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Is There Too Little Antitrust Enforcement in the US Hospital Sector?[†]

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From 2002 to 2020, there were over 1,000 mergers of US hospitals. During this period, the FTC took enforcement actions against 13 transactions. However, using the FTC's standard screening tools, we find that 20 percent of these mergers could have been predicted to meaningfully lessen competition. We show that, from 2010 to 2015, predictably anticompetitive mergers resulted in price increases over 5 percent. We estimate that approximately half of predictably anticompetitive mergers had to be reported to the FTC per the Hart–Scott–Rodino Act. We conclude that there appears to be underenforcement of antitrust laws in the hospital sector. (*JEL* G34, G38, I11, K21)

The two federal agencies that engage in antitrust enforcement in the United States—the Federal Trade Commission (FTC) and the Department of Justice (DOJ)—play a vital role in preserving competition across the economy by enforcing federal antitrust laws that prevent the creation of market power through mergers. However, over the past 20 years, rising concentration across US industries has fueled concerns that federal antitrust laws are underenforced (Kwoka 2013; Baer et al. 2020). To that end, from 2000 to 2020, antitrust agencies only took enforcement action to block 2 percent to 3 percent of all mergers (Kades 2019).

While an enforcement rate between 2 percent and 3 percent might appear low, enforcement at this level could theoretically arise if the mergers that were occurring posed little threat to competition or if this level of enforcement were sufficient to deter future anticompetitive transactions. Alternatively, antitrust enforcement

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could be inefficiently low because of external impediments. Critics of the current antitrust paradigm have pointed to many such impediments, including low enforcement budgets, weak reporting requirements for merging parties, and legal precedents that favor merging parties over the FTC and DOJ (Wollmann 2019; Baer et al. 2020; Gaynor 2021).

In this paper, we evaluate whether there is too little antitrust enforcement in the US hospital sector, a $1.3 trillion industry (6 percent of US GDP) in which there have been broad concerns about lax antitrust enforcement (Dafny 2021; Gaynor 2021). From 2002 to 2020, there were over 1,000 horizontal hospital mergers among the nation's approximately 5,000 general acute care hospitals. During this period, the FTC (the enforcement agency that investigates hospital mergers) only took action to block 13 deals—an enforcement rate of approximately 1 percent.[1] Partly as a function of this consolidation, at present, 90 percent of US metropolitan areas have hospital markets with a Herfindahl–Hirschman index (HHI) of over 2,500 points, making them "highly concentrated" according to the 2010 DOJ/FTC Horizontal Merger Guidelines (Fulton 2017; US Department of Justice and Federal Trade Commission 2010).

If the FTC is optimally targeting enforcement, then the mergers that they do not challenge should have minimal effects on competition and prices. As a result, a simple test of the efficacy of antitrust enforcement is to examine whether there are consummated mergers occurring that could have been predicted, ex ante, to lessen competition and which, ex post, raised prices.

We carry out this test by analyzing hospital mergers in the United States using insurance claims data from three of the five largest US insurers—Aetna, Humana, and UnitedHealthcare—provided by the Health Care Cost Institute (HCCI). These data cover 28 percent of individuals in the United States with employer-sponsored health insurance and include the actual prices hospitals and insurers negotiated for care delivered to this population. We estimate the postmerger price increases generated by 322 hospital mergers involving 702 hospitals that occurred between 2010 and 2015. We find that the average merging hospital raised prices by 1.6 percent in the two years after the merger occurred via increases in inpatient and outpatient prices of 1.1 percent and 1.8 percent, respectively. We also find that an average year of mergers between 2010 and 2015 raised hospital spending on the privately insured in the first year following the mergers by $204 million. To put this spending increase in context, the FTC's average annual overall budget and antitrust enforcement budget between 2010 and 2015 were $315 million and $136 million, respectively.[2]

Are the mergers that led to large price increases the ones that the FTC could have ex ante predicted to be harmful via a lessening of competition? To answer this question, we use two common premerger evaluation methods to flag presumptively anticompetitive mergers and analyze whether they generated differentially large price increases. First, we flag mergers using cutoff rules for postmerger changes

[1] Enforcement actions are defined as matters that resulted in a final consent order requiring divestitures, matters where the parties abandoned or restructured the deal as a result of antitrust concerns raised during the investigation, or matters in which the FTC initiated litigation to block or undo the merger (Federal Trade Commission 2023).

[2] These budget figures are drawn from the annual reports of the FTC's Congressional Budget Justifications (https://www.ftc.gov/about-ftc/budget-strategy/budget-performance-financial-reporting) and presented using 2017 dollars. This comparison does not constitute a cost-benefit analysis since we do not know the marginal cost of additional enforcement effort or how effective more effort would be at thwarting anticompetitive hospital mergers.

in HHI defined by the 2010 Horizontal Merger Guidelines as those likely to harm competition. The guidelines highlight that mergers that result in increases in HHI of at least 200 points and lead to a postmerger HHI of over 2,500 should be "presumed to be likely to enhance market power" (US Department of Justice and Federal Trade Commission 2010, 19). Second, we flag mergers based on whether the merging parties experienced increases in willingness to pay (WTP) of 5 percent or more (Capps, Dranove, and Satterthwaite 2003; Garmon 2017; Raval, Rosenbaum, and Tenn 2017). WTP represents the marginal value that a hospital, or a set of hospitals, contributes to the value of an insurance network. Hospitals with higher WTP have greater strength in bargaining over prices with insurers. The change in WTP as a result of a merger therefore serves as an estimate of each hospital's expected change in markups. By focusing on hospitals with large percent changes in WTP, we aim to flag mergers with large expected price increases. WTP is the dominant tool used in hospital antitrust enforcement cases for ex ante prediction of merger-driven price increases (Dranove and Ody 2016; Capps et al. 2019).

While the average hospital merger in our data raised prices by 1.6 percent, we show that this average effect masks important variation in the postmerger price increases across transactions. Across our analytic sample, approximately 20 percent of all consummated transactions (and at least 25 percent of mergers in our analytic sample) could be predicted ex ante to increase concentration or lessen competition via our flags for the changes in HHI or WTP. The flagged transactions in our sample generated differentially large price increases relative to deals we did not predict would run afoul of the Horizontal Merger Guidelines. Indeed, transactions that we flagged under the 2010 Horizontal Merger Guidelines' HHI cutoffs increased the merging parties' prices by 5.2 percent via increases in inpatient and outpatient prices of 5.4 percent and 4.5 percent, respectively.[3] Similarly, transactions that generated WTP increases of over 5 percent raised hospitals' inpatient prices by 4.6 percent (with imprecise outpatient price increases). Ultimately, the existence of a substantial number of presumptively anticompetitive transactions with large ex post price increases provides evidence of potential underenforcement.

Past work has illustrated that mergers that fall below Hart–Scott–Rodino (HSR) reporting thresholds are less likely to be challenged by regulators (Wollmann 2019). In our setting, nearly 60 percent of hospital mergers appear to fall below HSR reporting thresholds. However, we find that approximately half of the deals that can be predicted ex ante to raise prices by lessening competition are above HSR thresholds and thus are likely visible to regulators. Likewise, mergers above HSR thresholds generate, on average, larger increases in WTP than deals below the thresholds. This suggests that the primary impediment to more active enforcement is not necessarily that the current HSR thresholds are limiting the FTC's visibility into mergers.

Our analysis has several limitations. First, we do not measure whether mergers impacted quality. However, past academic work has not found that mergers raise quality, and a broader literature highlights that, when hospitals become exposed to

[3] In 2023, the FTC and DOJ introduced revised Merger Guidelines. The new guidelines define problematic transactions as those that increased HHI by greater than 100 and led to a postmerger HHI of greater than 1,800 (US Department of Justice and Federal Trade Commission 2023). Transactions flagged using the updated guidelines raised prices by 4.3 percent.

competition, they tend to raise their clinical quality (Beaulieu et al. 2020; Cooper et al. 2011; Gaynor et al. 2013). Second, we are also unable to assess the effect of mergers on hospital efficiency (i.e., lower costs). However, a growing literature has found that hospital mergers of rivals do not meaningfully lower costs (Schmitt 2017; Craig, Grennan, and Swanson 2021). Moreover, if efficiency improvements exist, we find that they are not being passed through, on average, into lower prices. Third, we focus on consummated mergers, which are less likely to have large ex post price increases than mergers that were successfully blocked or preempted by existing regulations. As a result, our analysis should not be used to predict the effect of future proposed mergers.

This study joins a growing merger retrospectives literature that has assessed deals across many industries (Ashenfelter and Hosken 2010; Ashenfelter, Hosken, and Weinberg 2013, 2015; Miller and Weinberg 2017). Closest to our work outside the hospital industry are Bhattacharya, Illanes, and Stillerman (2023) and Majerovitz and Yu (2021), who perform large-scale merger retrospectives in the consumer packaged goods industry. Consistent with our results, both groups find that the average merger modestly increases prices, with substantial variation across transactions.

We also contribute to a recent literature analyzing the effect of hospital mergers on prices (Dafny 2009; Haas-Wilson and Garmon 2011; Garmon 2017; Cooper et al. 2019; Brand, Garmon, and Rosenbaum 2023). Consistent with this literature, we find that the average hospital merger raises prices. We expand on this literature in three ways. First, we highlight that the mergers with the largest price increases are those that could have been predicted ex ante to lessen competition and include those that ran afoul of the Horizontal Merger Guidelines. Second, we show that, while the FTC is intervening in the most anticompetitive transactions, the agency is not taking action against numerous transactions that run afoul of the Horizontal Merger Guidelines, meaningfully lessen competition, and lead to substantial price increases. Third, in contrast to the prior literature, which has primarily focused on inpatient care (the setting where regulators focus their attention), we show that mergers generate price increases for outpatient services that are at least as large as inpatient price increases.

I. Data and Measurement

A. *Measuring Hospital Prices*

To measure hospital prices, we leverage data from HCCI. The HCCI database includes the near universe of health insurance claims for employer-sponsored insurance plans offered by Aetna, Humana, and UnitedHealthcare between 2008 and 2017. We focus on individuals who are under age 65 and for whom one of these payors is their primary insurer. The HCCI payors cover approximately 28 percent of the US population with employer-sponsored health insurance (Cooper et al. 2019). Crucially, these data contain the negotiated transaction price—or "allowed amounts"—for each service that was provided.

Hospitals are multiproduct firms that offer numerous services, each with its own price. Hospitals differ in the mix of services they offer and the demographic profile of the patients they treat. Therefore, following Cooper et al. (2019) and

Gowrisankaran, Nevo, and Town (2015), we construct an adjusted "price index" to summarize the average price level for each hospital-year in our data. We do so separately for inpatient and outpatient services. Specifically, we estimate two regressions of the form

$$\log(p_{idht}) = \alpha_{ht} + \beta X_i + \pi_{dt} + \varepsilon_{idht}, \tag{1}$$

where the price of case i of type d (defined using diagnosis related groups (DRGs) for inpatient services and Current Procedural Terminology (CPT) codes for outpatient services) at hospital h in year t is a log-linear function of a hospital-year fixed effect α_{ht}, controlling for each patient's age (using indicators for ten-year age bins, except our bottom age bin, which spans 18 to 24) and gender X_i, and type-year fixed effects π_{dt}.[4]

We then use the estimates of α_{ht} from equation (1) to generate predicted values for each hospital-year, rescaling them as if all hospitals saw the average mix of "types" ($\overline{dt}$) with the average age and gender mix ($\bar{X}$):

$$p_{ht}^{INDEX} = \hat{\alpha}_{ht} + \hat{\beta}\bar{X} + \hat{\pi}_{dt}\overline{dt}, \tag{2}$$

where p_{ht}^{INDEX} is the estimated price index for a hospital in a given year. For some analyses, we present results using a "composite" price index that represents a weighted average of our inpatient and outpatient price indices according to hospitals' share of revenue that comes from inpatient and outpatient services, respectively.

B. *Hospital Ownership Transitions*

The primary data we use to measure merger activity come from the American Hospital Association's (AHA's) annual survey of hospitals. These data contain biographical information on the near universe of general acute care hospitals in the United States, including a measure of system ownership. Our final roster contains 4,846 hospitals in the continental United States. We track mergers in our hospital panel using changes to the system identifier provided by the AHA for 2002 to 2020. We leverage several additional data sources—the FactSet Research Systems database, the Irving Levin Associates' Health Care Services Acquisition Reports, and the Securities Data Company Platinum—to verify the existence and timing of mergers.[5]

Along with data on mergers, we collect data on premerger notification and enforcement activity from the FTC's annual reports to Congress pursuant to the HSR Antitrust Improvements Act of 1976.[6] We restrict our focus to cases with reported NAICS codes starting with "622," which indicate that the acquired firms are hospitals. Because this

[4] Outpatient visits can involve a number of procedures. To ensure that the prices we measure cover all services rendered during a visit—not payments negotiated as a bundle of services—we limit our analysis to outpatient cases where the patient has no other outpatient cases on the same day. Although this restriction limits the data to approximately 30 percent of patient days, we view this sample as one that provides a clean distinction between price and quantity.

[5] For more information on how we track hospital ownership, see online Appendix D of Cooper et al. (2019).

[6] See https://www.ftc.gov/policy/reports/annual-competition-reports.

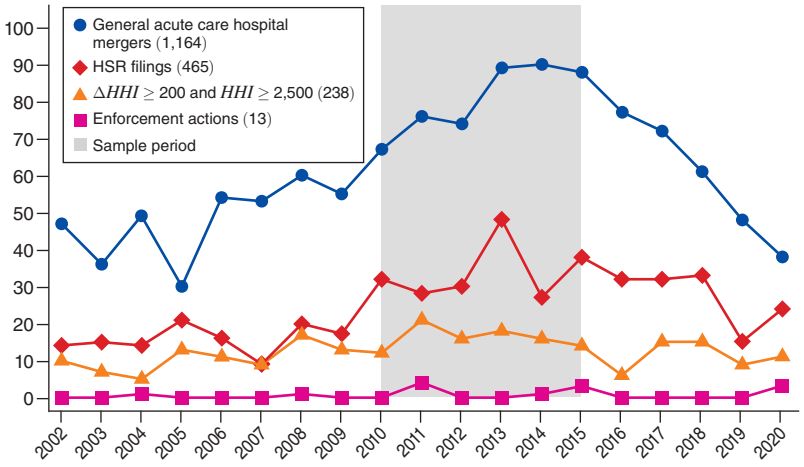

FIGURE 1. HOSPITAL MERGERS, HSR FILINGS, PRESUMPTIVELY ANTICOMPETITIVE MERGERS, AND FTC ENFORCEMENT ACTIONS BY YEAR, 2002–2020

Notes: The counts of mergers annually and mergers with an HHI increase of over 200 points that resulted in a postmerger HHI of over 2,500 are based on the authors' analysis. Data on HSR filings and FTC enforcement actions come from the FTC's annual reports to Congress pursuant to the HSR Act. The HSR filings are reported in fiscal years; all other numbers are reported in calendar years. Enforcement actions are defined as matters that resulted in a final consent order requiring divestitures, matters where the parties abandoned or restructured the deal as a result of antitrust concerns raised during the investigation, or matters in which the FTC initiated litigation to block or undo the merger. The sample period used in our retrospective merger analysis is shaded in gray and spans from 2010 to 2015.

category includes hospital types that we do not study, as well as acquisitions of hospitals by nonhospital entities, these reported figures should be considered an upper bound on relevant activities. We also estimate whether each merger in our panel is above or below HSR reporting thresholds. We describe our approach to classifying merger HSR reportability in online Appendix B. Deals that are flagged as above HSR thresholds should be reported to the FTC.

We plot all mergers in our database from 2002 to 2020 in Figure 1. We observe 1,164 mergers of general acute care hospitals. Notably, only 465 transactions (40 percent) were reported to the FTC during this period per the HSR Act reporting requirements. This suggests that more than half of hospital mergers fall below the HSR Act's reporting thresholds because of the value of the merging parties. Among consummated transactions, we estimate that 238 mergers (20 percent) involved at least one party that experienced an increase in HHI of greater than or equal to 200 points, which resulted in a postmerger HHI of 2,500 points or greater.[7] Likewise, in our analytic sample (described in Section II), we find that 25 percent of transactions involved at least one party that experienced an increase in HHI of greater than or equal to 200 points, which resulted in a postmerger HHI of 2,500 points or greater. Nevertheless, during this period, the FTC only engaged in enforcement actions to challenge 13 mergers. This implies that the agency

[7] We describe our HHI measures in Section IV.

challenged approximately 1 percent of all transactions and, at most, 5 percent of transactions that likely ran afoul of the thresholds set in the Horizontal Merger Guidelines.

II. Empirical Strategy

We estimate the causal effect of mergers using a difference-in-difference design. We follow the approach used in several prior studies (Cengiz et al. 2019; Brot-Goldberg et al. 2023; Craig, Grennan, and Swanson 2021) to address concerns about staggered timing (Roth et al. 2023). Our general approach is to construct an "experiment" containing one merging hospital and a "control" group of nonmerging comparison hospitals. We then estimate average treatment effects by stacking these experiments and estimating separate unit and time fixed effects for each experiment group.

For this exercise, we build an "analytic" sample of mergers and focus on the set of hospitals that merged between 2010 and 2015 that were located within 50 miles of at least one hospital in another system. Particularly for large national systems, the 50-mile restriction allows us to focus on the subset of hospitals that are plausibly affected by the merger.

We focus on the period from 2010 to 2015 because it aligns with the time window where we can accurately measure hospital prices for at least two years before and two years after merger events using HCCI data. For hospitals that merge multiple times in our sample period, we analyze the effect of the first merger within 50 miles.[8] As we detail in online Appendix Table A.1, there were 484 mergers between 2010 and 2015, including 377 mergers involving hospitals located within 50 miles of one another. By exclusively examining the hospitals that are located within 50 miles of a merging competitor, we focus our analysis on hospitals that are directly involved in a transaction (i.e., we do not measure price effects for all hospitals when a large national hospital system buys a single hospital but rather the price effects of the lone acquired hospital and the hospitals from the acquiring system that are located less than 50 miles away). As we illustrate in online Appendix Table A.6, we estimate that 57 percent of the mergers in our overall sample are below HSR thresholds (52 percent in our analytic sample).

Our final sample contains 702 merging hospitals, for which we can observe prices before and after the merger, representing 322 within-50-mile transactions.[9] We map the merging hospitals in our analytic sample in online Appendix Figure A.3, highlighting the transactions we estimate that would be flagged under the Horizontal Merger Guidelines.

In order to identify the treatment effect, we need a comparison, or "control," group of nonmerging hospitals to form counterfactual trends in prices. Our control group is composed of hospitals that did not experience a merger between 2008 and

[8] One hundred fifty-five of 702 hospitals in our analytic sample experience multiple within-50-mile mergers in our sample period.

[9] In online Appendix Table A.1, we compare our analytic sample to the sample of all mergers. We lose 55 transactions from our analysis because either the merging parties bill jointly after the merger occurs or HCCI beneficiaries do not attend these hospitals with sufficient volume in all years to estimate prices. Our analytic sample is broadly representative of all mergers meeting the 50-mile restriction.

$t + 2$, where t is the year that the merging hospital merged. To ensure that our control hospitals represent plausible counterfactuals, we use propensity scores to match comparison hospitals to "treated" hospitals on premerger observable characteristics. We use a probit regression to estimate the propensity scores and find the merging hospitals' 25 nearest neighbors (in terms of propensity scores) from the set of potential control hospitals. We also impose a caliper restriction so that the propensity scores of matched controls must be within 20 percent of a standard deviation from the treated merging hospital, even if this requires that the control group contain fewer than 25 hospitals (see online Appendix C for additional details).[10]

We exclude merging hospitals from our sample if they appear to be "failing" premerger. We identify "failing" hospitals based on whether their bed utilization in the year before the merger is below the first percentile, measured using Medicare's Healthcare Cost Report Information System (HCRIS) data. The logic behind this restriction is twofold. First, acquisitions of failing hospitals may involve larger changes to management practices or cost structure rather than changes to competition or bargaining leverage. Second, if these hospitals had closed in the absence of a merger, any suitable nonmerging control hospitals would also have closed and would therefore not provide any price observations in the postmerger period.

Ultimately, in our estimation strategy, each group of one merging hospital and its matched controls form an "experiment" around each merger event, e. For each merger, we limit our analysis to the period covering two years before and after the merger. We then estimate a regression of the form

$$(3)\quad \log\left(p_{eht}^{INDEX}\right) = \lambda_{eh} \times \mathbf{1}\{merged\}_{eh} \times \mathbf{1}\{post\text{-}merger\}_{t} + \eta_{eh} + \kappa_{et} + \varepsilon_{eht},$$

where the primary set of parameters to be estimated are λ_{eh}, each of which estimates the percent change in prices for hospital h due to merger e. Under this approach, we effectively estimate a separate difference-in-difference regression for each merger for each merging hospital. To estimate an average treatment effect across mergers, we stack experiments, maintaining experiment-specific estimates of η_{eh} and κ_{et}. This pooled regression gives equal weight to each merging hospital. We cluster our standard errors at the hospital level.

III. The Average Effect of Hospital Mergers

We begin by estimating the model in equation (3), pooling all 702 merging hospitals in our analytic sample. The resulting estimates give us the average effect of mergers on hospitals' inpatient prices, outpatient prices, and composite prices (the revenue-weighted average of inpatient and outpatient prices). As we illustrate in panel A of Table 1, after a merger, the average hospital raised its overall prices by 1.6 percent via a 1.1 percent increase in inpatient prices and a 1.8 percent increase in outpatient prices. We plot an event study of these estimates in Figure 2.

[10] Our matched controls can potentially be neighbors to a merger. However, they are not typically drawn from the same market as the specific treated hospital to which they are matched. Across our 702 experiment groups, the average geographic distance between matched treated-control pairs is 913 miles. The average distance between a treated hospital and its geographically closest matched control is 147 miles.

Table 1—The Effect of Mergers on Hospital Prices

	Count of hospitals (1)	Composite effect (2)	Inpatient price effect (3)	Outpatient price effect (4)
Panel A. All mergers				
Postmerger price effect	702	0.016	0.011	0.018
		(0.003)	(0.005)	(0.005)
Panel B. HHI				
$\Delta HHI \geq 200$ and postmerger HHI $\geq 2{,}500$	109	0.052	0.054	0.045
		(0.008)	(0.011)	(0.011)
$\Delta HHI < 200$ or postmerger HHI $< 2{,}500$	593	0.010	0.004	0.013
		(0.004)	(0.005)	(0.005)
Difference		0.042	0.050	0.032
		(0.009)	(0.012)	(0.012)
Panel C. WTP				
ΔWTP $\geq 5\%$	82	0.036	0.046	0.012
		(0.009)	(0.013)	(0.013)
ΔWTP $< 5\%$	620	0.014	0.007	0.019
		(0.004)	(0.005)	(0.005)
Difference		0.022	0.039	–0.007
		(0.009)	(0.014)	(0.014)

Notes: This table presents estimates from the regression given in equation (3) on subsamples of merging hospitals. The underlying regression is from a stacked difference-in-difference design comparing merging hospitals to a set of matched nonmerging control hospitals before and after the merger of the focal hospital. Rows represent different subsamples. Panel A reports the results for all mergers of hospitals within 50 miles of each other. Panel B compares merging hospitals with an HHI increase of over 200 points and a postmerger HHI greater than 2,500 points to merger hospitals with either an HHI increase less than 200 points or a postmerger HHI less than 2,500 points. For panel B, a merging hospital's market is defined as all hospitals within a 30-minute drive time of the merging hospital, and market shares are defined using a hospital's share of inpatient beds in the market, measured using AHA data. Panel C segments merging hospitals by whether measured changes in WTP as a result of their associated merger are above or below 5 percent. "Difference" denotes the difference in coefficients between the two subsamples within the panel. Our standard errors are clustered at the hospital level.

Across all three price measures, we find no significant difference in price trends between merging and nonmerging hospitals in the two years prior to the mergers occurring, but we find persistent differences in price in the two years following the mergers.[11] In online Appendix Figure A.4, we present an event study of the 202 merging hospitals that merged exclusively in 2012 and 2013, so we can present four years of premerger and postmerger results. We again see no evidence of substantial or statistically significant pre-trends in this longer event study. Online Appendix D includes discussion of our robustness strategy. We show, for example, that our results are not sensitive to our matching strategy, specifying alternative distances between merging hospitals, and constructing confidence intervals using randomization inference.

To assess the scale of the harm these mergers produced, we measure the total impact that mergers had on spending on the privately insured through their effects on prices. For each merging hospital, we fix the total spending at that hospital among the privately insured in the year prior to the merger. We then multiply $t - 1$ spending by λ_{eh}, the postmerger price increase for hospital h in merger e. We then sum over

[11] In online Appendix F, we estimate that there are larger price increases among mergers in less affluent regions of the United States.

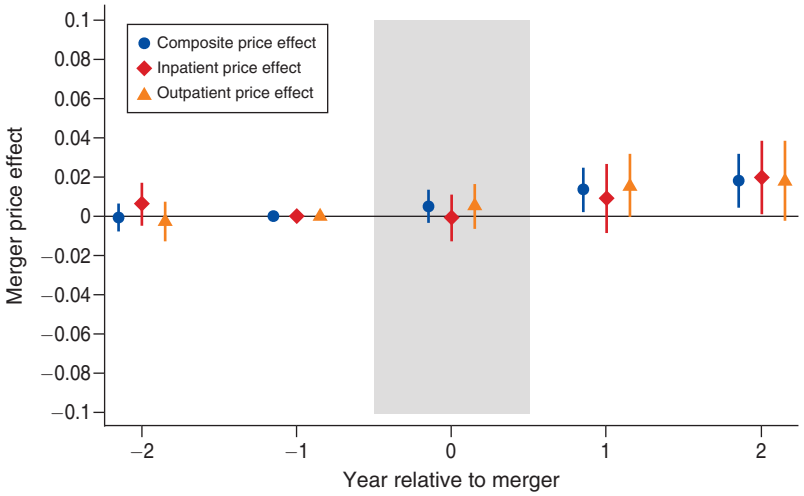

FIGURE 2. THE IMPACT OF HOSPITAL MERGERS ON INPATIENT, OUTPATIENT, AND COMPOSITE HOSPITAL PRICES

Notes: This figure presents event study estimates of equation (3) on our sample of 322 mergers involving 702 targets and acquirers located less than 50 miles from one another. Each dot represents a point estimate, and the vertical line displays the corresponding 95 percent confidence interval. Hospital pricing data come from HCCI. This is based on estimates from equation (3), with standard errors clustered at the hospital level.

the merging hospitals to capture the effect of merger-driven price changes on spending in a given year, holding quantities of care fixed.[12] For the period 2010–2015, the average year had 53 hospital mergers, which increased spending on the privately insured by $204 million (in 2017 dollars) in the year after they occurred. Note that our estimate only considers the effect of mergers on a single year of spending; the total effect would be larger if the price increase persisted over time (which we show empirically occurs).

IV. Treatment Effects for Mergers Predicted to Lessen Competition

The average merger in our sample raised hospital prices by 1.6 percent. In this section, we test whether certain mergers could have been predicted ex ante to generate above-average price increases via a lessening of competition using the standard screening methods used by the FTC.

A. *Changes in Concentration*

The 2010 Horizontal Merger Guidelines note that mergers that result in postmerger increases in HHI of at least 200 points with a postmerger HHI of at least 2,500 should be considered presumptively anticompetitive. As a result, we flag mergers in our sample that would have generated HHI changes that would have been flagged using these standards.

[12] We measure spending on the privately insured using HCRIS data. For more detail on how we estimate aggregate spending changes, see online Appendix E.

To measure HHI, assume that a market M includes many hospital systems $S \in \mathcal{S}(M)$, where $\mathcal{S}(M)$ is the set of systems in M. Each system is defined as a set of one or more hospitals h, which have a collective owner. Formally,

$$HHI_M = 10{,}000 \times \sum_{S \in \mathcal{S}(M)} \left(\sum_{h \in S} s_{hM} \right)^2,$$

where s_{hM} is h's market share within M. A monopoly market has an HHI of 10,000; if instead there are many small independent hospitals, the HHI will be closer to zero.

Measuring HHIs requires us to define relevant geographic markets and measure hospitals' market shares. We assume that a hospital's relevant market includes every hospital within a 30-minute drive time from their facility. We measure a hospital's market share as its share of inpatient hospital beds. We use hospital beds rather than activity to define concentration because, unlike hospital activity, changes in bed volume in the short run are unlikely to be highly correlated with changes in hospital quality or prices. We measure the change in HHI for a hospital h due to merger e, ΔHHI_{eh}, as the difference between the HHI in its market in the year before the merger and a computed counterfactual where we change system membership to reflect the merger, holding bed counts and the system membership of nonparticipating hospitals fixed. In panel A of online Appendix Figure A.1, we plot the distribution of ΔHHI_{eh}. The average merging hospital in our sample experienced an increase in HHI of 267 points.

We find that, in our analytic sample, 82 of 322 transactions (25 percent) involving 109 hospitals generated an HHI increase of at least 200 points with a postmerger HHI of at least 2,500. Thus, these transactions could have been flagged ex ante as presumptively enhancing market power, according to the 2010 Horizontal Merger Guidelines (overall, from 2010 to 2015, we find that 97 of 484 transactions—20 percent—would be flagged by the change in HHI they generated). In panel B of Table 1, we find that the flagged mergers in our analytic sample raised inpatient prices by 5.4 percent and outpatient prices by 4.5 percent. These increases are significantly greater than the price increases among mergers that did not result in such substantial increases in HHI. We provide event studies for these results in panels A and B of Figure 3. As we illustrate in online Appendix Table A.2, we see similar price increases among the 30 percent of transactions that would be flagged using thresholds from the 2023 Merger Guidelines.

There is not a well-established standard for market definitions, and market definitions are often an area of dispute in hospital merger cases (Capps et al. 2019). Therefore, in online Appendix Table A.5, in addition to measuring the HHI in a market defined by a 30-minute drive time, we also present estimates where we define the market as a fixed 15-mile radius around the merging hospital. Although this alternative market definition generates different quantitative estimates, this result is robust using both measures of HHI.

B. *Changes in Competition*

WTP is one of the dominant screening tools used in hospital antitrust enforcement (Capps et al. 2019). In this section, we analyze whether mergers that WTP

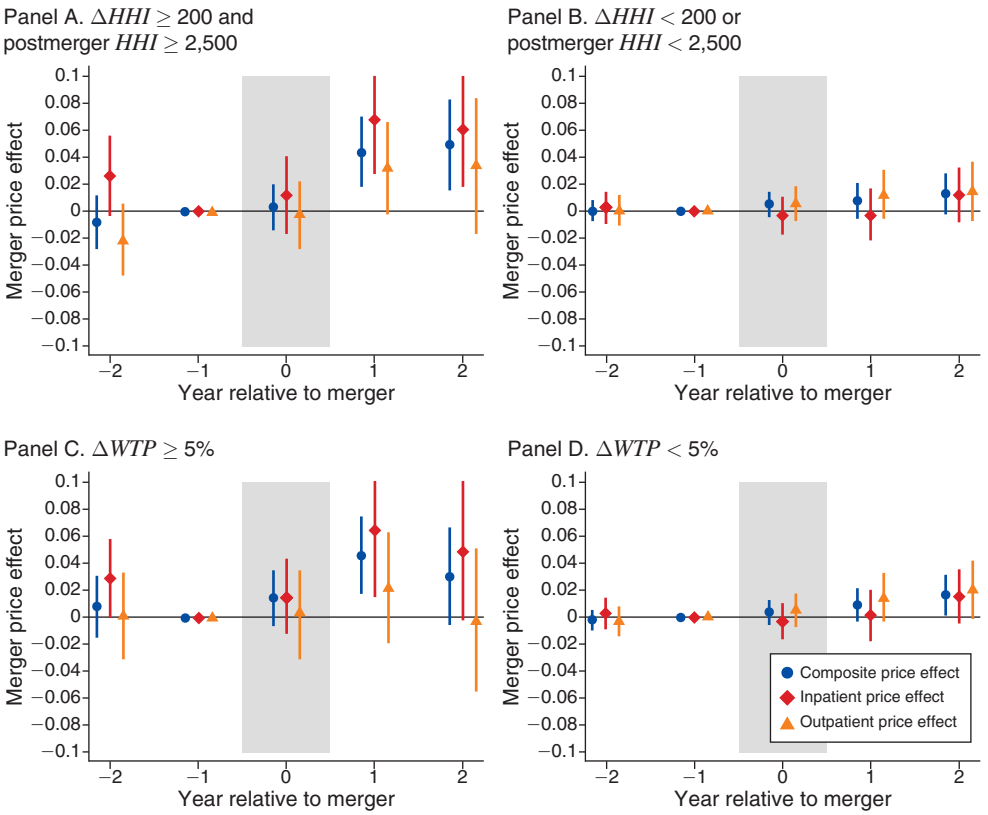

FIGURE 3. EVENT STUDIES FOR FLAGGED AND NONFLAGGED MERGERS

Note: This figure presents event study estimates of equation (3) on mergers that generated a $\Delta HHI \geq 200$ and postmerger $HHI \geq 2{,}500$ (panel A), mergers that generated a $\Delta HHI < 200$ or postmerger $HHI < 2{,}500$ (panel B), mergers that generated a $\Delta WTP \geq 5\%$ (panel C), and mergers that generated a $\Delta WTP < 5\%$ (panel D). Each dot represents a point estimate, and the vertical line displays the corresponding 95 percent confidence interval. Hospital pricing data come from HCCI. This is based on estimates from equation (3), with standard errors clustered at the hospital level.

screening suggest would lessen competition resulted in larger ex post price increases. As Capps, Dranove, and Satterthwaite (2003) and Gowrisankaran, Dranove, and Satterthwaite (2015) note, patient demand for hospital care is quite inelastic to price. Therefore, the actors who discipline hospital prices are insurers, who negotiate with hospitals over prices directly. Insurers can obtain lower prices by credibly threatening to exclude a hospital from their network. The strength of this threat depends on consumers' ex ante WTP for the option to use the hospital in the event that they become sick. If WTP is lower, insurers can exert more leverage to lower prices. Under this model, hospital mergers raise prices because the insurer must exclude the entire merged entity if a deal is not struck, thus lowering the value of its plan offerings (Ho and Lee 2017). These effects are greater when hospitals are closer substitutes. We provide further detail on the microfoundations of this measure in online Appendix A.

We follow the literature and model patients' hospital choice using a logit demand system. Under this assumption, the WTP of patient i for hospital h is

$\ln\left(\frac{1}{1-s_{ih}}\right)$, where s_{ih} is the probability that i chooses hospital h. Our measure of the *percent* change in WTP is

$$\Delta WTP_m = \frac{\int_i \left(\ln\left(\frac{1}{1-(s_{ih}+s_{ih'})}\right) - \left[\ln\left(\frac{1}{1-s_{ih}}\right) + \ln\left(\frac{1}{1-s_{ih'}}\right)\right]\right) dF_i}{\int_i \left[\ln\left(\frac{1}{1-s_{ih}}\right) + \ln\left(\frac{1}{1-s_{ih'}}\right)\right] dF_i},$$

where h and h' are the hospitals participating in merger m.[13]

We estimate demand using our sample of inpatient admissions. We integrate over patients i within the set I so that WTP for a given hospital is the sum of demand among relevant patients. As Capps, Dranove, and Satterthwaite (2003) emphasize, patient heterogeneity in hospital demand and substitution is an important source of merger-driven market power increases. We face a practical trade-off in accommodating heterogeneity. Flexibility improves the fit of the model. However, more flexible hospital choice probabilities—estimated using a smaller set of patients—are noisier. We follow the demand estimation strategy from Raval, Rosenbaum, and Tenn (2017). The general approach is to assume that, within a small enough subgroup g, patients have homogeneous preferences over hospitals. This allows us to represent demand as a vector of group-specific fixed effects and use observed market shares as estimates of the relevant predicted choice probabilities. We take all hospitalizations in which a patient visited a hospital within 100 miles of their home zip code. We then partition the patients into groups g. We assume that, within group, patients have the same (ex ante) preferences for hospitals, but we impose no restrictions on across-group differences. We assign groups based on patient observables (demographics, health, and location), then iteratively coarsen the partitions until they contain a minimum number of patients. Our primary specification uses a minimum group size of 50, resulting in 27,525 groups sized between 50 and 1,449. Given this setup, we can measure ΔWTP as above by replacing s_{ih} with its empirical analogue $\hat{s}_{g(i)h}$, the actual share of patients in group g who visit hospital h. We describe this procedure in greater detail and explore robustness in online Appendix A. In panel B of online Appendix Figure A.1, we show the distribution of ΔWTP. The mean and median increases in WTP were 1.8 percent and 0.5 percent, respectively.[14]

In panel C of Table 1, we analyze the postmerger price increases in our cohort of mergers, segmenting the transactions by the ΔWTP of the parties involved in the deals. Theory predicts that greater changes in WTP for a given hospital, or group of hospitals, will lead to greater price increases (Capps, Dranove, and Satterthwaite 2003). As we illustrate in online Appendix Figure A.8, postmerger price increases are positively correlated with merger-driven increases in WTP. We flag mergers if they are estimated to raise WTP by 5 percent or more. Forty-two deals involving 82 hospitals are flagged by this measure. We find that flagged mergers increased composite prices by 3.6 percent (versus 1.4 percent in our cohort with WTP increases of less than

[13] We construct the *percent* change since the change in WTP we measure is proportional to the predicted price change.

[14] Online Appendix Figure A.2 is a scatterplot of these changes against changes in HHI and illustrates that they are broadly correlated.

5 percent). The WTP approach does better at predicting inpatient price increases than outpatient prices: we observe that hospitals with a WTP change of 5 percent or more raised their inpatient prices by 4.6 percent and do not find precisely estimated changes in outpatient prices. This is unsurprising given that WTP is estimated using demand for inpatient services. We provide event studies of these estimates in panels C and D of Figure 3.

C. *The Margin for FTC Enforcement Actions*

The two exercises above illustrate that there are many deals that can be predicted, via screening tools used by the FTC, to raise prices via a lessening of competition and observably do raise prices ex post. We view this as evidence of underenforcement of antitrust laws against hospital mergers. It is possible that the FTC did not take action against deals that could be predicted ex ante to lessen competition because they were not visible to the agency. Wollmann (2019) notes that deals under HSR thresholds are not required to notify the FTC and are thus potentially overlooked by the agency. However, as we illustrate in online Appendix Table A.6, we find that deals *above* HSR thresholds have higher average ΔWTP than deals below HSR thresholds. Indeed, 21 percent of deals from 2010 to 2015 that are above HSR thresholds would be flagged as anticompetitive using the HHI screening guidelines, and 14 percent have a ΔWTP over 5 percent (or 27 percent and 18 percent, respectively, for the mergers in our analytic sample). By contrast, among deals that are below HSR thresholds, 19 percent would be flagged as anticompetitive using the HHI screening guidelines and 6 percent have a ΔWTP over 5 percent (or 24 percent and 9 percent, respectively, for the mergers in our analytic sample).[15]

Therefore, we view this "underenforcement" as coming from choices made by the government (either through low FTC funding or through the FTC being unwilling to take on certain cases) rather than from failures in ex ante merger screening methods or the visibility of transactions related to deal size and HSR thresholds.[16] To further demonstrate this, we compare the changes in HHI and WTP for cases that were litigated by the FTC against the changes in HHI and WTP for all the mergers in our sample and mergers we flagged as potentially anticompetitive. Litigation typically focuses on the worst potential effects of the merger. To mimic this, we can take, for each hospital in a transaction, the largest change in HHI and WTP across merging hospitals. As we illustrate in online Appendix Table A.8, the changes in HHI and WTP for litigated cases were 3,607 and 22.9 percent, respectively. These cases where enforcement actions occurred involved changes in HHI and WTP that are markedly larger than the changes observed in our full sample of mergers (435 and 2.0 percent) or even in our flagged mergers (1,843 and 9.6 percent). This suggests

[15] As we note in panel A of online Appendix Table A.6, mergers that we estimate are HSR reportable are more likely to have changes in HHI that would flag them as anticompetitive than those that are below reporting thresholds (21.3 percent versus 19.3 percent). Similarly, reportable deals are more likely to have ΔWTP of over 5 percent than those that are below reporting thresholds (14.0 percent versus 5.8 percent).

[16] The FTC may be hesitant to take on deals that are not as flagrantly problematic because of concerns that these less flagrant cases could be more challenging to win and that losing cases could establish problematic precedents in the courts. Additionally, in some cases, states have used Certificates of Public Advantage (COPAs) to override federal law and block enforcement action. This could lead the FTC to be reluctant to take on cases where they think states could invoke a COPA.

that the FTC is able to identify problematic mergers but highlights that their margin for intervention allows many anticompetitive mergers to be consummated.

V. Discussion and Conclusion

There were 1,164 hospital mergers between 2002 and 2020. During that period, the FTC took enforcement action against 13 transactions. This massive wave of consolidation has led the US hospital industry to experience a preventable "death by a thousand cuts." We show that, between 2010 and 2015, the 322 hospital mergers in our analytic sample raised overall hospital prices, on average, by 1.6 percent. This was driven by 1.1 percent and 1.8 percent increases in inpatient and outpatient prices, respectively. Our findings that postmerger outpatient price increases that are at least as large as inpatient price increases suggests that researchers and policymakers should consider the impact of mergers on outpatient prices during antitrust analysis. Ultimately, we find that an average year of mergers—approximately 53 transactions—raises health spending on the privately insured in the year following a merger by $204 million. While the hospital sector only accounts for 6 percent of US GDP, this merger-driven increase in spending is larger than the antitrust enforcement budget of the FTC.

Our results highlight that existing premerger screening tools—both those that use simple market concentration measures and those that take a structural approach—can, ex ante, identify problematic mergers. In turn, we find that these predictably harmful mergers generate large ex post price increases. From 2010 to 2015, while the FTC intervened in eight cases, we estimate that 20 percent of transactions—97 mergers—could have been flagged as likely to raise prices via a lessening of competition. We also find that these flagged mergers led to ex post price increases of, on average, 5 percent or more. Finally, we show that approximately half of the mergers that could have been flagged ex ante as likely to raise prices via lessening competition were above HSR reporting thresholds and were thus visible to regulators. We conclude that there is likely too little antitrust enforcement in the US hospital sector.

REFERENCES

American Hospital Association. 2019. *Annual Survey of Hospitals*. Chicago: American Hospital Association. https://www.ahadata.com/aha-annual-survey-database (accessed September 5, 2019).

ArcGIS. 2019. *ArcGIS APIs*. Redlands, CA: Esri. https://developers.arcgis.com/rest/ (accessed December 18, 2019).

ArcGIS. 2023. *ArcGIS Shapefiles*. Redlands, CA: Esri. https://hub.arcgis.com/datasets/1b02c87f62d24508970dc1a6df80c98e_0/explore?location=37.315440%2C-115.429520%2C4.82 (accessed May 10, 2023).

Ashenfelter, Orley C., and Daniel S. Hosken. 2010. "The Effect of Mergers on Consumer Prices: Evidence from Five Mergers on the Enforcement Margin." *Journal of Law and Economics* 53 (3): 417–66.

Ashenfelter, Orley C., Daniel S. Hosken, and Matthew C. Weinberg. 2013. "The Price Effects of a Large Merger of Manufacturers: A Case Study of Maytag-Whirlpool." *American Economic Journal: Economic Policy* 5 (1): 239–61.

Ashenfelter, Orley C., Daniel S. Hosken, and Matthew C. Weinberg. 2015. "Efficiencies Brewed: Pricing and Consolidation in the US Beer Industry." *RAND Journal of Economics* 46 (2): 328–61.

Baer, Bill, Jonathan B. Baker, Michael Kades, Fiona M. Scott Morton, Nancy L. Rose, Carl Shapiro, and Tim Wu. 2020. *Restoring Competition in the United States: A Vision for Antitrust Enforcement for the Next Administration and Congress*. Washington, DC: Washington Center for Equitable Growth.

Beaulieu, Nancy D., Leemore S. Dafny, Bruce E. Landon, Jesse B. Dalton, Ifedayo Kuye, and J. Michael McWilliams. 2020. "Changes in Quality of Care after Hospital Mergers and Acquisitions." *New England Journal of Medicine* 382 (1): 51–59.

Bhattacharya, Vivek, Gastón Illanes, and David Stillerman. 2023. "Merger Effects and Antitrust Enforcement: Evidence from US Consumer Packaged Goods." NBER Working Paper 31123.

BLS Beta Lab. 2019. *Consumer Price Index: All Items in US City Average, All Urban Consumers, Seasonally Adjusted*. Washington, DC: US Bureau of Labor Statistics. https://beta.bls.gov/dataQuery/find?fq=survey:%5Bcu%5D&s=popularity:D (accessed October 5, 2021).

Brand, Keith, Chris Garmon, and Ted Rosenbaum. 2023. "In the Shadow of Antitrust Enforcement: Price Effects of Hospital Mergers from 2009 to 2016." *Journal of Law and Economics* 66 (4): 639–69.

Brot, Zarek, Zack Cooper, Stuart Craig, and Lev Klarnet. 2020. *Amalgamated Merger Database 2001–2020*. Accessed June 1, 2021.

Brot, Zarek, Zack Cooper, Stuart Craig, and Lev Klarnet. 2024. *Data and Code for: "Is There Too Little Antitrust Enforcement in the US Hospital Sector?"* Nashville, TN: American Economic Association; distributed by Inter-university Consortium for Political and Social Research, Ann Arbor, MI. https://doi.org/10.3886/E197602V1.

Brot-Goldberg, Zarek, Timothy Layton, Boris Vabson, and Adelina Yanyue Wang. 2023. "The Behavioral Foundations of Default Effects: Theory and Evidence from Medicare Part D." *American Economic Review* 113 (10): 2718–58.

Capps, Cory, David Dranove, and Mark Satterthwaite. 2003. "Competition and Market Power in Option Demand Markets." *RAND Journal of Economics* 34 (4): 737–63.

Capps, Cory, Laura Kmitch, Zenon Zabinski, and Slava Zayats. 2019. "The Continuing Saga of Hospital Merger Enforcement." *Antitrust Law Journal* 82 (2): 441–96.

Cengiz, Doruk, Arindrajit Dube, Attila Lindner, and Ben Zipperer. 2019. "The Effect of Minimum Wages on Low-Wage Jobs." *Quarterly Journal of Economics* 134 (3): 1405–54.

Centers for Medicare and Medicaid Services. 2010. *Provider of Services Data*. Cambridge, MA: NBER. https://www.nber.org/research/data/provider-services-files (accessed May 2, 2023).

Cooper, Zack, Stuart Craig, Martin Gaynor, and John Van Reenen. 2019. "The Price Ain't Right? Hospital Prices and Health Spending on the Privately Insured." *Quarterly Journal of Economics* 134 (1): 51–107.

Cooper, Zack, Stephen Gibbons, Simon Jones, and Alistair McGuire. 2011. "Does Hospital Competition Save Lives? Evidence from the English NHS Patient Choice Reforms." *Economic Journal* 121 (554): F228–60.

Craig, Stuart V., Matthew Grennan, and Ashley Swanson. 2021. "Mergers and Marginal Costs: New Evidence on Hospital Buyer Power." *RAND Journal of Economics* 52 (1): 151–78.

Dafny, Leemore S. 2009. "Estimation and Identification of Merger Effects: An Application to Hospital Mergers." *Journal of Law and Economics* 52 (3): 523–50.

Dafny, Leemore S. 2021. "How Health Care Consolidation Is Contributing to Higher Prices and Spending, and Reforms That Could Bolster Antitrust Enforcement and Preserve and Promote Competition in Health Care Markets." Testimony before the US House Committee on the Judiciary, Subcommittee on Antitrust, Commercial, and Administrative Law, April 29, 2021.

Dartmouth Atlas. 2010. *ZIP Code Crosswalk*. Hanover, NH: Dartmourth Atlas Project. https://data.dartmouthatlas.org/supplemental/ (accessed May 2, 2023).

Dingel, Jonathan I., Joshua D. Gottlieb, Maya Lozinski, and Pauline Mourot. 2023. "Market Size and Trade in Medical Services." NBER Working Paper 31030.

Dranove, David, and Christopher Ody. 2016. "Evolving Measures of Provider Market Power." *American Journal of Health Economics* 2 (2): 145–60.

FactSet Research Systems. 2020. *FactSet Research Systems Database*. Norwalk, CT: FactSet Research Systems. Accessed November 3, 2021.

Federal Trade Commission. 2023. *Annual Competition Reports*. Washington, DC: Federal Trade Commission. https://www.ftc.gov/policy/reports/annual-competition-reports (accessed July 3, 2023).

Fulton, Brent D. 2017. "Health Care Market Concentration Trends in the United States: Evidence and Policy Responses." *Health Affairs* 36 (9): 1530–38.

Garmon, Christopher. 2017. "The Accuracy of Hospital Merger Screening Methods." *RAND Journal of Economics* 48 (4): 1068–102.

Gaynor, Martin. 2021. "Antitrust Applied: Hospital Consolidation Concerns and Solutions." Testimony before the US Senate Committee on the Judiciary, Subcommittee on Competition Policy, Antitrust, and Consumer Rights, May 19, 2021.

Gaynor, Martin, Rodrigo Moreno-Serra, and Carol Propper. 2013. "Death by Market Power: Reform, Competition, and Patient Outcomes in the National Health Service." *American Economic Journal: Economic Policy* 5 (4): 134–66.

Gowrisankaran, Gautam, Aviv Nevo, and Robert Town. 2015. "Mergers When Prices Are Negotiated: Evidence from the Hospital Industry." *American Economic Review* 105 (1): 172–203.

Haas-Wilson, Deborah, and Christopher Garmon. 2011. "Hospital Mergers and Competitive Effects: Two Retrospective Analyses." *International Journal of the Economics of Business* 18 (1): 17–32.

Health Care Cost Institute. 2022. *Claims Data from Beneficiaries with Employer-Sponsored Coverage from Aetna, Humana, and UnitedHealthcare*. Washington, DC: Health Care Cost Institute. https://healthcostinstitute.org/data (accessed December 1, 2022).

HERE Technologies. 2019. *HERE Mapping Data*. Berlin, Germany: HERE Technologies. https://www.here.com/platform/routing (accessed December 5, 2019).

Ho, Kate, and Robin S. Lee. 2017. "Insurer Competition in Health Care Markets." *Econometrica* 85 (2): 379–417.

Ho, Kate, and Robin S. Lee. 2019. "Equilibrium Provider Networks: Bargaining and Exclusion in Health Care Markets." *American Economic Review* 109 (2): 473–522.

Irving Levin Associates Health Care Services. 2020. *Irving Levin Acquisition Reports*. New Canaan, CT: Irving Levin Associates. https://www.levinassociates.com/levinprohc/ (accessed December 1, 2021).

Kades, Michael. 2019. *The State of US Federal Antitrust Enforcement*. Washington, DC: Washington Center for Equitable Growth.

Kwoka, John E., Jr. 2013. "Does Merger Control Work? A Retrospective on US Enforcement Actions and Merger Outcomes." *Antitrust Law Journal* 78 (3): 619–50.

MacKinnon, James G., and Matthew D. Webb. 2020. "Randomization Inference for Difference-in-Differences with Few Treated Clusters." *Journal of Econometrics* 218 (2): 435–50.

Majerovitz, Jeremy, and Anthony Yu. 2021. "Consolidation on Aisle Five: Effects of Mergers in Consumer Packaged Goods." Unpublished.

Miller, Nathan H., and Matthew C. Weinberg. 2017. "Understanding the Price Effects of the MillerCoors Joint Venture." *Econometrica* 85 (6): 1763–91.

Raval, Devesh, Ted Rosenbaum, and Steven A. Tenn. 2017. "A Semiparametric Discrete Choice Model: An Application to Hospital Mergers." *Economic Inquiry* 55 (4): 1919–44.

Roth, Jonathan, Pedro H. C. Sant'Anna, Alyssa Bilinski, and John Poe. 2023. "What's Trending in Difference-in-Differences? A Synthesis of the Recent Econometrics Literature." *Journal of Econometrics* 235 (2): 2218–44.

Schmitt, Matt. 2017. "Do Hospital Mergers Reduce Costs?" *Journal of Health Economics* 52: 74–94.

US Bureau of Labor Statistics. 2015. *Quarterly Census of Wages and Employment Data*. Washington, DC: US Bureau of Labor Statistics. https://data.bls.gov/cew/doc/layouts/csv_quarterly_layout.htm (accessed September 19, 2020).

US Bureau of Labor Statistics. 2018. *ACS 1-Year Estimates Public Use Microdata Sample*. Washington, DC: US Bureau of Labor Statistics. https://data.census.gov/mdat/#/search?ds=ACSPUMS1Y2018&cv=ESR&rv=NAICSP&wt=PWGTP (accessed September 19, 2019).

US Census Bureau. 2010a. *Gazetteer Files*. Washington, DC: US Census Bureau. https://www.census.gov/geographies/reference-files/time-series/geo/gazetteer-files.2010.html (accessed September 5, 2020).

US Census Bureau. 2010b. *Program Surveys Popest Datasets: County and City Databook*. Washington, DC: US Census Bureau. https://www2.census.gov/geo/docs/reference/ua/PctUrbanRural_State.xls (accessed November 9, 2021).

US Census Bureau. 2010c. *Program Surveys Popest Datasets: Census Bureau's County Population Totals*. Washington, DC: US Census Bureau. https://www2.census.gov/programs-surveys/popest/datasets/2000-2009/counties/totals/co-est2009-alldata.csv (accessed November 9, 2021).

US Census Bureau. 2017. *Model-Based SAHIE Estimates for Counties and States: 2017*. Washington, DC: US Census Bureau. https://www.census.gov/data/datasets/time-series/demo/sahie/estimates-acs.html (accessed November 12, 2021).

US Department of Justice and Federal Trade Commission. 2010. "Horizontal Merger Guidelines." Washington, DC: US Department of Justice and Federal Trade Commission.

US Department of Justice and Federal Trade Commission. 2023. "Merger Guidelines." Washington, DC: US Department of Justice and Federal Trade Commission.

White, Chapin. 2018. *RAND HCRIS Data: Web-Based Tool*. Santa Monica, CA: RAND Corporation. https://www.rand.org/pubs/tools/TL303.html (accessed December 12, 2020).

Wollmann, Thomas G. 2019. "Stealth Consolidation: Evidence from an Amendment to the Hart-Scott-Rodino Act." *American Economic Review: Insights* 1 (1): 77–94.