Intellectual Development Statement

Ryan C. McDevitt

Publications & Vita

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I am an applied microeconomist working primarily in the fields of industrial organization and health. Since my last intellectual development statement for promotion to full professor at Duke University's Fuqua School of Business in August 2020, my research, teaching, and service record has evolved in several notable ways:

- Thirteen papers published or forthcoming: *Journal of Political Economy*, the *Review of Economics and Statistics*, the *RAND Journal of Economics*, *JAMA*, *JAMA Internal Medicine*, *JAMA Open* (x3), *Health Affairs*, *Journal of Health, Politics, Policy, and Law*, the *American Medical Association Journal of Ethics*, the *British Journal of Anaesthesia*, and *Heliyon* (all with coauthors)
- Eight working papers either under review or to be submitted by the end of 2024, including one with revisions requested at the *American Economic Review* (all with coauthors)
- Grants from Arnold Ventures (∼$450,000), Washington Center for Equitable Growth (∼$50,000), National Institute of Health Care Management (∼$30,000), National Bureau of Economic Research (∼$10,000), and one pending from the American Investment Council (∼$750,000) (all with coauthors)
- Appointed editor at the *Journal of Industrial Economics* and Research Associate at the National Bureau of Economic Research
- Gave keynote address at the Welsh, Carson, Anderson & Stowe Quality Forum and participated in invited panels about my research on private equity at the Federal Trade Commission, Leonard Davis Institute, and Heritage Group
- Seminar invitations from Penn Economics, Penn Wharton, UCLA Anderson (x2), Chicago Harris, Chicago Booth, Stanford Health Policy, WUSTL Olin, Wisconsin Economics, Rochester Simon, BU Questrom, and Florida State Economics
- Won the Association of Competition Economics Best Paper Award (with coauthors)
- Taught six distinct courses across Fuqua's Daytime MBA, MMS, MSQM:BA, and MSQM:HA programs as well as Booth's MBA program and the Health Management Academy's Physician Business Leadership Program
- Won Fuqua's MMS Teaching Award in 2023 and was runner-up in 2024
- Won Fuqua's MSQM:HA Teaching Award in 2021 and MSQM:BA Teaching Award in 2022
- Served on Fuqua's Curriculum Committee and Duke's Academic Council
- Appointed to the American Society of Nephrology's Excellence in Patient Care Committee and Renalogic's Board of Advisors
- Engaged with Duke's health care community through the Duke-Margolis Center, Bass Connections, Fuqua's Health Sector Management program, Fuqua's Health Sector Advisory Council, and several collaborations with medical school faculty
- Advised nine Ph.D. students, two Duke Sanford master's students, two Duke Economics honors theses, and a Duke Economics master's student
- Supervised 27 independent studies for Fuqua MBA students

1 Research

I study how firm quality affects market outcomes. In my first papers, for instance, I show firms can credibly signal their quality by choosing different types of names, but then conceal their quality by choosing new names after developing a reputation for poor performance. In health care, firms' quality choices can be even more important. I find in the dialysis industry that facilities deliberately accept a higher infection rate to treat more patients, provide lower-quality treatments after being taken over by large chains, and use excessive doses of anti-anemia drugs to secure larger payments. As a related example, I find urology groups strategically hire female urologists when competition makes it worthwhile to differentiate, a horizontal dimension of quality that significantly affects women's health. Although all of my work is aimed at an academic audience, it often resonates more broadly and has been profiled by outlets such as The Economist, NPR, and The Daily Show.

1.1 Search, Reputation, & Quality

My research on firm reputation and quality began as part of my dissertation at Northwestern and resulted in two solo-authored publications. In the first ("A Business by Any Other Name: Firm Name Choice as a Signal of Firm Quality," *Journal of Political Economy*, 2014), I show firms can credibly signal their quality in response to consumers' search behavior by sorting on different types of names. This result may at first seem counterintuitive in light of cheap talk: sorting should unravel as low-quality firms mimic the names of high-quality firms to attract more business. In the paper, however, I demonstrate how separation on quality can occur when consumers differ in their willingness to search and this willingness is correlated with how profitable certain consumers are for high-quality firms relative to low-quality ones.

Although the model in the paper applies across many settings, I focus specifically on the market for residential plumbing services because it has the characteristics necessary for a large-sample empirical study. I find that plumbing firms with names beginning with an "A" or a number charge higher prices, receive five times as many service complaints, and operate predominately in large markets like Chicago. All of these findings are consistent with a stylized model of ordered search since names starting with an "A" or a number have historically appeared at the top of a category's listings in the yellow pages.

As a natural extension, I show these results apply not just to antiquated phone directories but to internet search engines as well: plumbing firms that advertise on Google receive ten times as many complaints, contradicting the theoretical prediction that only high-quality firms will win position auctions to appear at the top of Google's search results (Athey & Ellison 2011). The key insight from my paper is that firms respond strategically to the way in which consumers search, regardless of the platform. Because Google disproportionately attracts uninformed customers with a low willingness to search, a low-quality plumbing firm has a greater incentive to appear among the sponsored listings on Google, just as it has a greater incentive to use a name that appears at the top of the yellow pages. Given the FTC's recent investigation of Google's anticompetitive business practices, I was interviewed about my research for a Freakonomics podcast, "Is Google Getting Worse?", in November 2022.

In a related paper ("Names and Reputations: An Empirical Analysis," *American Economic Journal: Microeconomics*, 2011), I test the theoretical prediction that a firm's poor performance will reduce the value of its name as consumers update their beliefs about the firm's underlying quality (Tadelis 1999). Once the value falls far enough, a firm will change its name to conceal its track record and exploit uninformed consumers, like when ValuJet rechristened itself AirTran after crashing a plane in the Florida Everglades or Andersen Consulting changed its name to Accenture following the Enron accounting scandal. Although the theoretical work in this area is extensive, few empirical studies had previously explored the topic.

Using the market for residential plumbing services once again, I confirm a main theoretical result: poor performance leads a firm to conceal its reputation. I find that a firm with a record of complaints one standard deviation above the mean is more than twice as likely to change its name. In addition, firms with

longer track records are less likely to change their names *or* exit, while those that made more firm-specific investments in advertising are more likely to change their names *than* exit (because they often use the same phone numbers and receive priority for better ad placements in the yellow pages). Finally, I show that firms in small markets value their reputations considerably more than firms in large markets do, as would be expected if consumers in smaller communities rely more on word of mouth to find reliable providers.

1.2 Quality in Health Care

In a second strand of research, I apply both structural IO and applied micro techniques to study various topics in health economics. This agenda has emerged more recently for me and has required a considerable amount of effort to become familiar with the Byzantine details of the U.S. health care system. As a sign of the progress I have made on this front since being promoted to full professor in July 2021, I was appointed as a Research Associate in the NBER's Economics of Health Program, was named to the American Society of Nephrology's Excellence in Patient Care Committee, and was asked to serve on the advisory board of Renalogic, a company that helps self-funded plans and their members manage the financial costs of dialysis.

Gender Disparity My first publication in this area models provider quality and strategic differentiation in health care ("Market Structure and Gender Disparity in Health Care: Preferences, Competition, and Quality Care," *RAND Journal of Economics*, 2014), which was the final chapter of my dissertation and coauthored with Jimmy Roberts (former classmate at Northwestern now at Duke). In the paper, we examine how fixed costs and heterogeneous preferences limit the options available to patients and how the interplay between these two forces affects health outcomes. Although this topic had been studied previously across many settings (Berry & Reiss 2006), limited work had considered how changes in market structure affect a patient's well-being when the preferences of one group limit the choices of another — and none, to my knowledge, had done so using a structural product-choice model.

Our measure of variety in this setting is the gender mix of physician groups. Because many patients prefer to receive care from someone of the same gender, competition may lead groups to strategically hire male or female physicians to attract more patients. We examine this phenomenon in the historically male-dominated field of urology, where fewer than 6% of urologists are women despite women comprising approximately 30% of patients and strongly preferring female urologists.

In light of these gender-based preferences, we first estimate the market size required to support a given number of male and female urologists. Using the entry model of Bresnahan & Reiss (1991), we find that the population needed to support a single female urologist is approximately the same as one that would support 16 male urologists, while the second female urologist in a market requires a population nearly 3.7 times as large as the first compared to a range of 1.8–2.4 for subsequent male urologists. The larger entry thresholds for female urologists suggest that market structure — and not other potential explanations, like female physicians disproportionately preferring non-surgical fields like pediatrics — may be responsible for the gender disparity among urologists. As such, we estimate a model of competition across urology groups that explains a meaningful portion of the disparity.

In the model, groups choose how many male and female urologists to employ, with their optimal choices depending endogenously on the expected responses of competitors. We find that a group becomes much more likely to employ a female urologist as competition intensifies, as would be expected given the potential gains from differentiating. Due to the possibility of business stealing, however, a group is also much more likely to hire a female urologist if it expects to be the only one in the market to do so. In addition, we find evidence of complementarities between male and female urologists: a group that moves from being the smallest to the largest in our data becomes seven times more likely to employ a woman, as larger groups can better leverage their colleagues by allocating patients to the physician who lines up best with their preferences.

The lack of choice for female urology patients has important consequences. We find that counties without a female urologist have a 7.3% higher death rate from female urological cancers, even after controlling for the

county's death rate for other cancers. This result is consistent with women delaying or forgoing consultations with urologists when only male urologists are available, suggesting that competition among urology groups has meaningful implications for the welfare of women.

Quality-Quantity Tradeoff Another point of differentiation is the absolute level of quality offered by providers, a vertical dimension that complements the horizontal aspects we considered for urology groups. To study this facet of firm strategy, Paul Grieco (former classmate at Northwestern now at Penn State) and I developed an empirical framework for measuring the relationship between productivity and patient outcomes that accounts for a firm's endogenous choice of output quality ("Productivity and Quality in Health Care: Evidence from the Dialysis Industry," *Review of Economic Studies*, 2017). Although previous work had considered the relationship between productivity and quality using indirect measures, our paper is the first to do so directly.

Our motivation stems from the fundamental tradeoff health care providers face between increasing the number of patients they treat and maintaining high standards of care. The tension between the quality and quantity of treatments lies at the heart of many recent payment reforms, such as Medicare's prospective payment system (PPS), which ties reimbursements to a fixed amount per service irrespective of a provider's actual costs. Although these initiatives aim to limit wasteful health care expenses, they may inadvertently result in less-effective care if providers cut costs by reducing the quality of their treatments. Measuring the tradeoff between the number and quality of treatments is therefore essential for understanding the full impact of any potential policy change. Applying our empirical framework to dialysis facilities, we find that the cost of improving treatment quality is substantial, whereas conventional methods would show only a small tradeoff.

Properly identifying a quality-quantity tradeoff requires us to overcome several econometric challenges. For one, facilities deliberately choose their targeted levels of quality, so estimating the relationship between quality and quantity becomes confounded by differences in productivity that are observable to the facility but not to the researcher, such as a nurse's innate skills or a patient's underlying condition. As greater productivity effectively shifts out a facility's production possibilities frontier, the facility becomes able both to treat more patients *and* to provide better care. At the extreme, high levels of unobserved productivity could even result in a positive correlation between quality and quantity; this correlation would bias reduced-form estimates of the quality-quantity tradeoff and lead researchers to underestimate facilities' true costs of improving their care.

In light of these challenges, we obtain consistent estimates of the quality-quantity tradeoff by building on the structural methods for estimating firm-level production functions first proposed by Olley & Pakes (1996) and later extended by Levinsohn & Petrin (2003), Ackerberg et al. (2015), and Gandhi et al. (2020), among others. Conceptually, we adapt these methods to incorporate a "quality-choice" stage that comes after a facility makes its capital and labor decisions. That is, after installing machines and hiring workers, a manager observes their facility's expected level of productivity and dictates an optimal level of quality by, for example, stipulating guidelines for the cleanliness of equipment or training staff how to safely administer procedures. Incorporating these endogenous quality choices into our estimation strategy is particularly important in health care settings like dialysis because facilities would otherwise appear more productive when they are instead just providing lower-quality treatments.

To address the second main econometric challenge — that we do not directly observe facilities' quality choices — we use observable measures of patient outcomes as proxies for what those actual choices must have been. Our approach is based on the assumption that, if high-quality care is more likely to result in better outcomes, then those outcomes themselves are valid proxies for the facility's unobserved quality choices; we also use an IV strategy to recover the impact of quality choices on output that corrects for attenuation bias.

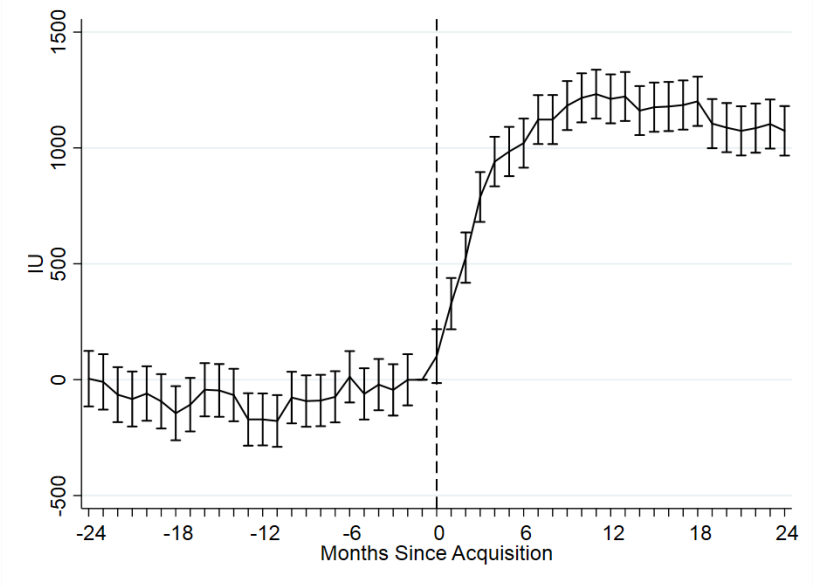
From our analysis, we find a substantial quality-quantity tradeoff in dialysis: a facility can increase its patient load by 1.6% by allowing its targeted infection rate to increase by 1 percentage point, holding input levels and productivity constant. Similarly, holding the number of patients constant but allowing a one standard deviation increase in the targeted infection rate would reduce a facility's costs by the equivalent of five

full-time employees, nearly 40% of the staff at a typical facility. These findings suggest that some dialysis facilities sacrifice patients' well-being in the pursuit of higher profits, an insight I explore further in related work with Paul Eliason (former Duke Economics Ph.D. student now at University of Utah), Ben Heebsh (former Duke Economics Ph.D. student now at the Federal Trade Commission), and Jimmy Roberts.

Mergers & Acquisitions In our paper ("How Acquisitions Affect Firm Behavior and Performance: Evidence from the Dialysis Industry," *Quarterly Journal of Economics*, 2020), funded in part by the National Science Foundation, we study how dialysis facility acquisitions affect the treatments and outcomes of patients. Like many parts of U.S. health care, dialysis has become increasingly concentrated over the past three decades, with the share of independent dialysis facilities falling from 86% to 21% and the two largest for-profit chains, DaVita and Fresenius, now owning 75% of facilities. Previous studies of health care consolidation have typically considered only broad measures of competition and outcomes — showing, for instance, that more-concentrated hospital markets tend to have higher mortality rates. Much less work has examined the precise ways in which mergers and acquisitions cause health outcomes to change. For our analysis, we use detailed claims data from Medicare's dialysis program to show directly how large chains transfer their corporate strategies to the approximately 1,200 independent facilities they acquired between 1998 and 2010.

We find that acquired facilities alter patients' care in ways that both increase reimbursements and decrease costs. One prominent way facilities do this is by increasing the amount of injectable drugs they administer to patients, for which Medicare paid a fixed per-unit rate during our study period. The most notable of these is EPOGEN (EPO), a drug used to treat anemia that was Medicare's largest prescription drug expense in 2010, totaling more than $2 billion. Reflecting the outsize profits at stake, we show in Figure 1 that patients received 128.9% higher doses of EPO after their facilities were acquired by a chain. Similarly, acquired facilities increased their use of the iron-deficiency drug Venofer relative to Ferrlecit, a perfect substitute that offered lower reimbursements. On the cost side, chains reduced expenses by replacing high-skill nurses with lower-skill technicians, increasing the patient-load of each employee by 11.9%, and increasing the number of patients treated at each dialysis station by 4.6%.

Figure 1: EPO Doses at Acquired Dialysis Facilities



Stretching resources in this way potentially reduces the quality of care received by dialysis patients, as overburdened staff are more likely to make mistakes and less able to disinfect stations between shifts. Reflecting these tradeoffs, patients at acquired facilities were 6.1% more likely to be hospitalized in a given month, while the survival rate for new patients fell by up to 3.0%. In addition, new dialysis patients who started

treatment at an acquired facility were 9.4% less likely to receive a kidney transplant or be added to the transplant waitlist during their first year on dialysis, a reflection of worse care because transplants provide both a better quality of life and a longer life expectancy than dialysis. Despite patients mostly receiving worse care following a takeover, per-treatment reimbursements increased by 7.5%, amounting to $274.5 million in additional spending over our sample period.

Like much of the merger-effects literature, our findings may face multiple threats to identification: acquisitions do not occur randomly and acquired facilities likely differ from those not acquired in important, potentially unobservable ways. For instance, facilities may systematically alter their mix of patients after being taken over by a chain, in which case the change in outcomes we attribute to a change in ownership may actually stem from a change in the facility's demographics. Similarly, chains may disproportionately target facilities located in areas with more lucrative patients, potentially biasing our estimates of how reimbursements change following an acquisition.

We overcome these challenges by taking advantage of the uniquely detailed nature of our data. Unlike many claims datasets, we have repeated measures of patients' clinical outcomes and precise measures of their conditions' severity, allowing us to mitigate concerns about a changing mix of patients. In addition, the long length of our panel allows us to observe patients with the same characteristics being treated at the same facility both before and after an acquisition, permitting us to identify the effects of an acquisition solely from within-facility changes in ownership. And, due to the chronic nature of dialysis, in many cases we can even estimate specifications with patient-level fixed effects, a particularly conservative approach for measuring how an acquisition affects patients' treatments and outcomes.

We conclude our paper by considering whether an acquisition's effect on market power can explain the changes we observe for patients' outcomes. With prices set administratively for Medicare patients, standard models of regulated markets with endogenous product quality would predict that a facility facing more competition will offer higher-quality treatments to attract more patients, given the assumption that demand is elastic with respect to quality. In dialysis, however, that assumption fails to hold: patients do not respond to changes in quality and rarely switch facilities (for many reasons, but mainly due to high travel costs). We therefore find very similar qualitative and quantitative results across all of our outcomes when comparing acquisitions that increased market concentration with those that did not. As such, changes in market power cannot explain the decline in quality we observe after a takeover, which implies that the strategy of the acquiring chain, rather than the subsequent concentration of the market, largely determines how patients fare following an acquisition.

Reflecting the policy implications of these findings, our work was cited by FTC Commissioner Christine Wilson in her recent statement regarding the Hart-Scott-Rodino Act, highlighted by Pulitzer Prize-winning journalist Michael Hiltzik in his article on health care competition, and featured as the basis for a two-part Freakonomics podcast on the U.S. health care system.[1] We also received the best paper award from the Association of Competition Economics in 2021.

Joint Ventures The trend towards horizontal consolidation in dialysis has occurred along vertical dimensions as well. In preliminary work, funded in part by a grant from the Washington Center for Equitable Growth, Paul Eliason, Jimmy Roberts, and I study the vertical integration of dialysis facilities with nephrologists, a practice that has nearly tripled over the past decade, to the point where approximately one in three facilities now operates as a joint venture (JV).

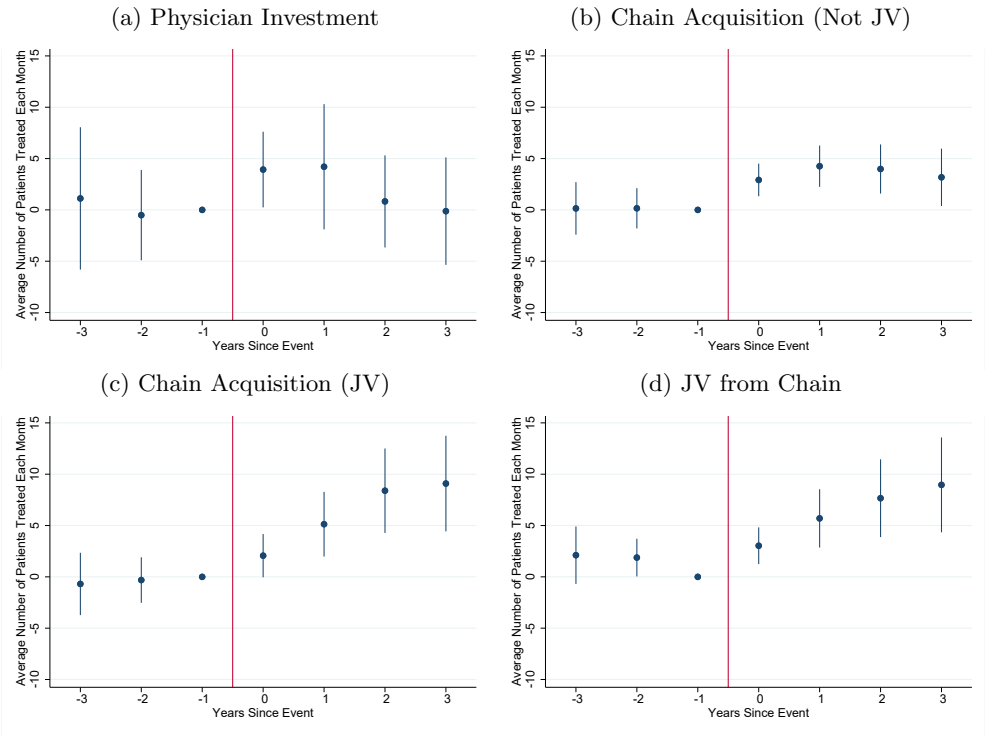
The implications of such ownership arrangements are ambiguous. Dialysis chains assert that their JVs benefit patients by improving the coordination and quality of care, whereas others have questioned whether JVs might distort treatment decisions and worsen patients' outcomes. A 2022 report from the Medicare Payment Advisory Commission (MedPAC) 2022, for instance, suggests that physicians with a financial interest in a facility might initiate patients on dialysis when it is of questionable value, pressure patients into receiving in-center dialysis rather than home-based modalities or a transplant, steer patients to facilities where they

[1] Cf., respectively, FTC, L.A. Times, and Freakonomics

have an ownership stake even if another one might be more convenient or provide a higher quality of care, and overfurnish profitable fee-for-service treatments while underfurnishing those covered by a bundle.

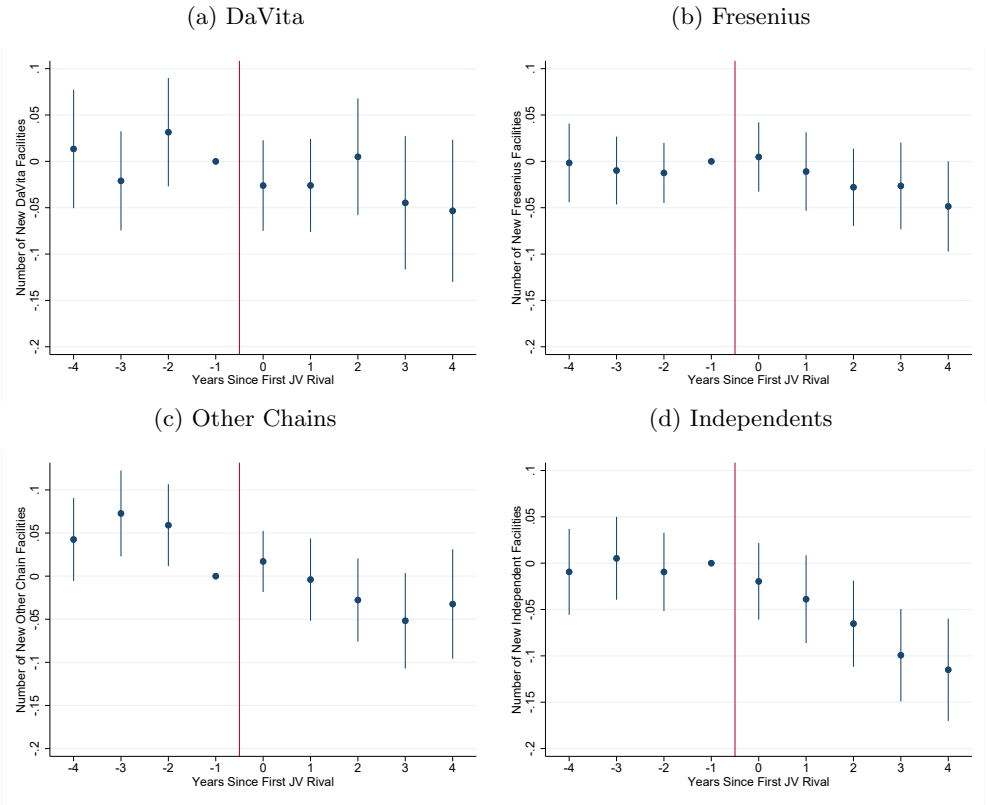
Empirical studies of JVs have so far been stifled by a lack of data on shared ownership. We fill this gap by constructing a panel dataset of all JV facilities across the U.S. as well as the identities of their physician owners, made possible through a FOIA request for ownership data from Medicare. We find that the number of JVs increased from 476 of 4900 facilities in 2006 to 2299 of 7727 facilities in 2017, reflecting a sharp rise in the share of JV facilities from 9.8% to 29.8%. We further show that DaVita and Fresenius impose exclusive contracts on their JV owners and medical directors, effectively preventing them from owning or directing rivals' facilities. Chains enter into these agreements primarily to secure more referrals, as Figure 2 shows the increase in patients following a change in ownership flows mostly to JVs relative to a physician's investment in an independent facility or a horizontal merger; we also document a strong correlation between a medical director's compensation and the number of patients they send to the facility they direct. Without access to referrals, rivals find it difficult to reach a sufficient scale and become less likely to enter a market already served by a JV, a foreclosure effect that stands out clearly from the event studies in Figure 3.

Figure 2: Patient Loads Following Ownership Transitions



Once completed later this year, our paper will provide both novel descriptive evidence on horizontal and vertical consolidation in dialysis as well as a counterfactual analysis from a structural model of entry, exit, and vertical integration to show how foreclosure impacts market structure and patients' access to care. Regulators are likely to be interested in our findings (cf. Politico).

Figure 3: Entry Following Rival JV Formation



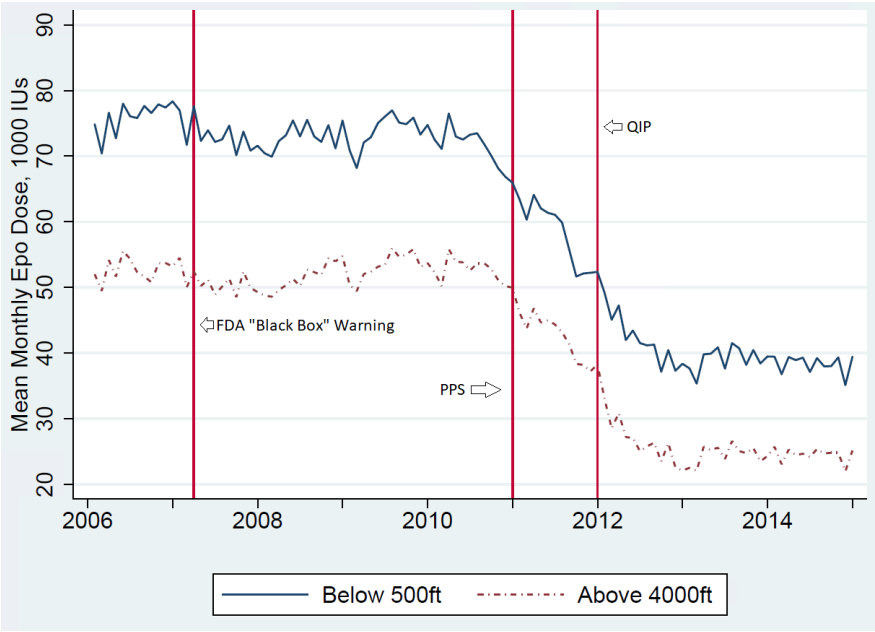
Bundled Payments Continuing our work on dialysis supported by the National Science Foundation, Riley League (former Duke Economics Ph.D. student now at University of Illinois) joined Paul Eliason, Ben Heebsh, Jimmy Roberts, and me in studying the effects of a Medicare payment reform that curtailed dialysis facilities' incentives to overuse injectable drugs by moving from a per-dose reimbursement to a bundle ("The Effect of Bundled Payments on Provider Behavior and Patient Outcomes," revisions requested, *American Economic Review*). Before changing its reimbursement scheme in 2011, Medicare paid facilities using a hybrid system that gave providers a fixed payment for each dialysis session and a fee-for-service payment for any injectable drugs administered during treatment. As we showed in our *QJE* paper, these fee-for-service payments proved lucrative for providers, with EPO accounting for as much as 25% of DaVita's revenue and up to 40% of its profits, but the pervasive use of EPO increased the risk of mortality and cardiovascular events for patients and prompted calls for reform.

The move to bundled payments corresponded with a nearly 50% drop in the average EPO dose given to patients. Because Medicare simultaneously imposed the bundle on all providers, however, we cannot immediately link the change in EPO doses to the change in reimbursements, as other contemporaneous changes could have coincided with the payment reform. Moreover, providers base their treatment decisions in part on a patient's underlying health, so any correlation between EPO doses and outcomes may be biased by unobserved confounds. Reflecting this possibility, we show that OLS regressions of hemoglobin and transfusions on patients' EPO doses produce spurious negative and positive correlations, respectively, even though randomized controlled trials have shown the drug in fact causes the opposite clinical response.

In light of these empirical challenges, we use a novel source of exogenous variation in providers' treatment decisions to identify the marginal effect of EPO on outcomes: patients living at higher elevations have less severe anemia at baseline and therefore naturally require less EPO to manage their condition. During the fee-for-service era, this physiological distinction made patients at higher elevations less profitable for providers, as

they received smaller doses of EPO to keep their blood levels within clinical guidelines. After Medicare moved to bundled payments, providers' financial incentives flipped, with patients at lower elevations becoming less lucrative for providers who no longer received separate payments corresponding to these patients' larger doses. The uniformly applied payment reform therefore had different financial implications for facilities at different elevations and resulted in different changes in patients' EPO, as shown clearly in Figure 4.

Figure 4: EPO Doses at High and Low Elevations over Time



For our estimation, we use the interaction between elevation and the payment reform as an excluded instrument while controlling directly for time trends and elevation in the regressions. Our empirical strategy of interacting one variable with time-series variation and another with cross-sectional variation closely resembles a traditional difference-in-differences estimation, where the first difference compares doses across varying levels of elevation, while the second compares doses during the fee-for-service era, when financial incentives favored administering large amounts of injectable drugs, with those administered during the PPS era when the financial incentives reversed.

For this specification to have a causal interpretation, the interaction between a facility's elevation and Medicare's payment reform must affect health outcomes only through its influence on EPO doses, conditional on other controls. That is, the exclusion restriction in our setting requires that (i) any other mechanism through which elevation affects patients is constant over time and (ii) any other mechanism causing health outcomes to differ before and after the PPS affects patients uniformly with respect to their elevation. Although not directly testable, several pieces of evidence suggest our empirical strategy satisfies these requirements, such as parallel pre-trends for patients' EPO doses across high and low elevations and no meaningful changes in observable patient characteristics or facility inputs like staffing levels.

Using our IV approach, we find the average post-PPS reduction in EPO of 31.5% caused hemoglobin levels to fall by 3.4% and the number of blood transfusions to increase by 41.3%, suggesting worse management of patients' anemia. The sharp rise in transfusions also highlights facilities' strategic response to bundled payments, as transfusions shift the costs of treating anemia from the dialysis facility (in the form of EPO) back to Medicare. For acute outcomes, the decline in EPO caused hospitalizations from cardiac events to fall by 11.6% and mortality rates by 14.1%.

Performance Pay As Medicare moved to bundled payments for dialysis, policymakers raised new concerns that facilities would begin undertreating patients once injectable drugs became a marginal cost rather than a source of profit. In response, Medicare developed the Quality Incentive Program (QIP), which assigns facilities an annual quality score based on a set of standardized measures related to their patients' care, such as infection rates and transfusions, and then cuts reimbursements by up to 2% for those facilities that perform poorly. In our recent working paper, "Gaming and Effort in Performance Pay," we show that while pay-for-performance models like the QIP do spur providers to exert more effort in caring for patients, as Medicare intended, they also incite providers to game the system's financial incentives by dropping patients who would cause their quality scores to fall, an unintended consequence that can have severe repercussions for the affected patients.

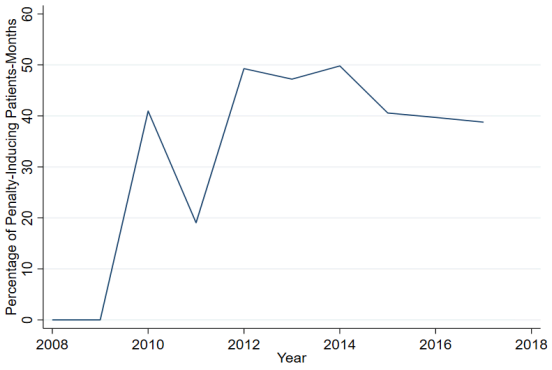
As shown in Figure 5a, the measures used to construct a facility's quality score have been continually updated since the QIP's inception, allowing us to cleanly identify how providers respond to performance pay: the annual changes in Medicare's criteria generate substantial variation in how a given patient influences their facility's score even if that patient's underlying characteristics remain unchanged. Because some patients would suddenly cause their facilities' reimbursements to fall if they remained below the QIP's new standards, we can use the exogenous shocks in Figure 5b to isolate the different forms of gaming and effort facilities employ in response to Medicare's incentives. We find in Figure 5c that patients become much more likely to switch facilities when their characteristics would trigger a penalty in a particular year, a pattern consistent with insiders' claims that facilities involuntarily discharge less-desirable patients (Fields 2010, Mueller 2023).

Figure 5: QIP Criteria and Switching

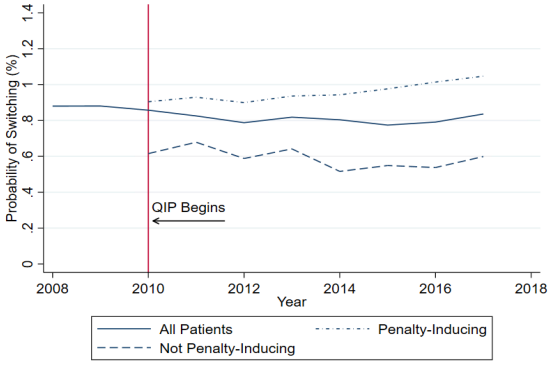
(a) QIP Criteria and Weights

Measure	Description	Performance Year 2010	2011	2012	2013	2014	2015	2016	2017
Low HGB	% of patients with HGB<10 g/dL	50%							
High HGB	% of patients with HGB>12 g/dL	25%	50%	33%	33%	21.4%			
Low URR	% of patients with a median URR below 65%	25%	50%	33%					
Bad Vasc. Access	% of patients using a catheter or graft for vascular access			33%	33%	21.4%	21.4%	14.7%	15.6%
Low Kt/V	% of patients with Kt/V<1.2				33%	21.4%	21.4%	14.7%	15.6%
Infection	% of patients with a positive blood culture					21.4%	21.4%	23.5%	15%
Transfusion	Ratio of observed and predicted transfusions							14.7%	15.6%
Readmission	Ratio of observed and predicted unplanned readmissions						21.4%	17.6%	22.6%
High Calcium	% of patients with 3-month mean of serum calcium>10.2 mg/dL					14.3%	14.3%	14.7%	15.6%

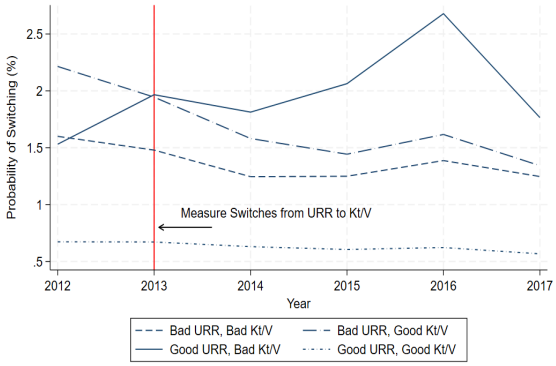
(b) Percentage of Penalty-Inducing Patients



(c) Switching by Penalty-Inducing Status



(d) Switching by URR and Kt/V Status



Two performance measures in particular illustrate this phenomenon. Dialysis facilities must regularly track the amount of waste and toxins they clear from a patient's blood, with adequacy measured by either the urea

reduction ratio (URR) or Kt/V. These two measures are closely, but not perfectly, related: patients with an identical URR might end up having very different measures of Kt/V, primarily due to differences in body weight. Initially, the QIP used URR as its measure for dialysis adequacy, but then switched to Kt/V in the program's fourth year, with the nominal change in criteria leading to a large and abrupt shift in the types of patients who switch facilities in Figure 5d. When the QIP penalized poor URR scores, patients with bad URR and good Kt/V were more likely to switch facilities than those with good URR and bad Kt/V; when the QIP penalized poor Kt/V instead, the pattern flipped.

Facilities' incentives for dropping penalty-inducing patients are clear-cut. A facility with the average load of 50 eligible patients and at the bottom decile of QIP scores could move from the worst possible score to the best by dropping just three of its patients. Similar to our example of dialysis adequacy, we use Medicare claims data to detect whether facilities engage in such strategic behavior across all QIP criteria by calculating how much each patient's diagnostic measures would reduce their facility's score in a given year. From this approach, we find in our most-conservative specification that a patient not meeting any of Medicare's QIP standards is 14.3% more likely to switch facilities than a patient who satisfies them all. We also find that penalty-inducing patients are more likely to switch facilities after being hospitalized — a result consistent with facilities selectively refusing to take back patients who might harm their QIP scores — and that penalty-inducing patients are not more likely to switch to more-convenient or higher-quality facilities, suggesting their move was unlikely to be voluntary.

Along with strategically dropping patients, facilities can also improve their QIP scores by exerting more effort to provide better care. To improve adequacy scores, for example, a facility could increase the amount of time their patients spend being dialyzed, although doing so comes with the opportunity cost of not using the station for an additional session; the facility must then weigh the financial penalty of the QIP against the forgone payments from not treating another patient. For the QIP measures where we have data directly related to effort, we find facilities improve their quality of care when the incentives from the QIP do not conflict with other profit-maximizing activities. During the years in which the QIP penalized facilities for having patients with low hemoglobin levels, for example, facilities administered higher doses of the fee-for-service drugs that stimulate red blood cell production, allowing them to avoid the reimbursement cut from falling short of the QIP's benchmark while at the same time earning higher profits from the separately billable drugs. Similarly, when the QIP penalized hypercalcemia, facilities reduced calcium levels by prescribing more cinacalcet, a drug covered under Part D for which the patient, rather than the facility, bears the cost. When meeting the QIP's standards would require a facility to increase its costs, however, like with run times for adequacy or EPO for transfusions, we do not find the same unambiguous increase in effort.

Strategic Discharge I further study the effects of Medicare's PPS with Paul Eliason, Paul Grieco, and Jimmy Roberts ("Strategic Patient Discharge: Evidence from Long-term Care Hospitals," *American Economic Review*, 2018). As we showed for dialysis, an advantage of Medicare's PPS is that it provides an incentive to deliver care efficiently, as extraneous procedures and tests would increase costs without yielding any additional revenue. Like we found with the QIP, however, one drawback of these reimbursement schemes is that providers may base their treatment decisions not on clinical guidelines for effective care but on the financial incentives created by the payment system.

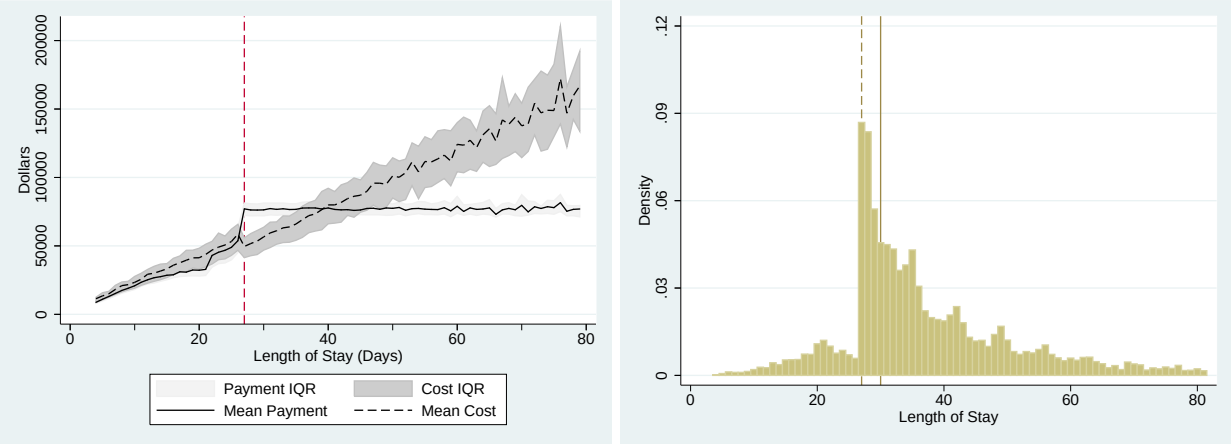
Long-term acute-care hospitals (LTCHs) offer a clear example of this tension. Under the current PPS, Medicare reimburses LTCHs a fixed amount per admission based on a patient's diagnosis-related group (DRG), and these per-stay reimbursements are substantially larger than those for general acute-care hospitals. To discourage LTCHs from exploiting their higher reimbursement status by admitting patients and then quickly sending them back to acute-care hospitals, Medicare classifies patients as short-stay outliers (SSOs) if they stay fewer than a pre-specified number of days and reimburses LTCHs considerably less for these patients.

Tying reimbursements to a length-of-stay threshold creates a narrow window during which an LTCH achieves maximum profitability for each patient, colloquially referred to as the "magic day" by industry participants. To take advantage of these opportunities, some LTCHs may strategically discharge patients to maximize their profits at the expense of patients' care: keeping patients longer than medically necessary increases their risk of developing hospital-acquired infections and other complications, whereas prematurely discharging patients

simply because they became eligible for a lump-sum payment could mean they have not yet received adequate treatment.

Using a decade's worth of Medicare claims data, we first present descriptive evidence that LTCHs are much more likely to discharge patients right after they reach the magic day compared to what would be expected if patients were discharged solely for clinical reasons. We use the sharp discontinuity in payments around the threshold to identify this practice, showing in Figure 6 that LTCHs discharged 25.7% of patients during the three days immediately after crossing the threshold compared to 6.8% in the three days immediately preceding it.

Figure 6: Medicare Payments (left) and Discharge Patterns (right) for LTCHs



Although the nearly fourfold increase in discharges just past the SSO threshold would seem to be an obvious byproduct of LTCHs' strategic maneuvering, we do not observe many of the confounding factors that could have influenced the decision, such as a patient's desire to be released or the full details of their medical needs. To establish that LTCH's are indeed responding strategically to Medicare's financial incentives, we use several sources of exogenous variation in the data that allow us to isolate the effect. First, the SSO threshold varies across DRGs within a year and within a DRG across years. Using both this time-series and cross-sectional variation, we find that LTCHs consistently discharge patients on the magic day for any given DRG in any given year. Furthermore, if facilities discharged patients solely based on clinical reasons, we would expect to observe a smooth distribution of discharges across the length of patients' stays; instead, the discontinuous jump in discharges lines up perfectly with the discontinuous jump in payments. We also show that in 2002, when LTCHs received per-day payments and did not face a discontinuity in the reimbursement schedule, discharges had no discernible spikes around what would become magic days in later years.

Another threat to identification could be that discharges cluster on the magic day simply because Medicare bases the threshold on a DRG's average length of stay from the previous year and patients with similar diagnoses receive similar treatments. The strong association between discharges and providers' financial incentives suggests this type of coincidence is not driving our results. We show that the likelihood of a patient being released on the magic day is greater among the DRGs for which it is most profitable. In addition, we find that discharges of patients to their homes — the easiest type of discharge to manipulate — exhibit the clearest signs of strategic behavior, whereas discharges due to death are unrelated to reimbursements, a key falsification test. We also find that for-profit hospitals are more likely to strategically discharge patients, as are facilities co-located with acute-care hospitals that can easily transfer patients across floors. Lastly, we find that facilities operated by the two dominant LTCH chains are more likely to discharge patients on the magic day — and when these chains acquire other LTCHs, the acquired hospitals become more likely to do so as well (much like we found for the independent facilities acquired by dialysis chains in our *QJE* paper).

We build on our descriptive analysis by estimating a structural model of LTCHs' discharge decisions to predict how they would respond to alternative payment policies. Conceptually, our model is based on an LTCH deciding each day whether to discharge a patient immediately or to keep them in the facility for another day, where the LTCH weighs the revenue-based incentives of immediately discharging the patient against the many cost-based and non-pecuniary reasons to hold the patient in the facility longer (e.g., the incremental costs of treatment, the risk incurred by releasing the patient too early, and the marginal benefit of additional care). Here we use the nonlinear reimbursement schedule that generates a sharp jump in payments on the magic day to isolate the revenue-based motives underlying facilities' discharge decisions as well as variation stemming from differences across DRGs, regions, and years.

Using the estimates from our structural model, we evaluate a new reimbursement scheme recently proposed by MedPAC that would eliminate the sharp jump in payments at the SSO threshold, replacing it with higher per-day payments instead. Our analysis suggests that more patients would be discharged in the days prior to what would have been the SSO threshold because LTCHs no longer have a reason to extend a stay solely to receive larger payments on the magic day. At the same time, the larger per-day payments may provide an incentive to delay discharges in advance of the SSO threshold. Based on our projections, among those patients still in an LTCH within three days of what would have been the magic day under the current PPS, the proposed formula would decrease the number of them held until the old magic day by about 9%, reducing the average stay by a day relative to the status quo and saving Medicare approximately $19 million each year for the nine most-common DRGs.

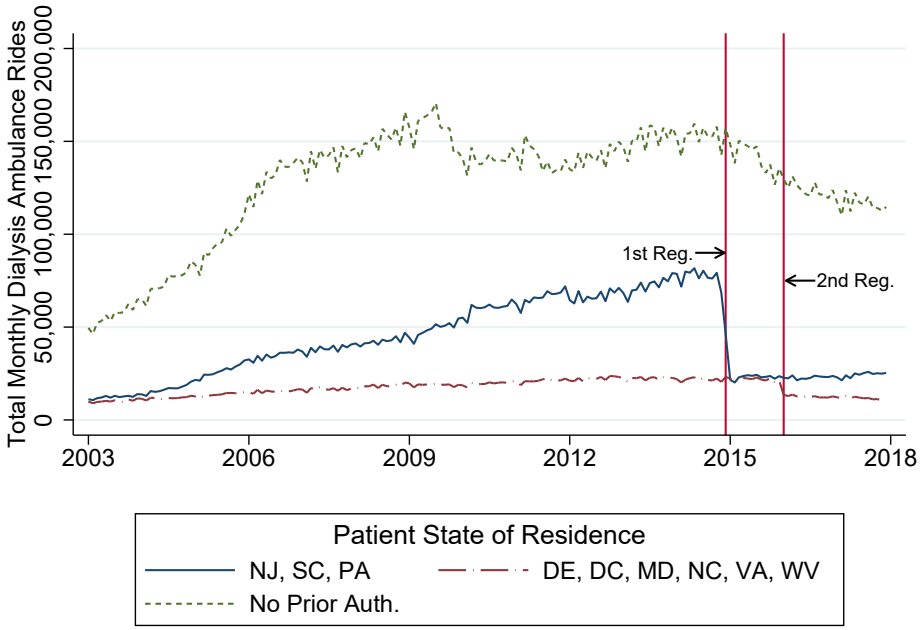
Medicare Fraud As we found for dialysis and long-term care hospitals, fraud poses a serious problem for Medicare: it both distorts patient care and wastes limited public resources. To combat and deter this fraud, the federal government uses two main approaches: litigation through the courts, which attempts to recover funds that have already been paid out, and administrative regulations that prevent improper payments from being made in the first place. Although in theory both approaches can be used effectively, the costly and expansive monitoring required to implement wide-reaching regulations has prompted a long literature in law and economics favoring the use of targeted litigation instead (Coase 1960, Becker 1968). The enforcement of most health care policies reflects this view, yet no large-scale empirical studies have compared the effectiveness of commonly used pay-and-chase litigation to the preemptive regulations like prior authorization now being used extensively throughout the U.S. health care system.

In our forthcoming paper ("Ambulance Taxis," *Journal of Political Economy*, 2024), Paul Eliason, Riley League, Jetson Leder-Luis (BU Questrom), Jimmy Roberts, and I study the unnecessary use of ambulances to transport patients between their homes and dialysis facilities to provide the first empirical evidence that administrative regulations can reduce health care fraud more effectively than relying solely on ex post litigation. Although Medicare reimburses ambulance rides for those with a demonstrated medical need for assistance, unscrupulous companies have exploited a historically lax enforcement of the rules to provide fraudulent rides to ineligible patients, essentially serving as a very expensive taxi service. From 2003 to 2017, Medicare spent $7.7 billion on 37.5 million non-emergency ambulance rides for dialysis.

For our empirical analysis, we use a novel data set of all criminal and civil lawsuits filed against providers accused of ambulance fraud in Medicare's dialysis program over the past two decades combined with Medicare claims data and the staggered rollout of prior authorization across the country to identify the effects of both litigation and regulation on the use of non-emergency ambulance rides, the firms that provide them, patients' access to care, and their resulting health outcomes. We find that prior authorization had a much larger effect on wasteful spending than pursuing lawsuits against fraudulent providers. As shown in Figure 7, adopting prior authorization caused an immediate and persistent drop in non-emergency ambulance rides of 68%, a substantially larger effect than either criminal or civil litigation. When weighed against the associated costs of prior authorization and litigation, our results suggest this type of regulation is a much more efficient way to reduce unnecessary Medicare expenses.

In addition to causing a large drop in the number of non-emergency ambulance rides to dialysis facilities, prior authorization also led to substantial changes in the market for ambulance services. We find that the number of ambulance companies fell sharply in the areas subject to prior authorization, and those that remained

Figure 7: Rides by Prior Authorization Regulation



became more specialized in providing non-emergency dialysis rides, underscoring important mechanisms through which preemptive regulations can reduce fraud. In line with its limited impact on ridership, we find that litigation had a limited effect on the firms not directly prosecuted in the market.

To determine whether the decline in ridership constitutes a reduction in wasteful spending rather than a cut to essential services, we also consider the extent to which prior authorization may have impeded patients' access to care. In this case, the sharp drop in ambulance rides following prior authorization could have made some patients more likely to skip dialysis, increasing their risk of developing serious complications and diminishing their quality of life. Despite this possibility, we find no evidence that the prior authorization disrupted patients' care or led to worse downstream outcomes. We estimate the federal government would have saved $4.8 billion had it started requiring prior authorization in 2003, when our data begin, rather than waiting until 2014 to pilot the program, and would have done so without any negative consequences for patients.

Continuing with this research agenda, we have received funding from Arnold Ventures to study whether price competition from procurement auctions can help reduce health care fraud in addition to its ability to reduce spending overall. The relationship between competition and fraud is not obvious. Competition could dampen the incentives to commit fraud by reducing prices and markups, thereby reducing the potential profits from engaging in illicit activities. On the other hand, competitive pressure could advantage larger firms in ways that allow only fraudulent firms to survive or induce collusion among firms seeking to maintain their previously high margins. Moreover, increased competition on the observable dimensions of price and quantity could prompt firms to shirk on unobservable dimensions instead, a prominent concern in health care where quality can be difficult to assess but has an outsize effect on patients' welfare.

In our preliminary work, we examine the relationship between competition and fraud using the market for durable medical equipment (DME). DME has been plagued by high levels of abuse for years, with rates of improper payments estimated at nearly 20%, due in large part to the highly fragmented nature of the market, where tens of thousands of companies supply thousands of products that range from power mobility devices to oxygen tanks to diabetes test strips. Historically, Medicare procured DME using regulated prices

and had limited oversight of suppliers but has recently piloted a program under which firms compete through procurement auctions to provide DME to beneficiaries. Although past research has found these auctions reduced prices and quantities (Ding et al. 2022, Ji 2023), no studies have yet examined their impact on fraud.

For our empirical analysis, we begin by identifying fraudulent and suspicious firms using hand-collected data on the thousands of DME suppliers that were either subject to anti-fraud enforcement or have connections to prosecuted firms, including common owners, close geographic proximity (e.g., same office building), or high levels of shared referrals from potentially complicit physicians. Our initial findings indicate that, perhaps surprisingly, increased price competition worsened fraud in the DME market. Following the lower prices that arose from procurement auctions, firms that we identify as suspicious increased their market share, seeing smaller reductions in prices and quantities than firms we identify as not suspicious. We then investigate the mechanisms responsible for these results. When faced with greater price competition, firms appear to reduce the quality of their products: fraudulent firms become more willing to shirk on quality, as evidenced by higher repair rates and the reselling of used DME as though it were new.

Private Dialysis Prices Although our work on dialysis has focused primarily on Medicare beneficiaries, a disproportionate share of the industry's revenue comes from private payers due to the Medicare Secondary Payer Act (MSPA). This law, which permits dialysis patients to retain their commercial coverage for 30 months before transitioning onto Medicare, was the focus of a recent Supreme Court ruling that established a path for private payers to reduce their dialysis-related expenditures. The case originated from a suit brought by DaVita that alleged Marietta Memorial Hospital pushed patients onto Medicare by imposing high copays, coinsurance, and deductibles for dialysis, potentially violating the MSPA. A central issue in the case was the high levels of spending for patients enrolled in employer-sponsored health plans and whether DaVita's interpretation of the MSPA would lead to a situation in which these plans no longer covered treatments for kidney failure, effectively forcing enrollees onto Medicare instead. Despite the ongoing policy discussions and corresponding legal debates, little was known about the prices that private insurers actually pay for dialysis before we published two recent studies on the topic.

In the first ("Variability in Prices Paid for Hemodialysis by Employer-Sponsored Insurance in the US from 2012 to 2019," *JAMA Open*, 2022), Riley League, Paul Eliason, Jimmy Roberts, Heather Wong (former Duke Economics pre-doc now an Economics Ph.D. student at Michigan), and I use claims data from the Health Care Cost Institute to provide novel evidence on the prices paid by commercial insurers for dialysis, finding a median of $1,476 per session. At roughly six times Medicare's rate of $240, the markup we document for dialysis is the largest of any health care sector in the U.S. We further show the impact these high prices have on spending overall ("Assessment of Spending for Patients Initiating Dialysis Care," (*JAMA Open*, 2022). We find spending increases from $5,025 to $19,654 for privately insured patients who start dialysis, amounting to an average of $238,126 over the first year compared to $80,509 for those on Medicare.

Private Equity Related to my work on the influence of for-profit dialysis chains, I have recently developed a research agenda studying the effects of private equity (PE) acquisitions of health care providers. Over the past three decades, PE firms have invested hundreds of billions of dollars across the U.S. health care system. Proponents of PE's growing role point to its success at providing access to capital, streamlining operations, and turning around underperforming entities through financial discipline and better management practices. Detractors view PE's emphasis on maximizing returns through cutting costs and negotiating higher payments as inevitably leading to unaffordable and lower quality care.

The rise of PE in health care has coincided with a heightened scrutiny of its influence by academics, policymakers, and politicians. Workshops like the Federal Trade Commission's March 2024 meeting often take a highly critical view of PE, admonishing the entire investment class for a perceived decline in quality following their buyouts of hospitals, nursing homes, and various other providers. My research offers a more measured assessment, however, generally finding equivalent — or in some cases even improved — outcomes after PE obtains an ownership stake, a thesis I outline in a forthcoming *AMA Journal of Ethics* article with Ambar La Forgia (Berkeley Haas) entitled "How Should We Assess Quality of Health Care Services in Organizations Owned by Private Equity Firms?"

My research on PE begins with an assessment of how service lines change following an acquisition. In our first paper ("Private Equity Acquisition and Responsiveness to Service-Line Profitability at Short-Term Acute Care Hospitals," *Health Affairs*, 2021), Marcelo Cerullo (Duke Department of Surgery), Anaeze Offodile II (Memorial Sloan Kettering), Kelly Yang (former Duke Economics Ph.D. student now at Indiana Kelley), Jimmy Roberts, and I find that, relative to non-acquired hospitals, PE acquisitions were associated with a higher probability of adding profitable hospital-based services (e.g., interventional cardiac catheterization), profitable technologies (e.g., robotic surgery), and freestanding or satellite emergency departments. Moreover, PE acquisitions were associated with an increased probability of providing services that were previously categorized as unprofitable but that have more recently become areas of financial opportunity (e.g., mental health). Finally, PE-acquired hospitals were less likely to add or continue services that have unreliable revenue streams or that may face competition from nonprofit hospitals (e.g., outpatient psychiatry).

We then joined with Karen Joynt Maddox (WashU Medicine) to study the association between PE acquisitions of acute-care hospitals and measures of comorbidity, mortality, readmission, length of stay, and spending among Medicare beneficiaries ("Association Between Hospital Private Equity Acquisition and Outcomes of Acute Medical Conditions Among Medicare Beneficiaries," *JAMA Open*, 2022). We find significantly lower inpatient mortality (-1.1 percentage points) and lower 30-day mortality (-1.4 percentage points) among patients admitted with acute myocardial infarction, although PE acquisitions were not associated with significant differences along other dimensions of quality and spending or with differences across other medical conditions. In contrast to a long literature showing that PE acquisitions cause quality to deteriorate, we find most outcomes either improve or do not decline meaningfully at the PE-acquired hospitals in our sample. Because financial performance typically improves at these hospitals post buyout, our findings potentially suggest welfare improved overall, which we outline in our *Harvard Business Review* article "What Happens When Private Equity Firms Buy Hospitals?" Over the next few months, we plan to build on these results by studying the integration of physician groups within hospital systems using funding we received from the National Institute for Health Care Management.

I have also presented these and related findings at the March 2024 FTC workshop on PE in health care and as a keynote speaker at Welsh Carson's Quality Forum in May 2024. To continue this research agenda, I am in the final stages of securing $750,000 of funding from the American Investment Council to acquire data and publish academic studies with Ambar La Forgia, Riley League, and Kelly Yang on topics such as the characteristics associated with PE success and failure in health care and the role of administrative burdens in spurring health care consolidation.

Duke Health Collaborations In addition to my work on private equity with Marcello Cerullo, I have established a number of productive collaborations with other faculty at Duke Health. Lisa McElroy (kidney/pancreas transplant surgeon) and I recently led an analysis of racial disparities in kidney transplant education ("Provision of Transplant Education for Patients Starting Dialysis: Disparities Persist, *Heliyon*, 2024) and have begun a series of related projects with Duke Economics Ph.D. student Xuyang Xia. Karthik Raghunathan (anesthesiologist), Riley League, and I have published several papers on cost-effectiveness and practice patterns related to anesthesia, some with funding from Merck. Chris Behrer (medical student), Henry Eyring (accounting), and I have worked with Intermountain Health and the American Society of Nephrology to obtain data and funding to study the cost-effectiveness of SGLT-2 inhibitors and GLP-1 agonists. Finally, Jay Lusk (family medicine) and I published a commentary in *JAMA* on backstop price caps and recently submitted a grant proposal to the American Heart Association to fund future projects on health policy motivated by my Health Care Markets course, which he took as a Fuqua MBA student in 2021.

1.3 Internet-Based Quality Improvements

I also have a series of papers that consider how technological innovations affect market outcomes, particularly by making higher-quality options available. In addition to the results from "A Business by Any Other Name" related to internet position auctions, I examine the implications of moving other types of transactions to web-based platforms ("The Effect of Social Interaction on Economic Transactions: Evidence from Changes in

Two Retail Formats," *Management Science*, 2015). My work with Avi Goldfarb (Rotman), Sampsa Samila (National University Singapore), and Brian Silverman (Rotman) shows that reducing the amount of social interaction required to make a purchase leads consumers to buy a different mix of products. In this case, we can think of the sales channel itself as a type of quality choice made by the firm, as some customers prefer the anonymity of making purchases online.

Another related quality improvement is the transition from dial-up internet to broadband. In the first of two papers ("The Broadband Bonus: Estimating Broadband Internet's Economic Value," *Telecommunications Policy*, 2011), Shane Greenstein (Harvard Business School) and I provide the first estimates of broadband's incremental contribution to U.S. GDP that (i) calibrate against historical adoption patterns and (ii) incorporate counterfactuals in the spirit of Fogel (1962). We find that for internet-related GDP from 1999 through 2006, broadband accounted for $28 billion of the $39 billion observed in 2006. Of this, households generated $20–$22 billion of broadband revenue, approximately $8.3–$10.6 billion of which would not have been realized in a counterfactual setting with just dial-up internet. Consumer surplus accounted for $4.8–$6.7 billion of this amount, which is not measured in GDP. These estimates differ from existing benchmarks by an order of magnitude and relate to several policy debates; as such, I presented our findings to the Federal Communications Commission in 2009 and our paper continues to be well cited. This project led to follow-on papers commissioned by the Conference Board and the OECD as well as a full-page profile in *The Economist*.

In a second paper ("Evidence of a Modest Price Decline in U.S. Broadband Services," *Information Economics and Policy*, 2011), we extend our analysis by constructing a consumer price index for broadband services in the U.S. To do so, we use over 1,500 service contracts offered by DSL and cable providers from 2004 through 2009. This represents a novel contribution, as no public data for broadband prices were previously available to construct such an index. From our analysis, we find a quality-adjusted price decline ranging from 3% to 10% across the five-year period of our study, which is faster than the BLS estimates for the last three years. The relatively sluggish decrease in broadband prices stands in contrast to the rapidly declining price path of other new technologies as they became more widely adopted, such as digital cameras and microchips.

1.4 Firm Competition and Quality Choice Models

Similar to the structural model we used to analyze the composition of urology groups, I consider how venture capital differs from other markets in terms of competition and specialization, another type of endogenous quality choice ("Specialization and Competition in the Venture Capital Industry," *Review of Industrial Organization*, 2015). In the paper, co-authored with Yael Hochberg (Jones) and Michael Mazzeo (Olin), we use a structural product-choice model adapted from Mazzeo (2002) to show that the impact of competition on venture capital firms' profits is markedly different than in other industries. In particular, our estimates suggest that the incremental effect of additional same-type competitors increases as the number of same-type competitors increases. We further find that the effect of generalist investors on specialists is substantial — and larger than the effect of same-type competitors. We attribute our unique findings to the presence of strong inter-firm co-investment networks, as they often embody cooperative relationships among VC firms that may initially soften the effects of competition.

Also related to this strand of work, Bryan Bollinger (Stern), Ulrich Doraszelski (Wharton), Ken Judd (Stanford) and I develop a dynamic model in which firms decide when and where to enter a growing market ("The Timing and Location of Entry in Growing Markets: Subgame Perfection at Work," *RAND Journal of Economics*, 2024). We add to the empirical IO literature by not pre-specifying the order in which firms enter a market, allowing instead for the roles of leader and follower to be determined endogenously. In the model, we characterize the subgame perfect equilibrium of the dynamic game and show that the times and locations of entry are governed by the threat of preemption. Because each firm has the opportunity to preempt its rival, both firms enter too early, which in turn reduces rents. We show that rent dissipation may be far greater than when firms are assumed to enter the market in a pre-specified order, the assumption made in the existing literature on spatial competition. We verify our model's predictions using data on the entry of restaurants, gas stations, and hotels at interstate exits across the United States.

1.5 Public Policy

In another stream of research, I explore the policy implications of banks offering alternative financial services such as check cashing along with their traditional services. Aaron Sojourner (former classmate at Northwestern now at Upjohn Institute) and I study this topic in our forthcoming paper ("The Need for Speed: Demand, Regulation, and Welfare on the Margin of Alternative Financial Services," *Review of Economics & Statistics*, 2024), where we provide novel evidence on how service fees, travel costs, and check-clearing times affect individuals on the margin between check cashing and the mainstream banking system.[2]

To do so, we use a five-and-a-half year panel of transaction data from a bank that offers both types of services. By merging location, price, and transaction data, we show that check-cashing fees affect demand nearly two and a half times as much as travel costs. We further show that lower-income consumers are less sensitive to these fees, likely because they have less discretion over how they convert checks into cash. Taken together, our findings highlight a tension between regulations that limit check-cashing fees and public initiatives that promote a greater use of mainstream deposit accounts among the 28% of Americans who remain unbanked or underbanked.

As a second contribution, we show that many deposit-account holders willingly pay high fees to accelerate access to their funds, with customers becoming much more likely to cash their checks than deposit them when the wait for their checks to clear through the banking system grows longer: an extra day of check-clearing time makes our bank's account holders 65.5% more likely to choose check cashing over making a deposit. Our estimates imply that the average customer is willing to pay the equivalent of $11.17 per day to speed up access to his or her cash, with lower-income households willing to pay even more. Notably, these estimates are the first in the literature derived from individual choice data — rather than surveys — that show how accelerating access to funds would benefit consumers, helping illuminate the potential impact of the Federal Reserve's recent initiatives to expedite the federal accounts clearing house payment system.

In other policy-related work, Aaron Chatterji (OpenAI and Fuqua), Joowon Kim (former Fuqua Strategy Ph.D. student), and I examine how state legislators' school ties influence state funding for higher education ("School Spirit: Legislator School Ties and State Funding for Higher Education," *Journal of Public Economics*, 2018). We find that states with a larger share of legislators who attended their states' public colleges and universities provide more funding for higher education. Building on this idea, we are currently working with Jorge Guzman (Columbia GSB) and Joyce Ma (Fuqua Strategy Ph.D. student) to explore whether the business backgrounds of state legislators have a similar influence on their votes for specific laws or funding decisions (e.g., whether legislators who previously owned small businesses are more likely to support legislation that benefits small businesses).

2 Teaching

Over the past 15 years, I have taught courses in economics, strategy, and econometrics. At Fuqua, I taught Managerial Economics as a part of the Daytime MBA core courses from 2013 to 2018. The course covers the fundamentals of microeconomics through a mixture of lectures, case discussions, and simulations. While teaching the course, I revamped the material by writing 63 pages of lecture notes, incorporating 23 recent articles for case discussions, and filming 20 videos to guide students' independent studying. These efforts proved successful: (i) my average instructor rating the last time I taught the course was 6.94/7.00, (ii) I won the Daytime MBA teaching award for the course in 2019 and was runner-up in 2015, 2017, and 2020, (iii) I was named a "favorite professor" by *Poets & Quants* for the course in 2015 and 2016, (iv) and I was named a "top-40 under 40 business school professor" by *Poets & Quants* in 2017. I also taught two sections of this course for Fuqua's MMS program in 2017 and then three sections of the course each year from 2022 to 2024, receiving an average instructor rating of 6.87/7.00, the teaching award in 2023, and runner-up in 2024.

[2]This paper was previously R&R at the *Journal of Finance*, but we declined the offer to do so in favor of publishing our work in a top economics journal rather than a field journal.

I was also heavily involved in developing Fuqua's online master's programs. In 2018, I co-developed the Managerial Economics for Health Care course for Fuqua's online health analytics program, and in 2019 I developed an entirely new course, Analysis of Health Care Effectiveness and Outcomes, which focuses on causal inference methods like IV and RDD applied to health care topics. For Fuqua's MSQM:BA program, I adapted my health care causal inference course to cover general business topics (such as advertising and reputation) and taught two courses in 2021. I found that developing and teaching these courses requires a tremendous amount of time and effort, as doing so entails filming and reviewing several hours of lectures along with producing new material suitable for online learning. I received teaching awards for the MSQM:HA program in 2020 and 2021 and for the MSQM:BA program in 2022.

I have also taught a Daytime MBA elective, Health Care Markets, at the insistence of the dean's office. As yet another new prep, I incorporated several innovations into the course. Most notably, I adapted the material from my MSQM:HA causal inference course so we could cover papers from leading economics journals like *AER*, *JPE*, and *QJE* and adequately discuss important topics such as racial and gender disparities in health care. Although this level of rigor proved challenging for most MBA students, I received an average instructor rating of 6.78/7.00 the last time I taught the course in 2021.

Before coming to Fuqua, my primary course at Simon, The Economics of Competitive Strategy, was an MBA elective that covered a broad range of managerial issues. It resembled the core strategy courses of other MBA programs in terms of topics, though perhaps focused more heavily on insights from microeconomics and IO. During my three years teaching the course at Simon, I received an average instructor rating of 4.7/5.0, two Teaching Honor Roll awards, and the Professor of the Year award from the MBA Class of 2012. As a graduate student, I taught a section of Kellogg's core strategy course in their part-time MBA program, receiving an average instructor rating of 9.4/10.0. During a leave from Fuqua in 2022, I taught a version of this course at Booth, receiving an instructor rating of 4.7/5.0 — the highest average rating of any instructor ever teaching the course — and received student comments such as, "Best professor at Booth, worth every penny to borrow from Duke. Without question, absolutely need to be nominated for (additional) teaching awards; comes to class incredibly prepared (memorizing all three hours of material), master of technological implements and teaching aids, and excellent research material/topic relevance" and "Professor McDevitt is a very engaging, thoughtful teacher who engages you to think about your answer in a tactful manner. This is a great strength but also could be a weakness. When students, including myself, answer a question, Professor McDevitt may follow-up the answer and ask another question to dig deeper. While this is great for us to be very thoughtful and understand our own logic, students, myself included, have said they were a bit nervous to speak up in class because they knew they'd be intellectually challenged. Although a visiting professor, Professor McDevitt also used a lot of quantitative materials for what I expected to be a 'fluffier' class. To me, this class epitomized Booth's reputation of intellectual rigor, and while I didn't opt for this class based on professor, I'm so glad I took it with Professor McDevitt."

More recently, I developed courses on microeconomics, strategy, and causal inference for the Health Management Academy's Physician Business Leadership Program, where I have so far taught four cohorts of physicians. Although Senior Associate Dean Purohit declined my offer to develop and teach similar versions of these courses for Fuqua's executive education programs, I would be happy to discuss this possibility again with the dean's office if they have different priorities in the future.

To summarize: in my fourteen years as a business school professor, I have taught five distinct courses across four different programs, winning teaching awards for three of them.

3 Service

I have served my university and the profession in many ways over the past fifteen years. I have been an editor at the *Journal of Industrial Economics* since January 2021, before which I was an associate editor from 2016–2020. I have refereed for numerous journals, including *Econometrica, American Economic Review,*

Quarterly Journal of Economics, Journal of Political Economy, Review of Economic Studies, and *JAMA*. In recognition of my efforts, I received an Excellence in Reviewing award from the *International Journal of Industrial Organization* in 2014.

Since joining the profession, I have strived to make my research more widely known by giving talks at several preeminent departments, organizations, and conferences, including Harvard, MIT, Yale, Northwestern, Booth, Stanford, Wharton, Kellogg, Haas, HBS, Columbia GSB, Penn, Johnson, Ross, Stern, Darden, Anderson, Olin, Penn State, Wisconsin, Simon, Rotman, Kelley, Eccles, the Bureau of Economic Analysis, the Consumer Financial Protection Bureau, the FTC Microeconomics Conference, the NBER IO Winter Meeting, and the NBER Digitization Winter Meeting. During the summer of 2018, I gave invited lectures at the University of Piura and the Shanghai University of Finance and Economics IO Summer School that covered large portions of my research agenda. As mentioned above, I also gave the keynote speech for Welsh Carson's Quality Forum for Private Equity in Health Care in May 2024.

Outside of Duke, I serve as a Research Associate at the National Bureau of Economic Research, a member of the American Society of Nephrology's Excellence in Patient Care Committee, and a faculty mentor for the American Society of Health Economists. I also previously served as an advisory board member for Renalogic.

At Fuqua specifically and Duke more broadly, I have contributed to the school's academic mission in several ways. I am a faculty affiliate of the Duke-Margolis Center for Health Policy; I assisted with faculty recruiting for the Health Sector Management program from 2015–2020 and led faculty recruiting for the Economics Area in 2019; I have — despite the absence of a Ph.D. program in Fuqua's Economics Area — coauthored with or served as a committee member for a number of graduate students, including Paul Eliason (Economics), Ben Heebsh (Economics), Riley League, (Economics), Kelly Yang (Economics), Ming Yi (Economics), Chris Behrer (Economics/Sanford/Medicine), Chelsea Park (Economics), Xuyang Xia (Economics), David Hall (Fuqua Strategy), Todd Hall (Fuqua Strategy), Joowon Kim (Fuqua Strategy), and Chris Calvin (Fuqua Accounting); I was an undergraduate honors thesis advisor for four Duke students; I supervised the independent study projects of 39 MBA students; I mentored Duke student-athletes as a part of Duke Athletes Education for Life; I have served on several Fuqua committees, including the Curriculum Committee and the Strategic Review Committee; I have been elected twice to represent Fuqua on Duke's Academic Council; I have provided feedback on several papers for faculty at Nazarbayev University; and, finally, I have been very involved with the Daytime MBA program through various activities such as judging Deloitte case competitions, teaching dozens of mock classes for prospective students, and selecting winners of the Paired Principles Award.

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