543)	(0.00364)	(0.00545)
Post	-0.000504	-0.00115	0.00434	-4.64e-06	-0.00151	0.00320
	(0.00364)	(0.00248)	(0.00368)	(0.00349)	(0.00236)	(0.00350)
Observations	11,214	10,830	10,830	11,214	10,830	10,830
R-squared	0.477	0.378	0.514	0.477	0.378	0.514
Dependent var. mean	0.69	0.84	0.72	0.69	0.84	0.72
Proposed facility acq. FE	X	X	X	X	X	X

, **, and * denote significance at the 10%, 5%, and 1% levels, respectively. The table replicates Table V in the body of the main text with one exception, which is that outcome measures are raw rather than standardized hospitalization and survival rates. Standard errors are clustered at the proposed facility acquisition level and reported in parentheses.*