Bargaining in Hospital Merger Models

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Abstract

Hospital prices for commercially-insured patients are generally set through bilateral negotiations with health insurance companies. Reflecting common industry practice, contemporary models of hospital/health insurer bargaining usually assume that multi-hospital systems bargain on an all-or-nothing basis. However, hospitals within systems may bargain separately, and a commitment to do so is sometimes put forward as a remedy for an otherwise anticompetitive merger. We analyze and compare the merger-induced changes in equilibrium prices in a Nash Bargaining framework under these two modes of bargaining. We show that, while the magnitude of price effects under either mode depends critically on the degree of pre-merger competition, the relative magnitude is ambiguous. We also consider the issue of mergers involving “must-have” hospitals, which we define as hospitals whose absence from an insurer’s network would reduce its appeal to such an extent that the insurer could no longer profitably offer it. We examine how the effects of mergers that create a “must-have” system, or that involve an existing “must-have” system, differ from mergers that do not.1

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1The views expressed in this article are those of the authors and do not necessarily reflect those of the Federal Trade Commission.”
1 Introduction

Hospital prices for commercially-insured patients are generally determined through bilateral bargaining between hospitals and managed care organizations (MCOs). For this reason, recent models of hospital competition are based on bargaining frameworks. Fundamentally, the principles of merger analysis when prices are set through bargaining between buyers and sellers are the same as when prices are posted by sellers on a take-it-or-leave-it basis: merger effects will be larger when the merging hospitals are closer substitutes for each other and when there are fewer proximate alternatives for the merging hospitals. However, there are some phenomena that are unique to bargaining environments. In this paper, we examine two such phenomena.

The first involves the mode of bargaining. A multi-hospital system has (at least) two ways that it could negotiate with MCOs. It could engage in “separate” bargaining, meaning that each hospital in the system bargains with MCOs separately; or the system could negotiate with MCOs on an “all-or-nothing” basis. We show that these two modes of bargaining do not produce identical merger effects, and illustrate how the mechanisms that produce the effects differ. Under separate bargaining, the mechanism is similar to the mechanism typically applied in unilateral effects analysis: post-merger, a hospital that fails to reach an agreement with the MCO will recapture a portion of the lost profits through patients that divert to the merger partner. Hence, one determinant of price effects due to eliminated competition is the diversion ratio. Under all-or-nothing bargaining, the mechanism is that the merged entity has the ability to withhold both hospitals from the MCO’s network, which would force those patients who viewed the merging hospitals as their first and second choices to use their third choice instead. Hence, patients’ valuations of their second vs. third choices take on greater significance under all-or-nothing bargaining.

We use a very simple, stylized model to establish that the merger effects can be larger or smaller under separate vs. all-or-nothing bargaining. We then use a simple simulation model to develop this intuition further. Consistent with theory, the simulations show that the result can go either way. In addition, we present some intuition suggesting that, ceteris
paribus, merger effects may be systematically larger under separate bargaining.

This result has some practical importance for hospital merger enforcement. Unilateral effects analysis in hospital merger matters is often couched in terms of all-or-nothing bargaining, and some empirical models are built on this assumption. This likely stems from the fact that all-or-nothing bargaining seems to be the most commonly used mode of bargaining in real-world hospital negotiations. However, when the results of such analyses suggest a large predicted merger effect, some might suggest that the solution to the problem is a remedy under which the hospitals bargain separately, rather than to block the merger. The results in this paper show that not only does switching to separate bargaining not eliminate the merger effect, there is little reason to believe that separate bargaining would mitigate the merger effect.

The second phenomenon we consider in this paper is mergers involving “must-have” hospitals. This is a term in somewhat common use in the industry, and is often a source of confusion. If “must-have” simply refers to a hospital or hospital system for which failing to reach an agreement would be very costly to the MCO, then it has no qualitative significance at all. Available models routinely accommodate such heterogeneity in hospital system bargaining power. To have analytical significance, the idea of “must-have”-ness must imply something more specific. We define it to be the property of a system (or hospital) of sufficient value to consumers that its absence from a network lowers the MCO’s variable profits to the point that it can no longer cover its fixed costs, and so ceases to offer that insurance product. As discussed in While this property

Under this definition, “must-have”-ness has analytical content because of a threshold effect. Generally, when a hospital does not reach an agreement with an MCO, some enrollees of that MCO will switch to other MCOs. This indirect recapture effect is part of what defines the hospital’s disagreement payoff in the Nash bargaining game. For a “must-have” hospital, all enrollees, as opposed to just the marginal enrollees, will switch to other MCOs when that insurance product is withdrawn from the market. Hence, the recapture effect is discretely larger when the “must-have” threshold is crossed.

We use a very simple stylized model to develop this concept. Our key (very preliminary)
finding is that the presence of a “must-have” causes hospital systems to extract all the surplus from MCOs (though some of the benefit accrues to non-“must-have” systems). This means that mergers that create a “must-have” when there was no “must-have” before will tend to have larger competitive effects, ceteris paribus. On the other hand, mergers involving an existing “must-have” will have very small effects. See Section XX below for a discussion of whether or not the conditions for “must-have”-ness are likely to be satisfied in practice.

Section 2 gives the Nash Bargaining framework that we adopt throughout. We present our analyses of separate vs. all-or-nothing bargaining in Section 3 and “must-have” hospitals in Section 4. We offer a brief discussion in Section 5.

2 Model

There is a set of hospitals, denoted $G$, and a single commercial MCO. Each hospital negotiates with the MCO over the price that the MCO will pay. The bargaining power of the MCO is derived from its ability to exclude the hospital from its network, thereby depriving it of patients. The bargaining power of the hospital is derived from the fact that its absence from the MCOs network makes that network less attractive to the MCOs customers.

We consider a Nash bargaining game between the MCO and an independent hospital $k$, in which the equilibrium price $p_k$ maximizes the objective function

$$\left[ (n_k^G p_k - c_k(n_k^G)) - 0 \right]^\alpha \left[ V(\phi(p_k, p_{-k})) - \sum_{g} n_g^G p_g - V(\phi(p_{-k})) + \sum_{g \neq k} n_g^G p_g \right]^{1-\alpha} . \ (1)$$

We assume Nash Bargaining because it is standard and tractable. If the true bargaining game was a different one, the calculations would change, but the main conceptual points discussed below would remain the same.

Here, $n_k^G$ denotes the (expected) number of patients covered by the MCO treated at hospital $k$ if the MCO reaches an agreement with all hospitals in $G$; $c_k(n_k^G)$ denotes the (expected) incremental cost of treating $n_k^G$ patients; $\phi()$ denotes the profit-maximizing premium charged by the MCO conditional on bargaining outcomes with hospital $k$ and each of the other hospi-
tals (collectively indexed as $-k$); $V(\phi(p_k, p_{-k}))$ denotes the gross equilibrium payoff (before payments to hospitals) of the MCO under the agreement with hospital $k$. $V(\phi(p_{-k}))$ denotes the disagreement payoff of the MCO (before payments to hospitals), and $n_{j}^{G \setminus k}$ denotes the (expected) number of patients covered by the MCO treated at hospital $j$ if the MCO reaches an agreement with all hospitals in $G$ other than $k$. This will be determined by the diversion ratio from $k$ to $j$ and the number of enrolless the MCO retains under the exclusion of $k$. The parameter $\alpha \in (0, 1)$ denotes the split of the joint surplus. Since the MCO is a monopolist here, the disagreement payoff of the hospital is assumed to be zero.

### 3 Separate vs. All-or-Nothing Bargaining

We begin the analysis of separate vs. all-or-nothing bargaining with a simple stylized example, and then we develop it further with a numerical simulation analysis.

#### 3.1 Numerical Example

We first illustrate the basic comparison of separate and all-or-nothing bargaining using a very simple, stylized example. There are three hospitals indexed by $j \in \{A, B, C\}$ and one MCO. The MCOs premium is exogenous (as it would be if, for example, it was fixed by government regulation). Each hospital attracts 300 patients when all hospitals are in the MCO’s network. If any hospital is missing from the network, 100 of its 300 patients goes to each of the other two hospitals, and the other 100 goes to neither. Using a Nash Bargaining framework, the bargaining problem for hospital $k$ is:

$$
\max_{p_k} \left[ \left( 300p_k - 0 \right)^{0.5} \left( \sum_{j} 300(\phi_F - p_j) - \sum_{j \neq k} 400(\phi_F - p_j) \right)^{0.5} \right]
$$

where $\phi_F$ denotes the fixed premium. The equilibrium prices are $p_A = p_B = p_C = .25\phi_F$.

Now suppose that A and B merge. Under separate bargaining, the bargaining problem for A becomes:
The bargaining problem for $B$ is analogous, while the bargaining problem for $C$ is unchanged. The equilibrium prices are now $p_A = p_B = 0.318\phi_F, p_C = 0.273\phi_F$.

The only thing that changes after the merger is that the disagreement payoff of $A$ (and $B$) increases from zero to $100p_B$ ($100p_A$). This is the familiar recapture of lost profits; if $A$ fails to get a deal, some of those patients will go to $B$, in which $A$’s negotiator has a profit stake. The magnitude of the merger effect depends on the closeness of substitution between $A$ and $B$, specifically how many of the patients who have $A$ as their first choice have $B$ as their second (and vice-versa). In this example, the diversion ratios between $A$ and $B$ are both equal to .33. As expected, the merger leads to a price increase for $A$ and $B$, and a smaller increase for $C$.

Now suppose the post-merger $AB$ system negotiates on an all-or-nothing basis. For $A$ and $B$, the merger simply doubles the stakes in the bargaining game with the MCO. Before the merger, failure of $A$ to reach an agreement means losing all of the patients whose first choice is $A$, and similarly for $B$; after the merger, the merged entity stands to lose both sets of patients. For the MCO, the merger at least doubles the stakes. Failure to reach an agreement with the merged entity will mean marketing a network that is missing both $A$ and $B$. If there is no competition between $A$ and $B$ (i.e., if there are no patients for whom $A$ is first choice and $B$ second choice, or vice-versa), then the merger will exactly double the stakes for the MCO and there will be no merger effect. But if there are some patients for whom $A$ and $B$ are first and second choices, then failure to reach an agreement means that those patients will have to use their third choice instead (hospital $C$ or not buy insurance). This means that what the MCO stands to lose more than doubles, which is the source of the merger effect. As before, the magnitude of the effect depends, in part, on the degree of substitution between $A$ and $B$.

The magnitude of the merger effect will depend on how many patients would continue to buy insurance if $AB$ were dropped from the network. Denote this number $N$. Intuitively,

$$\max_{p_A} \left[ \left( 300p_A - 100p_B \right)^{0.5} \left( \sum_j 300(\phi_F - p_j) - \sum_{j\neq k} 400(\phi_F - p_j) \right)^{0.5} \right].$$

(3)
$N$ must be at least 500: the 300 for whom $C$ is the first choice, the 100 for whom $A$ is first choice and $C$ is second choice, and the 100 for whom $B$ is first choice and $C$ is second choice. In addition, $N$ is at most 700 because 200 patients (100 each from $A$ and from $B$) already dropped insurance when their first choice became unavailable.

We solve the post-merger equilibrium for three values of $N$: 500, 600, and 700. For $N = 500$, the post-merger equilibrium is $p_{AB} = 0.382 \phi_F, p_C = 0.294 \phi_F$. For $N = 600$, the post-merger equilibrium is $p_{AB} = 0.318 \phi_F, p_C = 0.273 \phi_F$. For $N = 700$, the post-merger equilibrium is $p_{AB} = p_C = 0.25 \phi_F$.

Note that when $N = 700$, there is no merger effect at all. In this model, since premiums are fixed, the only way for patients to register dissatisfaction with their hospital options is to drop their insurance. If $N = 700$, then no patient who retains his/her insurance when forced to accept his/her second choice would drop it when forced to accept his/her third. Note also that for $N = 600$, the equilibrium under all-or-nothing bargaining is the same as under separate bargaining, but the price increases are larger when $N = 500$ and smaller when $N = 700$.

Generally, as the patients would continue to buy insurance gets smaller, the merger effect gets larger. This is because more people who would have retained their insurance if they lost their first choice will drop their insurance if they lose their second choice as well, meaning that $C$ is a more distant third.

These differences in the merger effects come from the fact that the mechanisms, while both related to the closeness of substitution between $A$ and $B$, are quite different. Under separate bargaining, the effect is based simply on the degree of diversion between $A$ and $B$. Under all-or-nothing bargaining, it depends on the degree of diversion between $A$ and $B$ and on the gap between consumers’ valuation of their second vs. third choices. The greater this gap across the population, the more likely it will be that merger effects under all-or-nothing bargaining will be larger than under separate bargaining, ceteris paribus. Hence, there is no clear theoretical support for the notion that separate bargaining will result in systematically lower merger effects.
3.2 Simulation Analysis

In this section, we examine the intuition discussed above in a more complete setting using simulated hospital markets. We take the approach of keeping the model on which the simulations are based as simple as possible while not sacrificing essential intuition. Hospitals, which are differentiated by location and quality, engage each MCO in Nash bargaining. In turn, the MCOs engage in an oligopoly game in which they market their hospital networks to consumers. These consumers face uncertainty over hospital preferences at the time they make their insurance decision. Consumer preferences are defined on travel time, hospital quality, and an idiosyncratic draw. The disagreement payoff for the MCO in the bargaining game is largely determined by the value the hospital adds to the MCO’s network, which is determined the location and quality of all hospitals, consumer preferences, and the extent of competition in the MCO market. To simplify the exposition of basic properties, we also limit this exercise to the monopoly MCO case.

3.2.1 Setup

An agreement between the MCO and a hospital consists of a linear per-patient price. With its network and its negotiated prices in place, the MCO sets the profit-maximizing premium for its insurance product. Given this premium, consumers choose whether to purchase insurance from the MCO. Consumers who purchase insurance become sick with some probability, and seek care at their most preferred hospital in the MCOs network (people with no insurance do not use any hospital). For convenience, we set this probability equal to one, in order to abstract from the issue of risk-aversion. The MCO, as we model it, is an assembler of a network and not an insurer per se. We assume that out-of-pocket costs faced by consumers are the same for all hospitals in the network, regardless of the price negotiated with each hospital by the MCO. In other words, the MCO does not steer consumers by giving them incentives to use hospitals with which the MCO has a lower contracted price.

To begin, we defined consumer $i$’s utility for each hospital in choice set $G$ as

$$U_{ig} = V_{ig} + \epsilon_{ig}, \forall g \in G$$

(4)
where \( V_{ig} \) is a linear-in-parameters index of hospital characteristics and interactions of hospital and consumer characteristics, and \( \epsilon_{ig} \) is an IID, across consumers and hospitals, error term.

We assume that consumers do not know the realization of their idiosyncratic preference draws \( \epsilon_{ig} \) when they are deciding whether to buy insurance. Rather, they know the distribution of those shocks, and that they will choose the hospital with the greatest utility once this uncertainty is resolved. Hence, we define the valuation of consumer \( i \) for the MCO’s network consisting of some set of hospitals, denoted \( G' \) as

\[
U_{i}^{mco} = -\phi^{G'} + \lambda_1 + \lambda_2 \ln \sum_{g \in G'} e^{V_{ig}} + \zeta_i
\]  

where \( \phi^{G'} \) denotes the premium and \( \zeta_i \) denotes an idiosyncratic draw assumed to be unknown to both the MCO and the hospitals. Given this, and assuming that \( \zeta_i \) is a Type I Extreme Value draw, the probability that consumer \( i \) will choose to buy insurance offering network \( G' \) at price \( \phi^{G'} \) is defined as

\[
\Lambda_i^{G'}(\phi^{G'}) \equiv \left( 1 + \exp \left\{ \phi^{G'} - \lambda_1 - \lambda_2 \ln \sum_{g \in G'} e^{V_{ig}} \right\} \right)^{-1}.
\]

The MCO evaluates optimal premiums for a candidate vector of hospital prices, taking expectations over the distribution of both idiosyncratic components \( \zeta_i \) and \( \epsilon_{ig} \). This seems to be a reasonable approach in that, while bargaining with hospitals, the MCO will not know exactly who will buy insurance and who will go to which hospital conditional on buying insurance. Therefore, given a vector of prices for the network that includes each hospital in \( G, \{p_g\}_{g \in G} \), the MCO maximizes expected profit by solving the optimization problem:

\[
\max_{\phi^G} \left\{ \sum_i \left[ \left( \phi^G - \sum_g p_g \sigma_{ig}^G \right) \Lambda_i^G(\phi^G) \right] \right\}.
\]

where \( \sigma_{ig}^G \) denotes the probability, conditional on buying insurance, that consumer \( i \) would choose hospital \( g \) given that each hospital in \( G \) is in-network.

The MCO solves this optimization problem not only for the equilibrium network con-
configuration, but also for each network configuration under the hypothetical exclusion of one hospital or system (the disagreement pay-off). In this way, the MCO evaluates the incremental payoff under an agreement with each hospital or system. For example, given the network that excludes hospital $k$, the MCO solves:

$$\max_{\phi \in \mathcal{G} \setminus k} \left\{ \sum_i \left[ \left( \phi \mathcal{G} \setminus k - \sum_g p_g \sigma_{ig}^{\mathcal{G} \setminus k} \right) \Lambda_i^{\mathcal{G} \setminus k} \right] \right\}.$$  

Here, we assume that $\sigma_{ig}^{\mathcal{G} \setminus k} = 0 \forall i, g$.

### 3.2.2 Bargaining

Prices are determined through a set of separate Nash bargains. Each hospital or system in $G$ has a separate negotiation with a representative of the MCO. Negotiation proceeds under standard Nash assumptions: (i) all negotiations occur simultaneously; (ii) no party to any negotiation observes or is in any way affected by what happens in any of the other negotiations; (iii) both parties to each negotiation believe that all the other negotiations will be successful (i.e., that all other hospitals will be included in the MCOs network); and (iv) both parties to each negotiation have beliefs (which turn out to be correct in equilibrium) about the prices agreed to in the other negotiations.

For ease of notation, define the expected number of patients treated by hospital $k$ under a given network $G'$:

$$n_{k}^{G'} \equiv \sum_i \sigma_{ik}^{G'} \Lambda_i^{G'} (\phi^{G'})$$

and the (expected) pay-off for the MCO with network $G'$:

$$\Pi^{G'} \equiv \sum_{g \in G'} n_{g}^{G'} \left( \phi^{G'} - p_g \right).$$

Then the bargaining problem between the MCO and an independent hospital $k$ is:

$$\max_{p_k} \left[ \left( n_{k}^{G} (p_k - c) - 0 \right) ^{\alpha} (\Pi^{G} - \Pi^{G \setminus k})^{1-\alpha} \right].$$  \(\text{(6)}\)
As is standard in Nash bargaining, the equilibrium negotiated price for hospital $k$ maximizes a weighted product of the increase in hospital $k$’s payoff and the increase in the MCOs payoff if an agreement is reached. Since we assume $\sigma_{ik}^{G,k} = 0 \ \forall i$, the disagreement payoff for the hospital is zero. The weighting is defined by the parameter $\alpha \in (0, 1)$, which denotes the division of joint surplus between the hospital and MCO.

Hospital systems may bargain separately or on an all-or-nothing basis. If the hospitals within a system bargain separately with the MCO, then (6) is modified as:

$$\max_{p_k} \left[ \left( n_k^G (p_k - c) - \sum_{g \in S_k \setminus k} (n_g^{G,k} - n_g^G) (p_g - c) \right)^\alpha \left( \Pi^G - \Pi^{G \setminus k} \right)^{1-\alpha} \right]$$  \hspace{1cm} (7)

where $S_k$ denotes the system of which $k$ is a member. Here, the system affiliation changes the bargaining incentives of $k$ in that its disagreement payoff is now greater than zero as long as at least one other member of $S_k$ expects to add patients if $k$ fails to reach an agreement with the MCO. Hence, the system affiliation reduces the cost of failing to reach an agreement for $k$, resulting in a higher equilibrium price. The magnitude of this price difference will largely depend on how many patients the other members $S_k$ expect to add if $k$ is excluded, i.e., the diversion from $k$ to its partner hospitals, and the margins of the other members of $S_k$.

If $S_k$ bargains on an all-or-nothing basis, then the bargaining problem is:

$$\max_{\{p_g\}_{g \in S_k}} \left[ \left( \sum_{g \in S_k} n_g^G (p_g - c) - 0 \right)^\alpha \left( \Pi^G - \Pi^{G \setminus S_k} \right)^{1-\alpha} \right] .$$  \hspace{1cm} (8)

Here, the disagreement payoff of $S_k$ is again zero. Instead, the (potential) effect of system affiliation is manifested in the disagreement payoff of the MCO. To see this, first note that the cost to the MCO of failing to reach an agreement with $S_k$ must be at least the sum of the costs of failing to reach an agreement with the individual members of $S_k$. That is,

$$\Pi^G - \Pi^{G \setminus S_k} \geq \sum_{g \in S_k} (\Pi^G - \Pi^{G \setminus g}) .$$  \hspace{1cm} (9)

If the members of $S_k$ are not substitutes for one another from the perspective of consumers,
then (9) holds with equality. In this case, (8) is just a scaling-up of the separate Nash bargaining problems over the members of $S_k$. As such, there would be no anticompetitive increase in prices due to the system affiliation.

However, if at least two members of $S_k$ are substitutes for one another, then (9) holds with strict inequality. In this case, the system affiliation does not result in a mere scaling-up of the separate Nash bargaining problems, but rather induces a disproportionately larger cost of failing to reach an agreement for the MCO. This results in higher equilibrium prices relative to the case in which the members of $S_k$ were all independent, ceteris paribus.

Hence, system affiliation can lead to higher equilibrium prices whether the system bargains separately or on an AON basis. In each case, the magnitude of the price difference due to system affiliation increases in the extent to which the members of $S_k$ are substitutes for one another from the perspective of consumers.

### 3.2.3 Parameterization

We define consumer preferences as

$$U_{ig} = -\gamma_1 d_{ig} - \gamma_2 d_{ig}^2 + \eta_g + \epsilon_{ig}, \forall g \in G$$  \hspace{1cm} (10)$$

where $d_{ig}$ denotes the distance from consumer $i$ to hospital $g$, $\eta_g$ denotes a hospital-specific fixed effect which captures hospital quality, and $\epsilon_{ig}$ denotes the idiosyncratic component and is assumed to be distributed Type 1 Extreme Value. We use three sets of values for $(\gamma_1, \gamma_2)$ to reflect low, medium, and high travel costs. The values we choose are $(0.1, 0.001)$, $(0.3, 0.003)$, and $(0.5, 0.005)$.

In each market, eight hospital locations are randomly drawn from bivariate $N(0, 4)$ and 40,000 patient locations are randomly drawn from bivariate $N(0, 6)$. The parameter $\eta_g$ is an IID (across hospitals and markets) draw from $N(0, 1.2)$. We set the parameter values $\lambda_1 = 30$, $c = 8$, and $\alpha = 0.5$. As discussed in the next section, the value of $\lambda_2$ will vary with each simulation. The model is parameterized to generate insurance take-up rates in the 90% - 95% range and hospital profit margins in the 8% - 15% range.
The eight hospitals are randomly assigned into five systems: one three-hospital system, one two-hospital system, and three independents. We simulate thirty markets (ten draws of hospital and patient attributes crossed with the three sets of travel cost parameters) and evaluate the ten pairwise mergers in each market by numerically solving for the pre- and post-merger equilibria based on equations (6), (7), and (8).

3.2.4 Results

To test the results from the numerical example from Section 3.1, we compare price effects due to mergers in the simulation model under each mode of bargaining. We further compare the results for the following values of $\lambda_2$: 0.6, 0.8, and 1.0. Our intuition is that since $\lambda_2$ does not affect diversion ratios, but does affect the loss in consumers’ valuations of the MCO’s network, the frequency with which merger effects are greater under all-or-nothing bargaining should be greater for higher values of $\lambda_2$, ceteris paribus. To be clear, since higher values of $\lambda_2$ imply a greater loss in value due to an exclusion, price levels and merger effects are increasing in $\lambda_2$ under either mode of bargaining. However, since $\lambda_2$ scales the utility loss associated with having access to the only likely third best alternative, but does not affect diversion ratios, the effect of mergers on prices should generally be greater under all-or-nothing bargaining, relative to separate bargaining, for higher values of $\lambda_2$.

In keeping with the numerical example in Section 3.1, we first compare the modes of bargaining holding insurance premiums fixed. Since the prices levels vary between the modes of bargaining, we compare percent increases. We find that as $\lambda_2$ increases, all-or-nothing bargaining is more likely to result in larger price increases compared to separate bargaining. Specifically, we find that for $\lambda_2$ values of 0.6, 0.8, and 1.0, the price effect under all-or-nothing bargaining was greater in 18.0%, 31.3%, and 66.7% of mergers, respectively. Moreover, the average difference in the percent price increase (all-or-nothing - separate) is also larger for higher values of $\lambda_2$, although the changes are modest (-0.30%, -0.11%, 0.10%).

These results are consistent with the hypothesis that, while the relative price effects of separate and all-or-nothing bargaining are ambiguous, one potential systematic relationship lies in the value that consumers who likely view the merging hospitals as first and second
choices place on their likely third choice. If consumers who likely view the merging hospitals as first and second choices view their likely third choice as a close alternative, then merger effects are more likely to be larger under separate bargaining. If consumers who likely view the merging hospitals as first and second choices view their likely third choice as a very distant alternative, then merger effects are more likely to be larger under all-or-nothing bargaining.

We extend the analysis by allowing the MCO to optimize on its premium. Holding all else fixed, we find that the frequency with which all-or-nothing bargaining leads to a larger merger effect, while still increasing in $\lambda_2$, is much smaller relative to the fixed premium case. Specifically, we find that for $\lambda_2$ values of 0.6, 0.8, and 1.0, the price effect under all-or-nothing bargaining was greater in 2.0%, 3.3%, and 4.7% of mergers, respectively. However, we also find that the average difference in the percent price increase (all-or-nothing - separate) is lower for higher values of $\lambda_2$, (-1.42%, -1.79%, -2.12%).

The explanation for this result may be that the ability to optimize on its premium has greater value for the MCO under all-or-nothing bargaining than under separate bargaining. By definition, the MCO’s bargaining position is improved under either separate or all-or-nothing bargaining when it can optimize on the premium relative to when it cannot. However, under all-or-nothing bargaining, the MCO can offset the loss in value to its network associated with failing to reach an agreement with the merging systems to some degree by lowering the premium. This is a policy lever that the MCO does not have under separate bargaining. Obviously, under either mode of bargaining, the MCO optimizes its premium in response to any price increase. However, under separate bargaining, the MCO has no tool with which to modify the change in the hospitals’ disagreement payoffs to favor the MCO’s bargaining position. Under all-or-nothing bargaining, the MCO can favorably modify the change in its disagreement payoff by optimally setting the premium. This suggests that, holding all other factors constant, merger effects (and pre-merger price levels) may, on average, be lower when hospitals bargain on an all-or-nothing basis as opposed to separately.

Consistent with this intuition, we find that pre-merger prices in our simulations are lower in 93.3% of the market-system level observations under all-or-nothing bargaining (compared to separate bargaining) when the MCO can optimize on its premium. In contrast, we find
that pre-merger prices in our simulations are lower in 55.4% of the market-system level observations under all-or-nothing bargaining (compared to separate bargaining) when the MCO cannot optimize on its premium.

4 "Must-Have" Hospital Systems

We use a simple stylized model to analyze the issue of "must-have" hospital systems. There are three hospitals, denoted A, B, and C. In contrast to the above, there are two MCOs, denoted 1 and 2. There are 150 total patients. Premiums for both MCOs are again fixed at $\phi_F$, regardless of the composition of their networks. If a hospital is in both networks, it gets 50 patients (25 from each MCO). If a hospital is out of one network it gets 37.5 patients (the 25 it draws from the other payer plus we assume that half of the other 25 will switch payers so that they can continue to access that hospital). If an MCO has all three hospitals in its network, it gets 75 subscribers (25 going to each hospital). If a network is missing one hospital it gets 62.5 subscribers (the 25 who would have chosen each of the other hospitals, plus we assume that half of the patients will remain with the MCO despite losing their preferred hospital, divided equally among the other two hospitals). In this symmetric setup, each pair of hospitals competes equally.

For each hospital $k$, the bargaining problems are:

$$\max_{p_{k1}} \left[ \left( 25p_{k1} + 25p_{k2} - 37.5p_{k2} \right)^{0.5} \left( 75\phi_F - \sum_j 25p_{j1} - 62.5\phi_F + \sum_{j\backslash k} 31.25p_{j1} \right)^{0.5} \right]$$

$$\max_{p_{k2}} \left[ \left( 25p_{k1} + 25p_{k2} - 37.5p_{k1} \right)^{0.5} \left( 75\phi_F - \sum_j 25p_{j2} - 62.5\phi_F + \sum_{j\backslash k} 31.25p_{j2} \right)^{0.5} \right]$$

The equilibrium prices for all six hospital/MCO combinations is $0.5\phi_F$.

The 37.5 number does not necessarily reflect competition between A and B. That number indicates how many subscribers who prefer A (WLOG) will switch from 1 to 2 (WLOG) in
order to maintain access to $A$. How many patients do this will depend on how much they prefer $A$ to their second choice. This is a function of the competition between $A$ and $B$ and of the competition between $A$ and $C$, but from the point of view of $A$, all that matters is the total number of patients who switch insurers (because everything gets multiplied by $p_{A2}$). In contrast, the disagreement payoffs of the MCOs do explicitly incorporate competition between $A$ and $B$, because they specify how the subscribers who remain with their insurer when their preferred hospital goes out of network divide themselves among the other two hospitals (one number is multiplied by $p_{B1}$, and the other by $p_{C1}$). Because of the symmetry of the example, this turns out not to matter as long as the numbers sum to 62.5, but that will not be true in general.

Assume a merger of $A$ and $B$ with all-or-nothing bargaining post-merger. Now instead of $A$ and $B$ each keeping half of their patients (through subscribers switching insurers) when they go out of network, the $AB$ system will keep more than half (specifically we assume three-quarters) of its patients, so $AB$ gets 87.5 of its maximum potential of 100 patients. This is because of lost competition: the number was one-half when MCO 1 offered two remaining choices, but goes up to three-quarters when there is only one remaining choice. Moreover, some of that competition is between $A$ and $B$; meaning that some of those extra retained patients are patients who, pre-merger, would have stayed with MCO 1 if $A$ went out of network because $B$ remained in network (and vice-versa). Hence, the four bargaining problems are:

\[
\max_{p_{AB1}} \left[ \left( 50p_{AB1} + 50p_{AB2} - 87.5p_{AB2} \right)^{0.5} \left( 75\phi_F - 50p_{AB1} - 25p_{C1} - 37.5\phi_F + 37.5p_{C1} \right)^{0.5} \right]
\]

\[
\max_{p_{AB2}} \left[ \left( 50p_{AB1} + 50p_{AB2} - 87.5p_{AB1} \right)^{0.5} \left( 75\phi_F - 50p_{AB2} - 25p_{C2} - 37.5\phi_F + 37.5p_{C2} \right)^{0.5} \right]
\]
\[
\max_{p_{C1}} \left[ \left( 25p_{C1} + 25p_{C2} - 37.5p_{C2} \right)^{0.5} \left( 75\phi_F - 50p_{AB2} - 25p_{C1} - 62.5\phi_F + 62.5p_{AB1} \right)^{0.5} \right]
\]

\[
\max_{p_{C2}} \left[ \left( 25p_{C1} + 25p_{C2} - 37.5p_{C1} \right)^{0.5} \left( 75\phi_F - 50p_{AB2} - 25p_{C2} - 62.5\phi_F + 62.5p_{AB2} \right)^{0.5} \right] .
\]

(11)

In this setting, the equilibrium prices are \( p_{AB1} = p_{AB2} = 0.714\phi_F, p_{C1} = p_{C2} = .571\phi_F. \)

Now assume the same setup as before, except that all of the 12.5 patients who prefer \( A \) but do not switch away from MCO 1 when \( A \) goes out of its network go to \( C \), instead of being divided equally between \( B \) and \( C \). This means that there are no patients who prefer \( A \) but are willing to remain with 1 because it has \( B \) in its network; all those decisions to remain with 1 are driven by the presence of \( C \). This is just another way of saying that \( A \) and \( B \) do not compete. For example, the post-merger bargaining problem between \( AB \) and MCO 1 is now:

\[
\max_{p_{AB1}} \left[ \left( 50p_{AB1} + 50p_{AB2} - 75p_{AB2} \right)^{0.5} \left( 75\phi_F - 50p_{AB1} - 25p_{C1} - 50\phi_F + 50p_{C1} \right)^{0.5} \right] .
\]

(The bargaining problems for \( C \) are unchanged.) In this setting, the equilibrium prices are \( p_{AB1} = p_{AB2} = p_{C1} = p_{C2} = .5\phi_F. \) As expected, this merger does not affect equilibrium prices.

To assess the effect of a merger creating a “must-have” hospital system, again assume a merger of \( A \) and \( B \) and all-or-nothing bargaining post-merger. However, now assume that the absence of the merged entity from a MCO’s network leaves it unable to generate enough variable profit to cover its fixed costs. Hence, the MCO ceases to offer that plan and receives a payoff of zero. Because of this, the merged entity gets the same number of patients whether or not it contracts with 1 (WLOG), since all of the patients who prefer \( AB \) now enroll in MCO
2. This is the heart of the “must-have” idea: as a hospital gets more and more important, the payer’s disagreement payoff gets smaller and smaller. When it hits zero, that’s an incremental change for the insurer, but the system’s disagreement payoff jumps up discretely, causing a corresponding discrete jump in the equilibrium price. With the appropriate modifications to (11), the post-merger bargaining problems are:

\[
\begin{align*}
\max_{p_{AB1}} & \left[ \left( 50p_{AB1} + 50p_{AB2} - 100p_{AB2} \right)^{0.5} \left( 75\phi_F - 50p_{AB1} - 25p_{C1} - 0 \right)^{0.5} \right] \\
\max_{p_{AB2}} & \left[ \left( 50p_{AB1} + 50p_{AB2} - 100p_{AB1} \right)^{0.5} \left( 75\phi_F - 50p_{AB2} - 25p_{C2} - 0 \right)^{0.5} \right] \\
\max_{p_{C1}} & \left[ \left( 25p_{C1} + 25p_{C2} - 37.5p_{C2} \right)^{0.5} \left( 75\phi_F - 50p_{AB2} - 25p_{C1} - 62.5\phi_F + 62.5p_{AB1} \right)^{0.5} \right] \\
\max_{p_{C2}} & \left[ \left( 25p_{C1} + 25p_{C2} - 37.5p_{C1} \right)^{0.5} \left( 75\phi_F - 50p_{AB2} - 25p_{C2} - 62.5\phi_F + 62.5p_{AB2} \right)^{0.5} \right].
\end{align*}
\]

Jointly maximizing these objective functions yields \( p_{AB1} = p_{AB2} = 1\frac{1}{7}\phi_F, p_{C1} = p_{C2} = 5\phi_F \). However, this cannot be an equilibrium since it implies a negative disagreement payoff for the MCOs in the bargaining problems with \( C \). In this setting, hospital prices cannot exceed the fixed premium. To find an equilibrium, we first note that, in the symmetric equilibrium, the surplus for \( AB \) is, by definition, zero since \( AB \) recaptures all of the patients it would lose if it failed to reach an agreement with either MCO. Therefore, the value of the Nash objective functions involving \( AB \) are zero irrespective of the surplus earned by the MCOs from an agreement with \( AB \). Hence, we define the equilibrium by maximizing the Nash objective functions involving \( C \) subject to the restriction \( p_{AB1} = p_{AB2} = \phi_F \). This yields \( p_{AB1} = p_{AB2} = \phi_F, p_{C1} = p_{C2} = 2\frac{2}{3}\phi_F \). Hence, the price increases in this merger are larger than in the case in which \( AB \) was not a “must-have”.

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Note also that the same equilibrium is obtained irrespective of the degree of pre-merger competition between $A$ and $B$. To see this, note that in all-or-nothing bargaining, the degree of pre-merger competition between two hospitals is manifested in the change in the disagreement payoffs of the MCOs as a result of the merger. If that payoff is moved to zero because a merger has created a “must-have” hospital system, the same equilibrium is obtained irrespective of how much competition is eliminated by the merger.

5 Discussion

Recent work in the analysis of hospital mergers has had bargaining theory at its core. This is appropriate because commercial hospital prices are generally determined through negotiations between hospitals and MCOs. This fact, combined with the fact that patients generally do not face price differences across within-network hospitals, means that analyses that involve patients directly responding to price changes are generally inapplicable.

But applying bargaining theory the analysis of hospital mergers provides benefits beyond simply establishing general realism and avoiding obvious error. For example, this kind of theory has been used to develop merger simulation methods (\cite{1,2,3,4,5}). In this paper, we show that bargaining theory can also provide useful theoretical insights that are applicable to hospital merger analysis.

The separate bargaining vs. all-or-nothing bargaining issue discussed in this paper is highly relevant to the question of meaningful remedy in the presence of an otherwise anti-competitive merger. In a well-known antitrust case, the Federal Trade Commission found that the consummated acquisition of Highland Park Hospital by Evanston Hospital had caused prices to increase and therefore had violated the antitrust laws. Rather than force a divestiture, the remedy that was decided upon was to require that the negotiations be separate with “fire-walled” negotiating teams bargaining for each hospital.\footnote{See http://www.ftc.gov/os/adjpro/d9315/080428commopiniononremedy.pdf.} A necessary (not sufficient) condition for this remedy to be effective is for the price effect under separate bargaining to be lower than under all-or-nothing bargaining. The results in this paper suggest
that, insofar as our bargaining model is a reasonable representation of reality, there is no reason to believe that this condition will be satisfied. At a minimum, it is possible for merger effects to be larger under separate bargaining. Moreover, this study provides some rationale for why, all other factors equal, price effects due to mergers may be higher, on average, under separate bargaining. Finally, we note that the theory described here on why separate bargaining is unlikely to be a meaningful remedy for an otherwise anticompetitive hospital merger is consistent with the intuition described in an amicus brief filed by several academic economists in the Evanston matter.\(^3\)

The second part of our paper involves the idea of a “must-have” hospital. The term must-have, in common parlance, generally just means a hospital with a high degree of bargaining power. But under this definition, the analysis of a must-have hospital is the same as any other hospital: hospitals with more bargaining power command higher prices all else equal. For the concept of “must-have”-ness to have analytical content, it must mean something more specific. We define a “must-have” hospital system to be a system such that the absence of that system from a payer’s insurance product causes that product to fail because it drives the variable profit below fixed costs.

Perhaps the most important implication of our analysis is that as a practical matter, “must-have”-ness as we define it is likely quite rare, which means that most of the time the analysis of large dominant hospital systems is not conceptually different from other hospital merger analyses. There are several reasons why it is likely to be rare. First, the hospital system would have to be very dominant, so dominant that not even one MCO can offer a plan (at a correspondingly low premium) that attracts enough subscribers to remain in business. Second, in the context of a merger, “must-have”-ness must hold post-merger as well as pre-merger. To see why this is important, imagine a city with three hospitals and several MCOs. Suppose that pre-merger, no MCO can remain in business offering a plan that does not include at least two of the three hospitals. Now suppose that two of those three hospitals were to merge. Would the merged entity be a “must-have”? Most likely not, because the attractiveness of a one-hospital network is higher when the prices of the merged

\(^3\)See http://www.ftc.gov/os/adjpro/d9315/071017econprofsamicusbrief.pdf.
hospitals increase. Indeed, it is likely that a one-hospital network including the non-merging hospital will be the primary remaining constraint on prices for the merged system. Third, the model ignores dynamic considerations. A hospital that drives an MCO out of business will face a more concentrated insurance market in the future, which will reduce its profits.

When the condition for must-have hospitals does hold, the results become somewhat strange. A merger that creates a “must-have” that did not exist before has price effects that are extraordinarily high, but a merger involving an existing “must-have” has effects that are extraordinarily low.