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Bargaining in Healthcare Markets: Applications of Nash-in-Nash and Extensions

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Many prices in healthcare are determined in business-to-business negotiations. Private, self-insured employers negotiate with private insurers over insurance plan characteristics and prices. Insurers in turn negotiate with healthcare providers and pharmaceutical manufacturers/distributors over prices for the goods and services used in providing care. Providers themselves negotiate with suppliers of the medical devices they use to provide services. Combined with the rich data that has become available to healthcare researchers, this has led to a growing body of empirical research on bargaining in healthcare markets, particularly in the development of structural models of bargaining that researchers can estimate

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from data and use to consider counterfactual policies. In this chapter, we review these models and their importance for healthcare and bargaining research more broadly. We also discuss other studies that provide the foundation for this literature or that inform the directions in which this literature could mature in order to better capture bargaining scenarios important to healthcare policy and economics more broadly.

12.1 Bargaining in Healthcare, Upstream, and Downstream

Health economists have for some time analyzed the ex-ante willingness-to-pay for adding a player to an economic exchange—variously referred to as a player's "marginal contribution" or "added value" or "gains from trade"—a fundamental building block to most economic models of bargaining. Pioneering work in Town and Vistnes [65] and Capps et al. [3] characterized healthcare as an *option demand* market, in which intermediaries offer a network of upstream suppliers to downstream consumers, and these networks are valued by consumers' ex-ante willingness-to-pay for expected future treatment needs. Ho [35, 36] connected these ideas to their current use, estimating detailed demand models for hospitals, and then estimating an explicit bargaining game.

To fix ideas, consider the following model. For a trading network $\mathcal{G}$, define the gains for a hospital h trading with partner j (here the model is sufficiently abstract for j to be, for example, an upstream input supplier or a downstream insurer):

$$GFT_{hj}^{H} := \pi_h^H(\mathcal{G}, \{p_{hj}, \mathbf{p_{-hj}}\}, \phi) - \pi_h^H(\mathcal{G} \setminus hj, \mathbf{p_{-hj}}, \phi) \quad (12.1)$$

where p_{hj} denotes the price negotiated between the focal parties, and $\mathbf{p_{-hj}}$ is the vector of prices negotiated by other trading pairs in $\mathcal{G}$. ϕ is a vector of demand and supply parameters governing production, consumption, and bargaining. π_h^H is a functional that maps these primitives ϕ and equilibrium objects $(\mathcal{G}, \mathbf{p})$ into ex-ante expected hospital surplus. Similarly, define gains from trade to partner j trading with the hospital, GFT_{hj}^{J}, by replacing π_h^H with π_j^J in (12.1).

After Ho [36], a series of empirical applications of bargaining in healthcare markets were relatively direct adaptations of the Crawford and Yurukoglu [8] empirical specification of the Horn and Wolinsky [40] "Nash-in-Nash" (NiN) bargaining model. The Grennan [27] study of hospitals bargaining with their suppliers and the Gowrisankaran et al. [25] study of hospitals bargaining with insurers contributed to this new methodology by clarifying the ways in which the model could be identified and estimated. The NiN model specifies that each buyer-supplier pair reaches a solution that maximizes its pairwise Nash Product, and no pair wants to renegotiate, taking the prices negotiated by the other pairs as given, solving:

$$\max_{p_{hj}} \left[GFT^J_{hj}\right]^{\phi^B_j(h)} \left[GFT^H_{hj}\right]^{\phi^B_h(j)} \forall hj \in \mathcal{G} \tag{12.2}$$

where the parameter $\phi^B_j(h) \geq 0$ represents the bargaining ability of player j negotiating with player h.

This model extends the well-known Nash-Bertrand Equilibrium (NBE) in prices with differentiated substitutes. To see this, consider a case where hospital h procures differentiated medical devices $j \in \mathcal{J}$ used in a particular surgical procedure (e.g., prosthetic knee implants). In this case, the network is the set of the device manufacturers paired with the hospital, $\mathcal{G} = \mathcal{J} \times h$. Further, assume that the quantity sold to this hospital is small relative to any fixed costs of production or distribution, so that $GFT^J_{hj} := \pi^J_j(\mathcal{G}, \{p_{hj}, \mathbf{p_{-hj}}\}, \phi) - \pi^J_j(\mathcal{G}\setminus hj, \mathbf{p_{-hj}}, \phi) = q_{hj}(p_{hj} - mc_{hj}) - 0$. Then we can solve for the pricing equation implied by the first-order conditions of this maximization problem:

$$p_{hj} = mc_{hj} + \frac{\phi^B_j(h)}{\phi^B_j(h) + \phi^B_h(j)} \left[\left(1 + \frac{\partial q_{hj}}{\partial p_{hj}} \frac{p_{hj} - mc_{hj}}{q_{hj}}\right) \frac{GFT^H_{hj}}{q_{hj}} + \frac{GFT^J_{hj}}{q_{hj}} \right]. \tag{12.3}$$

Here the markup of the supplier is a function of the total bilateral gains from trade, the demand elasticity, and the ratio of the supplier bargaining ability relative to that of the hospital $\frac{\phi_j^B(h)}{\phi_j^B(h)+\phi_h^B(j)} \in [0, 1]$. When this ratio is zero, $p_{hj} = mc_{hj}$. When this ratio is one, the equation reduces to the first-order condition for NBE where the manufacturer sets price, $\frac{\partial q_{hj}}{\partial p_{hj}} \frac{p_{hj} - mc_{hj}}{q_{hj}} = -1$.

The elasticity term measures how the total gains from trade shrink as equilibrium quantities respond to a price increase. In studies such as Grennan [27, 28] where physicians are not very price sensitive in their usage of medical devices, it plays a relatively small role.[1] However, elasticities are central in other contexts. For example, Brown [2] studies how New Hampshire's price transparency initiative affects equilibrium prices and quantities for medical imaging services. Transparency makes some consumers more price elastic as they gain information on prices and switch to cheaper providers. This increased elasticity then decreases the gains from trade generated by providers, lowering all prices in equilibrium.

Thus when prices are negotiated, they will be a function of elasticities (as they are when suppliers post prices), but they will also be a function of gains from trade and bargaining ability parameters. Bargaining abilities provide a new source of supply shifters when estimating demand, and a new parameter that may change under counterfactual analysis [27]. Gains from trade depend on the availability of close economic substitutes, and thus are related to market structure (and changes to market structure, such as mergers) in a manner that goes beyond standard cross-elasticity analyses. These three components: elasticities, gains from trade, and bargaining abilities represent the basic channels determining negotiated prices in this literature.

[1] This highlights one reason why bargaining models have been important in healthcare: NBE often implies unreasonably large markups when end users are insensitive to price [25, 27].

12.1.1 Applications to Buyer Power: Purchasing of Medical Devices, Pharmaceuticals, and Hospital Care

The conventional wisdom that "bigger is better" in business-to-business negotiations pervades the policy discussion on topics ranging from insurer mergers to hospital mergers to group purchasing organizations and whether or not the government should negotiate drug prices. For example, this notion has led U.S. policymakers to advocate for more centralized procurement of healthcare products and services by federal and state governments [43], rather than decentralized bilateral bargaining as is the norm.

In spite of conventional wisdom, a "buyer size advantage" is not a given in the economics literature. In a fairly general class of models, larger buyer firms may obtain better prices if and only if the supplier's surplus function is concave (e.g., Chipty and Snyder [5]). However, size may also be associated with differences in bargaining abilities if, for example, larger firms are better managed.[2] Moreover, mechanisms that lead to lower input prices may not improve welfare [4, 33].[3] The impact of these mechanisms may further depend on details such as geography or supplier market structure.[4]

These ambiguities and the multiplicity of mechanisms laid out in theory have prompted a move toward empirical studies. The empirical literature on the effects of buyer power in healthcare has focused on purchasing of healthcare production inputs, drugs, and hospital care.

One strain of the literature focuses on hospital mergers and costs. Hospital systems have consolidated substantially in recent decades [11]. A typical justification for these horizontal mergers is their potential to generate cost synergies. Much of the literature on the effects of

[2] Bloom et al. [1] find that larger hospitals have better management practices.

[3] For example, a merger downstream could lead to decreased innovation or product variety upstream [41].

[4] Geographic proximity may be a success factor for mergers (a common contributor to buyer size increases), economies of scale in supplier distribution, or otherwise. Larger buyers may spur competition among multiple suppliers. These competition effects may be mediated by buyers' demand commitments [12, 41], by suppliers' own tacit collusion [59, 60], or by the presence of transaction costs [22, 48].

hospital mergers on costs has focused on overall hospital costs [14, 56] and on labor costs [10, 54]. This literature generally finds that horizontal hospital mergers lead to cost reductions for at least some types of combinations. However, attributing these findings to changes in bilateral bargaining between hospitals and suppliers presents several difficulties. As noted in Gaynor and Town [23], cost data are usually limited to Medicare Cost Reports and state financial data, which "are not easily adjusted for changes in patient severity, and are subject to the vagaries of accounting methodologies."

One study that explicitly examines the effects of hospital mergers on bilateral bargaining, accounting for composition, is Craig et al. [7], which uses detailed data on hospital supply purchase orders issued by a sample of U.S. hospitals from 2009 to 2015. The authors find that, for a fixed basket of top hospital supply categories, the average merger target saved 1.9%, while the average acquirer achieved no savings. Heterogeneity in effect estimates was consistent with mergers inducing a small increase in hospital buyer power that is (1) driven by local returns to scale, and (2) more influential for merger targets than for acquirers. There was little evidence that savings, where they exist, are mediated by supplier market structure.

Several studies have examined the effects of strong purchasers on drug prices. A key finding in this literature is that buyers' ability to credibly exclude suppliers can be as important, or even more important, than buyer size. Duggan and Scott Morton [18] estimate that drug "formularies," which give insurance plans a mechanism to exclude suppliers, were crucial in restraining drug costs during the early rollout of Medicare Part D, the federal prescription drug benefit for the elderly in the U.S. They find that Part D led to a substantial relative decline in branded pharmaceutical prices, but only in drug classes where exclusion was statutorily allowed *and* where multiple substitutes were available on the market.

The importance of upstream competition for leveraging buyer power is echoed by other studies of drug pricing. Ellison and Snyder [19] find that large purchasers (chain drugstores) extract lower antibiotic prices from manufacturers than small purchasers (independents), but only for drugs with multiple competitors. Lakdawalla and Yin [42] find that exogenous increases in enrollment enable insurers to negotiate lower drug prices with pharmacies, but these buyer size discounts were smaller in drug classes where manufacturers extracted monopoly rents and left little surplus for insurers and pharmacies to divide. Looking across low- and middle-income countries, Dubois et al. [16] find that centralized procurement is associated with large discounts relative to decentralized procurement, and the discounts vanish when the drug is supplied by a monopolist.

The interaction between buyer size and supplier competition has also been emphasized in the literature on insurer-hospital bargaining. Staten et al. [64] argue that insurer size alone does not confer the power to extract price concessions from hospitals. In order to extract discounts, an insurer must also be able to credibly threaten to send its enrollees elsewhere, and such threats are undermined by patient loyalty to hospitals. Ho and Lee [37] provide a framework for exploring these forces. In their model, managed care organizations (MCOs) with market power compete for enrollees *and* negotiate with hospitals over the prices of hospital services. MCOs can threaten to exclude hospitals from their network. Household premiums are set via bargaining between employers and MCOs. Subsequent to these negotiations, households enroll with MCOs as a function of their premiums and provider networks, experience healthcare needs, and choose hospitals for treatment. The authors estimate this upstream-downstream bargaining model using detailed data on prices, premiums, enrollment, and hospital admissions for public employees in California.

In this model, equilibrium prices in a given MCO-hospital negotiation are a function of several forces that map the above notions of "hospital and insurer loyalty." For example, if dropping the hospital from the MCO's network leads to a large drop in enrollment, then the hospital can command a higher price. Similarly, prices will be increasing in a recapture effect, which represents the profits that a hospital will obtain if loyal enrollees re-sort into other MCOs when the hospital is excluded from the current MCO's network.

The Ho and Lee [37] results present nuanced evidence on buyer power in healthcare markets. First, in an option demand setting where employers negotiate premiums, removing an MCO can lead to positive *or* negative effects on remaining MCOs' premiums. Second, these premium effects can counteract or reinforce the remaining MCOs' increased market power with respect to hospitals, with ambiguous implications for hospital prices on net. Finally, premium and price effects are quite heterogeneous across markets, though consumer welfare always decreases when an MCO is removed, due to reduced product variety.

12.1.2 Applications to Supplier Market Power: Mergers and Hospital-Insurer Bargaining

Bargaining has been especially influential in the realm of antitrust, particularly in the analysis of horizontal mergers and market power. For example, the Federal Trade Commission's standard model for evaluating hospital mergers is a bargaining model [20]. In recent cases, court opinions have relied heavily on bargaining theory [50].

Gowrisankaran et al. [25] estimate a bargaining model of competition between hospitals and MCOs and use the estimates to evaluate the effects of hospital mergers. They find that MCO bargaining restrains hospital prices significantly. In a counterfactual analysis, they find that a proposed hospital acquisition in Northern Virginia would have significantly raised hospital prices, and remedies based on separate bargaining would not alleviate the price increases.

Gowrisankaran et al. [25] hold bargaining parameters fixed in their merger simulations, so price effects are driven by the impact of the merger on gains from trade (and internalization of cross-elasticities). In a model that estimates bargaining ability parameters, Lewis and Pflum [44] find that more of the observed price gap between system and non-system hospitals can be attributed to bargaining parameter differences than to differences in gains from trade driven by local market concentration.

The result that bargaining power parameters explain a substantial portion of the variation in prices is a recurring phenomenon in this literature. As these parameters are in part residuals, they could in principle capture many unmodeled phenomena internal (including firm organizational structure, information, incentives, management, and leadership) or external to the firm (including exclusionary contracting, quantity-based contracting, or other unmodeled features of the full vertical supply chain or contract space). Much of the subsequent literature has sought to increase the scope of the models and data in order to capture these elements of various bargaining scenarios in healthcare. A large part of the rest of the chapter discusses these extensions and related work.

12.2 Modeling Network Formation

Real world trading networks in business-to-business markets are rarely exogenously determined or costless to form (and reform). As in other contexts, these factors can lead to selection in who contracts with whom, potentially affecting demand and supply estimation. They can also change the outside options in negotiations relative to the “frictionless” NiN models we have discussed thus far. These are potentially important issues in considering how insurers construct their provider networks and how hospitals construct their supplier networks. New research is making strides toward quantifying the magnitudes of these issues.

12.2.1 Strategic Exclusion

The discussion in the previous sections focused on how buyers and sellers split their gains from trade, holding all other agreements fixed. The model assumes that all agreements involving positive gains from trade will be made in equilibrium. Exclusion is an off-equilibrium threat.

Contrary to this notion, exclusion is an increasingly pervasive phenomenon in healthcare markets. For example, insurers form restrictive formularies, pharmacy networks, and provider networks [31, 49, 52, 62]. Several theories of bargaining provide useful intuition as to what might be happening. Gal-Or [21] presents a stylized bargaining model in which insurers can reduce hospital prices in “exclusionary” contracts in which each insurer forecloses all but one hospital. However, if horizontal differentiation between hospitals is sufficiently large, and when the likelihood of becoming sick is sufficiently high, the only equilibrium that can arise is non-exclusionary. In a similar vein, Dana [12] and Inderst and Shaffer [41] present models in which a merged buyer’s bargaining advantage is mediated by buyers' demand commitments. The welfare implications of such demand commitments are complex. Some buyers will consume their less preferred product, but benefit on net from lower prices. In the healthcare context, similar tradeoffs precipitated the managed care backlash of the 1990s [32], as well as conflicts between physicians and hospitals regarding hospital attempts to sole-source medical devices [51].

A substantial body of reduced form empirical evidence supports the notion that exclusion can reduce insurer spending via price reductions. For example, many state Medicaid programs, which provide health insurance to low-income consumers, have been shown to successfully leverage restrictive formularies to lower retail drug expenditures [13, 26, 49]. In a similar vein, Sorensen [61] showed that the ability of Connecticut MCOs to channel enrollees to hospitals (i.e., their demand commitments) was a far more important determinant of negotiated hospital prices than MCO size.

Only very recently, a structural empirical literature has emerged that models equilibrium exclusion and demand commitments that provide buyers additional leverage to reduce negotiated prices. For example, Ho and Lee [38] propose the "Nash-in-Nash with Threat of Replacement" model (NiNTR), in which buyers can threaten to replace suppliers with viable alternative suppliers that are outside the network. The NiNTR solution looks similar to NiN, but with the additional requirement that insurer j will never pay hospital h more than its outside option of dropping h from the network and adding the best non-contracted alternative hospital k to the network (at k's reservation price). They also define a stability condition for NiNTR prices to be an equilibrium: a given network $\mathcal{G}$ is stable at NiNTR prices if, and only if, the network does not exclude any hospital that generates higher bilateral surplus with the insurer than any included hospital.

In order to make this intuition concrete, Ho and Lee [38] use the data and parameters from Ho and Lee [37] to simulate the counterfactual premium, price, and welfare effects of one insurer offering a restrictive hospital network. They estimate that, with a narrow network, the insurer would have been able to negotiate steep discounts. On average, consumers would benefit from the narrow network, as the resulting decrease in premiums would offset the consumer surplus loss of having access to fewer hospitals. However, consumer surplus varies widely: some consumers, such as those living close to excluded hospitals, would experience significant harm.

Ghili [24] and Liebman [45] propose alternative extensions of the Nash-in-Nash framework to accommodate equilibrium exclusion. Like Ho and Lee [38], Ghili [24] allows an insurer to threaten to replace any contracted hospital in its network with one outside its network. To rationalize observed variation across plans in network breadth, he assumes that different plans have different "economies of scale," captured by fixed costs of including additional hospitals in network. Liebman [45] proposes a different model, in which insurers commit to network size in an initial stage of the game. Prices are then determined as the result of an alternating offers bargaining game between all hospitals and insurers, where upon disagreement in bargaining for a given insurer-hospital pair, a replacement hospital may be randomly chosen.

12.2.1.1 Selection on networks

Shepard [58] focuses on how exclusion interacts with patient selection. A large theoretical and empirical literature suggests that more generous insurance plans will attract more costly enrollees. If insurers are not perfectly able to adjust premiums as a function of enrollees' risk, then costly enrollees will be less profitable to insurers.[5] This study focuses on a key aspect of plan generosity that interacts with insurer-hospital bargaining: whether plans cover the best-regarded academic (or "star") hospitals. Using rich data on claims and plan choices from Massachusetts' health insurance marketplace for low-income individuals, CommCare, Shepard [58] shows that consumers with a pre-existing attachment to star hospitals in Massachusetts are both very costly to insure and also far more likely to choose a plan covering star hospitals.

[5] "Risk adjustment" is a tool regulators use to limit insurers' incentive to seek low-risk enrollees. Risk adjustment works by measuring medical risk factors (e.g., age and diagnoses) and compensating plans that attract observably sicker people.

This form of selection provides a strong inducement for plans to drop star hospitals from their networks.

12.2.1.2 Quality regulation

A natural concern is that welfare is harmed when intermediary firms exclude suppliers. This might be particularly problematic in the healthcare setting, where excluding a high-quality provider or product may be a life-or-death matter and consumers may be insufficiently informed about tradeoffs. For example, Gruber and McKnight [31] find that the marginal enrollee in limited provider network plans does not simply avoid high-cost providers: she consumes less healthcare services overall.

The health economics literature has pursued this issue in a few different ways. Some papers have used structural model estimates to evaluate the effects of policy interventions that regulate network size. E.g., Ghili [24] and Liebman [45] study the effects of "network adequacy" rules that require minimum levels of coverage of local providers, finding that such standards would increase hospital prices and, perhaps, insurer premiums. Shepard [58] uses his structural estimates to evaluate the welfare effects of a targeted subsidy for plans that cover star hospitals. He finds that these policies would decrease welfare, as they would entail healthcare cost increases exceeding the increase in consumers' value for the hospitals.

In some instances, whether due to binding regulations or due to more informal pressures from healthcare suppliers or consumers, buyer firms opt not to fully exclude suppliers and instead rely on *partial* exclusion for leverage in bargaining. Starc and Swanson [62] consider the Medicare Part D context, in which plans are prohibited from excluding many retail pharmacies. Recently, many Part D plans have established restrictive "preferred pharmacy networks," where preferred status means reduced out-of-pocket costs to enrollees. In order for partial exclusion to result in a demand commitment, enrollees must respond to reduced out-of-pocket costs by frequenting preferred pharmacies. Starc and Swanson [62] show that: adoption of preferred networks is associated with selection of low-cost enrollees, consistent with Shepard

[58]; enrollees respond significantly to pharmacy "preferred status"; and preferred-network plans negotiate lower prices for drugs, with no effect on consumer access.[6] Unsurprisingly, the effects of preferred pharmacy networks disappear in plans that cover primarily subsidized beneficiaries who face low out-of-pocket prices no matter the pharmacy.

12.2.2 Frictions in network formation

The Ghili [24] study mentioned above rationalizes exclusion via fixed costs of adding and maintaining a buyer-supplier relationship. These costs can make it optimal to form a trading network that is smaller than the full network, and thus provide insurers a credible threat to replace an in-network hospital with an out-of-network one. To address the potential computational challenges involved in estimating a model with a large number of potential network configurations by, the paper uses a moment inequalities estimator derived from stability conditions on the observed networks in order to estimate the fixed costs of contracting. Applied to a health insurance market in Massachusetts, Ghili's estimated model finds that fixed costs of network formation add up to approximately one-third of insurer profits.

12.3 New Directions: Contracts, Organizations, and Information

Many of the models and applications discussed thus far have explicitly or implicitly assumed that the contracting parties have full information about all model parameters, for themselves and all parties who could potentially be included in the trading network. The contracting space is typically limited to linear prices, exchanged bilaterally, that only impact each other via their impact on equilibrium quantities. The players themselves are abstract entities, reducing complex and heterogeneously

[6] Similar "steering" effects are examined in the case of tiered hospital networks in Prager [53] and vertically integrated insurer-hospitals in Cuesta et al. [9].

skilled and motivated people and organizations down to a few parameters. Though these simplifying assumptions may be good approximations to reality in some contexts, in other cases they may miss important features of the market. Recent research has made progress toward better understanding and/or loosening these restrictions, but there are many opportunities for important contributions.

12.3.1 Enhancing the Contracting Space

Contracts in healthcare can be complex, and sometimes that complexity is critical for understanding equilibrium outcomes. An important example in drug procurement has been most-favored-nation (MFN) clauses or other types of "reference pricing" where the outcomes of prices negotiated in other agreements enter the negotiation directly through the contract stipulations, not only via their effects on demand. Scott Morton [57] and Duggan and Scott Morton [17] demonstrate these effects in studies of the U.S. Federal Government's introduction of an MFN clause on pharmaceutical prices supplied to Medicaid in the 1990s. Firms had to provide drugs to Medicaid at their lowest price. However, the rule resulted in higher prices to some non-Medicaid drug consumers.

More recently, a few papers have structurally modeled and estimated the impact of reference pricing on equilibrium prices, quantities, and entry patterns. Dubois et al. [15] consider the effects of a hypothetical U.S. reference pricing policy that would cap prices in U.S. markets by those offered in Canada. Counterfactuals based on their estimated model predict modest consumer welfare gains in the U.S., substantial consumer welfare losses in Canada, and an increase in overall pharmaceutical profits. Maini and Pammolli [47] also study the issue of reference pricing for pharmaceuticals, focusing on how reference pricing policies affect drug entry timing across countries within the EU. While they abstract from modeling the bargaining process underlying their pricing policy function, they consider both the direct externality imposed by reference pricing, and also the indirect externalities imposed on choice sets due to strategic entry delays (which are an optimal response to the reference pricing).

Another important feature of insurer-provider contracting is the desire to induce multiple providers to jointly balance the overall health benefits and financial costs of the care they provide. This desire has motivated both public and private payers in the U.S. to establish provider contracts with financial rewards/penalties based on *all* costs and consequences for a defined set of patients or episode of care (e.g., "Accountable Care Organizations" and "Comprehensive Care for Joint Replacement"). These efforts may be important in contexts where narrowly focused contracts have unintended consequences. For example, the literature on drug formularies in state Medicaid programs [13, 26, 49] finds that restrictive formularies may result in offsetting increases in other healthcare expenditures because drugs and other healthcare products and services are substitutes in the production of health. This may impose an externality on health insurance programs [63]. Further, Cooper et al. [6] show that many hospitals are staffed by specialists like emergency physicians, radiologists, and anesthesiologists that cannot be easily avoided by patients admitted at the hospitals where they practice. The result is that such specialists, even those staffed at in-network hospitals, can opt out of insurers' *physician* networks and charge inflated prices without sacrificing demand, and this lucrative outside option enables them to command high in network prices.

12.3.2 Asymmetric Information Bargaining

There is currently no standard approach for introducing asymmetric information explicitly to the Nash-in-Nash framework. This is unfortunate as much of the debate regarding transparency in healthcare hypothesizes about how such information may directly affect the bargaining problems between hospitals and insurers [34] or hospitals and device manufacturers [46].

Grennan and Swanson [29] study the latter context by examining what happens when hospitals obtain access to "benchmarking" data on the prices other hospitals pay for the same medical devices. They find that savings from access to this information are largest for physician preference devices, where high-price, high-quantity hospital-brand combinations average 3.9% savings, versus 1.6% for commodities.

The paper offers two theoretical models that could explain these savings: an asymmetric information bargaining model where hospitals are uncertain about manufacturers' bargaining parameters [55], and a model where bargaining parameters represent the outcome of an agency problem between hospital owners and the administrators who negotiate prices, so that benchmarking data allows owners to better monitor administrator effort [39]. They find evidence for both, but stronger evidence for the model of asymmetric information about bargaining parameters. They also model a role for externalities: transparency might discourage suppliers from agreeing to low prices with any buyer because that price can then become information that other buyers will use against the supplier, but they don't find empirical evidence of this effect.

12.4 Discussion: Progress and Opportunities for Bargaining in Healthcare and Beyond

The healthcare sector is one where most prices are set via business-to-business negotiations, and thus many important policy questions depend on bargaining outcomes across buyer-supplier networks. Because the healthcare setting has recently provided researchers with relatively rich data to model and estimate the surplus creation and division process, it has been at the forefront of much of the recent literature on empirical studies of bargaining. In many regards this literature has experienced a great deal of success in that the tools and approaches have quickly become influential, in particular with regard to antitrust in hospital and insurer markets.

However, the empirical bargaining literature (in healthcare and more broadly) is still young, and there are many challenges to tackle before researchers will have a toolkit that allows them to model the many interesting and important research questions that remain. There are currently very few structural papers that go beyond Nash-in-Nash to incorporate the phenomena documented in Sects. 12.1.1 and 12.2. Work that improves tractability (e.g., allowing endogenous network formation for counterfactuals with a high-dimensional player space, or incorporating externalities in structural models of bargaining under asymmetric information) or sheds further light on the importance and validity of modeling assumptions (e.g., fixed costs of adding a trading partner) would be a strong contribution.

Even less well-understood are the formal and informal contracts that exist between and within healthcare suppliers, or how those contracts may be disrupted in counterfactual scenarios. First, hospital surplus is to a great extent governed by physicians who recommend hospitals for inpatient and outpatient care and choose medical device brands (which are paid for by hospitals) to use in procedures.[7] Historically, physicians and hospitals were financially and organizationally distinct co-producers of care with strong informal ties and explicit prohibition of "kickback" arrangements, but recent decades have seen growth in hospital ownership of physician practices and gainsharing. The literature (and policymakers) have not yet grappled with the contracting relationships between physicians and hospitals as co-producers of care.

Second, the bargaining parameters estimated in the Nash-in-Nash framework are often an empirically important but not well understood "residual" in the sense that they will tend to absorb any modeling or measurement error in the relationship between gains from trade and prices. Empirically, bargaining parameters capture the relative weight put on buyer and supplier surplus necessary to explain price variation as a function of added value variation. Theoretically, they are often modeled as discount factors in a multi-stage bargaining game. In the real world, they may proxy for a host of factors—impatience, opportunity costs of time, laziness, fear of negotiation breakdown—that will depend on leadership, management, and incentives within firms. Work that advances our understanding of what real-world factors bargaining

[7] Relatedly, physician relationships with medical device and pharmaceutical manufacturers may impact both hospital/insurer ability to credibly exclude those manufacturers' products and researchers' ability to use choice patterns to infer consumer welfare [30].

parameters capture, perhaps involving new ways of incorporating those factors into surplus calculations, would be tremendously beneficial.

We anticipate that the ubiquity of bargaining, the welfare at stake, and the large amounts of detailed data available to researchers will continue to make healthcare applications important for empirical bargaining research in the future.

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