

Research Summary

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Robin S. Lee (robinlee@fas.harvard.edu)

My research primarily focuses on contracting and bargaining between firms in vertical markets characterized by two distinct features: (i) *bilateral oligopoly*, where firms on different “sides” of a market (e.g., upstream and downstream firms) have market power and bargain with one another over input or wholesale prices, investment, or other strategic variables; and (ii) *contracting externalities*, where the “gains from trade” accruing to firms depends on the contracting decisions of others. Although standard economic theory is generally well suited to analyze settings where firms can unilaterally set prices along a supply chain to other firms and consumers, it is less able to provide sharp predictions in these more complicated environments. Yet, the consequences of these negotiations have profound implications in markets that are both diverse and pervasive, ranging from health care, hardware-software, and content distribution industries.

In this research summary, I describe how my research, both past and current, relies on both theoretical models and empirical analysis of data to better understand how particular contracting decisions between firms—notably mergers, integration, and exclusive or selective contracting—affect industry structure, firm profitability, and consumer welfare, and can inform innovation, merger, and competition policy.

I. Theoretical Models of Competition in Vertical and Platform Intermediated Markets

In many industries, consumers adopt, join, or visit an intermediary or *platform* to access goods or services provided by other firms. The resulting intense competition among a small number of platforms to get these firms “onboard” is one particular manifestation of contracting in bilateral oligopoly, and is the subject of two early theoretical papers. The first, ***Competing Platforms*** (*Journal of Economics and Management Strategy*, 2014), examines how strategic contracting between intermediaries or downstream firms in a vertical market can lead to an inefficient market-splitting outcome despite there being strong network effects favoring a single dominant platform; this insight is a potential explanation for standards battles and excessive platform entry. The second, ***Exclusivity and Control*** (with Andrei Hagiu, *Journal of Economics and Management Strategy*, 2011), decomposes the tradeoff faced by an input provider and intermediary platform negotiating over exclusive access: although a firm that joins multiple platforms obtains higher profits by reaching a larger audience, a platform prefers exclusivity as it allows it to charge higher prices to consumers due to increased platform differentiation. If the second effect is larger, the platform can compensate the firm for exclusivity. We show which effect dominates depends on measurable properties of consumer demand and the intensity of competition.

In a policy oriented piece entitled ***Subsidizing Creativity: Zero Pricing and Network Neutrality*** co-authored with Tim Wu (*Journal of Economic Perspectives*, 2009), we note that Internet service providers (ISPs) often serve as a platform through which consumers access online content, and we apply insights from the theoretical literature on two-sided markets and the aforementioned work to argue why aspects of network neutrality, specifically a ban on pricing by ISPs to large content providers, may protect innovation and prevent harmful fragmentation of the Internet.

Although these theoretical models and insights are useful to inform what is possible, they do not provide guidance as to which forces are empirically relevant, and are limited in their ability to make

precise predictions in applied settings. Motivated by a desire to resolve such ambiguities, my later research has relied upon the empirical and econometric analyses of data informed by the institutional details of particular industries.

II. Empirical Studies of Bargaining and Contracting in Vertical Markets and Bilateral Oligopoly

a) Health Care

In the United States, nearly 70% of consumers obtain healthcare coverage either through an employer-sponsored health plan or directly through a private insurance company. A consumer's accessible "network"—the set of doctors and hospitals that the consumer can utilize upon joining a specific health plan—is established by bilateral negotiations between the insurance company and each healthcare provider. In exchange for serving an insurer's patients, each healthcare provider is reimbursed according to a schedule of negotiated rates. These rates determine the majority of the annual \$1 trillion in spending in the private insurance sector (approximately 40% of total national health expenditures) and are projected to continue to grow; yet in general, little is known about their determination.

A series of projects attempts to understand the impact of recent policy and market structure changes in imperfectly competitive health care markets on prices, expenditures, and welfare:

Insurer Competition in Health Care Markets (co-authored with Kate Ho, submitted) is motivated by the desire to better understand how increased insurer competition for patients—potentially induced by the formation of health insurance exchanges or an increase in the variety of employer provided plans—affects the negotiations between these same insurers and hospitals, and subsequently influences premiums charged to consumers in employer sponsored insurance markets. Though increased insurer competition may lead to lower premiums holding fixed input prices (i.e., hospital negotiated rates), it may also lead to higher hospital prices as hospitals are better able to "play" one insurer off another. We estimate a structural model of bilateral bargaining between firms, insurer premium setting, household demand for insurance products, and individual demand for hospitals and use it to simulate the removal of an insurer from consumers' choice sets. Findings indicate that increased insurer competition, though beneficial to consumers, can lead to both increases and decreases in negotiated hospital prices across markets, resulting in a redistribution of rents across health providers.

The Price Effect of Cross-Market Hospital Mergers (co-authored with Leemore Dafny and Kate Ho, in preparation) uses the theoretical model of hospital-insurer bargaining developed in the previous paper to inform how cross-market mergers of hospitals, which are growing increasingly common, can lead to price increases, and uses a new data set of hospital mergers over a 14 year period to estimate sizeable post-merger price effects.

In ***Physician Prices, Hospital Prices and Treatment Choice in Labor and Delivery*** (co-authored with Kyna Fong and Patricia Foo, revise and resubmit), we leverage within provider variation in payments from different insurers across time to identify physician responsiveness to financial incentives in procedure choice, contributing to evidence suggesting that changes to provider reimbursement rates can influence health care utilization.

Finally, a combination of empirics, theory, and simulation is employed in a series of working projects (***Narrow Networks in Managed Care***) to examine how insurer-provider negotiations are affected by the adoption of "narrow" or tiered networks plans, which offer consumers a discounted premium in exchange for access to a smaller set of providers. Using an equilibrium model of network determination, I along with co-authors explore whether these additional contracting instruments can incentivize provider cost efficiency, reduce negotiated prices, and lower premiums for consumers.

Enabling many of these studies is a unique and comprehensive data set acquired in 2012 that comprises seven years of eligibility and claims information for all employees and their dependents of a large California benefits manager, covering over 1M lives; crucially, this dataset contains the negotiated prices that were paid for each observed claim. Additionally, we have obtained yearly detailed hospital and physician provider network data for the employer's HMO and PPO plans, and can isolate year-to-year changes in the set of health providers that employers can access. It is worth noting that no other single purchaser has the same coverage of eligibility and claims data within California, and this breadth and concentration of coverage allows us to believe we can make a significant contribution to the understanding of health insurance markets.

b) Hardware-Software (Home Videogames)

The videogame industry is a canonical hardware-software market, characterized by a small number of hardware (platform) manufacturers and a concentrated market of software developers. During the "sixth-generation" of the industry (2000—2005), there were three main hardware platform providers; one platform had entered a year before the others and subsequently sold nearly double the number of units as its competitors combined. Was the dominant hardware platform's use of exclusive and integrated software anti-competitive, allowing it to unfairly maintain its early advantage?

In ***Vertical Integration and Exclusivity in Platform and Two-Sided Markets*** (*American Economic Review*, 2013), I attempt to answer this question by combining a dynamic model of consumer demand for hardware and software (which measures the benefit a platform receives from exclusive software) with a dynamic model of how software developers choose which platforms to support in order to simulate market outcomes had hardware providers been unable to integrate or acquire exclusive software titles. Whereas previous empirical literature in hardware-software markets often assumes consumers care only about the number of software titles onboard a platform, this paper crucially allows the benefit from each game to differ; given the skewed sales and hit-driven nature of videogames, this flexibility proves integral when identifying the marginal benefit of a single software product to each hardware platform's sales. In specifying a rich consumer demand system for hardware and software products, the paper also highlights the importance of accounting for dynamics (e.g., consumers anticipate future price changes and software releases) and heterogeneity of preferences for gaming.

Results from the exercise indicate that exclusivity and integration may have actually enhanced platform competition and aided the smaller, entrant platforms: without exclusive arrangements, high quality software would typically be released on all consoles; lower quality titles, constrained by the costs of developing for multiple systems, would likely have developed first for the larger incumbent platform due to its larger user base, and only later, if at all, developed a version for the other platforms. As a result, neither entrant platform would have been able to offer consumers any benefit over the incumbent; with exclusivity, however, entrants could create a competitive advantage, and was in fact leveraged by them in reality to gain traction in this networked industry. This suggests that integrated or exclusive software—while perhaps having differential effects on the entry of new software products (as in *U.S. v. Microsoft*)—can foster platform competition.

In ***Home Videogame Platforms*** (a chapter in the *Oxford Handbook of the Digital Economy*, 2012), I also survey recent economic research on the videogame industry and discuss how insights from this work can be used to inform other related questions.

c) Content Distribution (Multichannel Television)

I along with co-authors Greg Crawford, Michael Whinston, and Ali Yurukoglu investigate ***The Welfare Effects of Vertical Integration in the Multichannel Television Market*** (in preparation). Over 110M US households subscribe to a multichannel television operator, and are limited to receiving only channels with which their operator has contracted. We examine the integration of cable or satellite television operators with regional sports networks (RSNs), and examine the effect integration has price, viewership rating, investment, and carriage of each RSN. We comprehensively measure the potential anti-competitive and efficiency enhancing effects of integration through a structural model of viewership, subscription, distributor pricing, bargaining, and investment. Due to a so-called “terrestrial loophole” in FCC legislation, a cable operator could previously exclude rival distributors from carrying an exclusive RSN; leveraging the induced variation in supply of channels across markets, we use our estimated model to analyze the welfare effects of simulated vertical mergers and demergers of content and distribution in this industry.

III. Towards Richer Models of Network Formation and Bargaining in Bilateral Oligopoly

As discussed previously, what links together these disparate industries is the common feature that intermediaries (health insurers, videogame hardware manufacturers, multichannel television operators) negotiate and contract with other firms (software developers, television networks, health providers) for access to their products or services. Due to the complexities of the environment, theoretical models of multilateral bargaining and contracting with externalities are often too stylized or complicated for use in applied work.

Two recent projects of mine are an attempt to move towards tractable models of contracting that are tailored to environments characterized by bilateral oligopoly.

Recent empirical work has begun to adopt the “Nash-in-Nash” solution first proposed in Horn and Wolinsky (1988) as the workhorse bargaining model to determine the division of surplus in such settings. The Nash-in-Nash solution is a set of transfers between all pairs of agents such that each transfer is the solution to a bilateral Nash bargaining problem between each pair (hence, it can be interpreted as the Nash Equilibrium of Nash Bargains). However, as Nash bargaining is a cooperative game theory concept, there is a question of whether or not this solution concept is consistent with a non-cooperative model.

“Nash-in-Nash” Bargaining: A Microfoundation for Applied Work (co-authored with Allan Collard-Wexler and Gautam Gowrisankaran, submitted) answers this question, and provides a non-cooperative representation for the Nash-in-Nash solution. The paper examines a generalization of the Rubinstein (1982) alternating offers bargaining model to a setting with multiple firms. In this model, “upstream” firms simultaneously make bilateral offers to all “downstream” firms in “odd” periods, and downstream firms simultaneously make offers to upstream firms in “even” periods; any offer that is accepted ends the bargaining between a given bilateral pair. We provide necessary and sufficient conditions under which there exists an equilibrium of this game that generates the Nash-in-Nash solution, and provide stronger sufficient conditions under which the equilibrium outcome is unique; importantly, we allow firms to engage in multilateral deviations across multiple bargains, and do not restrict attention to stationary strategies. The paper provides conditions under which this bargaining solution may be appropriate and reasonable for use in applied work.

Another limitation of many bargaining models is that they often implicitly assume outside options are static, and that upon any bilateral disagreement, firms do not respond by re-contracting or adjusting their networks. Crucially, many papers also do not provide guidance as to which networks will form in

equilibrium, focusing instead only on surplus division *within* a given network. To address these concerns, ***Markov Perfect Network Formation: An Applied Framework for Bilateral Oligopoly and Bargaining in Buyer-Seller Networks*** (with Kyna Fong, revise and resubmit) provides a framework that can be taken to data and used to analyze these and other similarly structured industries. Importantly, the model in the paper informs both which firms contract with one another and also how input prices and negotiated rates are determined; the model also allows each firm's contracting partners to change over time—reflecting real world bargaining disputes, breakdowns, and changes to provider networks—and for each firm to anticipate these future changes when contracting and bargaining. We also demonstrate how this framework can help inform merger policy by examining hospital mergers in simulated health insurance markets; we show that accounting for subsequent network and rate changes is crucial to predicting the potential consequences of any merger, and that hospital mergers can actually be welfare enhancing for consumers even without any realized cost savings.

Given network formation—or the creation of relationships, trading partnerships, and links—is a general phenomenon underlying many areas of economic exchange and interaction, the wider applicability of the framework to other industries where similar questions arise seems promising and is the subject of future work.

IV. Other Papers

The theory of two-sided matching generally assumes that agents know their true preferences over potential partners prior to engaging in a match. However, in many matching markets, information acquisition plays an important role with costly interviews, dates, and meeting. Since these interviews affect the formation of preferences, their assignment can crucially affect the outcome of the eventual matching process. In ***Interviewing in Two-Sided Matching Markets*** (with Michael Schwarz, revise and resubmit), we generalize the one-to-one matching model of Gale Shapley (1962) to include a prior stage in which firms first choose a subset of workers to interview; we show that even if two equilibria involve the same number of interviews for all firms and workers, outcomes can be substantively different: the number of agents that remain unmatched depends not only on the number of interviews that each agent receives but also on the number of common interviewing partners among agents. We introduce the concept of *overlap* that captures this notion, and prove the probability of being matched is maximized with something we call *perfect overlap*.

In ***Multiple Equilibria and Selection by Learning in an Applied Setting*** (with Ariel Pakes, *Economic Letters*, 2009), we explore the use of learning algorithms to inform counterfactual analysis in the presence of multiple equilibria. We focus on the counterfactual reallocation of ATMs among banks following a hypothetical merger accompanied by an unexpected cost shock, and show: (i) simple enumeration of all potential equilibria is informative as the number of total equilibria is small compared to the number of potential allocations, and (ii) there may be a distribution of predicted equilibria given the variance of cost shocks, and this distribution has a notable dependence on both the cost specification and on the learning process. Thus, in order to use learning algorithms as a means of informing equilibrium selection, it would be helpful to obtain evidence on which processes are more relevant or likely in particular environments.

References

Except for preliminary work, all papers are available at <http://www.robinslee.com/>

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