Diagnosing Hospital System Bargaining Power in Managed Care Networks*

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We investigate the impact of hospital system membership on negotiations between hospitals and managed care organizations (MCOs). Previous research finds that system hospitals secure higher reimbursements by exploiting local market concentration. By leveraging system membership in the bargaining game, however, system hospitals may also extract a higher percentage of their value to an MCO. Our findings reveal that more of the observed price gap between system and non-system hospitals can be attributed to bargaining power differences than to differences linked to relative concentration. These results highlight the importance of explicitly modeling the bargaining process when evaluating negotiated-price markets more generally.

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Many of the important products that economists study (such as automobiles, real estate, services, and intermediate goods) are traded at individually negotiated prices. However, empirical studies of these markets typically treat them as having posted prices for convenience as a unique equilibrium price is determined in most posted-price settings once the sellers' costs, the buyers' willingness-to-pay, and the mode of competition are known. Negotiated prices are inherently more complex. For each buyer-seller pair there may be a range of possible prices at which mutually beneficial trade can occur while the parties' relative bargaining power determines the final transaction price. As a result, there can be

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substantial variation in negotiated transaction prices if there is significant variation in the relative bargaining power across buyers and sellers. Moreover, the relationship between prices and market structure is less straightforward because changes in market structure can influence both the range of prices within which trade can occur as well as the relative bargaining power that determines where the transaction occurs within this range.

We directly incorporate bargaining into an empirical model to study competition in a very important negotiated price market—the market for hospital services. The steady growth of hospital systems over the last 30 years has consistently generated concerns of increased market power. These concerns are particularly salient given that healthcare spending in the U.S. has nearly doubled over the last decade with hospital care now accounting for over 30% of total healthcare spending and over 5% of the total gross domestic product.

Unlike previous studies we separately estimate the two main channels through which system membership can impact negotiated prices. First, when the joining hospital now negotiates as one with the other system members in the local market the incremental value of including the multi-hospital system in the MCO's network is larger than the incremental value of adding the individual hospital because the MCO can no longer use one system member as a substitute for the other.[1] The higher incremental value of the multi-hospital system shifts the threat point of the MCO in the bargaining game resulting in a better *bargaining position* for the added hospital. Second, system membership may alter a hospital's *bargaining power* allowing the hospital to extract a higher share of the surplus generated by contracting with an MCO, resulting in a higher reimbursement rate.[2] This latter channel is of particular interest because it allows for an increase in prices after merger (through higher bargaining power) even when merging hospitals are located in different patient markets thus experience no change in bargaining position. Such effects could be very important as roughly one third of all hospital mergers and system acquisitions between 2000 and 2010

[1]The effect is similar to the familiar outward shift in residual demand enjoyed by differentiated product oligopolists in posted price markets who merge and no longer have to compete with each other.

[2]Much of the literature on hospital price setting has referred to the ability of a hospital to secure a higher markup as "bargaining power." Following the theoretical bargaining literature, we use the term more specifically to mean the ability of a hospital to secure a larger share of the surplus generated by the relationship with an MCO.

involved hospitals in completely different markets.[3]

Supporting the concern that system membership may improve hospitals' bargaining power, a reduced form investigation by Melnick and Keeler (2007) has revealed that average reimbursement rates are higher for system hospitals (particularly for members of large systems) even after controlling for patient mix, local market concentration, and range of other hospital and market characteristics that affect bargaining position. Despite the potential importance of bargaining power effects, recent studies of hospital competition (e.g., Town and Vistnes, 2001; Capps, Dranove and Satterthwaite, 2003; Ho, 2009) and recent antitrust analyses on hospital mergers (Farrell, Balan, Brand and Wendling, 2011) have focused exclusively on the effects of system membership that arise through changes in bargaining position only.[4] Since the value of the contract is never directly estimated, these studies are restricted to identifying a general relationship between the prices a hospital receives and the willingness-to-pay of MCO enrollees to have access to that hospital and the relative bargaining power of hospitals cannot be separately identified. A more recent study by Brand, Gowrisankaran, Nevo and Town (2012) does explicitly model the value generated by the hospital/MCO contract, and can separately identify bargaining position from bargaining power. However, like the previous studies, hospitals are still assumed to all have identical bargaining power that remains constant even if the structure of the market changes. As a result, some of the price differences arising because of variation in the bargaining power of hospitals may be mistakenly attributed to the hospital's bargaining position, potentially overstating the importance of local market concentration. In addition, any impacts that mergers or system affiliation have on a hospital's bargaining power that are uncorrelated with bargaining position will not be captured, leading the ultimate price effects to be underestimated.

We specify an empirical model that explicitly allows bargaining power to vary across

[3]There were well over 100 acquisitions nationwide between 2000 and 2010 of hospitals by systems in which the system did not have any local presence (authors' calculations based on data from the American Hospital Association's Annual Hospital Survey).

[4]The approach of Ho (2009) is somewhat unique in that she relies on a structural model to identify hospital profits using only data on MCO plan prices and MCO network information. In contrast, we measure hospital profits more directly using data on observed reimbursement rates and measures of observed hospital costs.

hospitals. Following Town and Vistnes (2001) and Capps et al. (2003) we estimate a logit model of demand based on the observed characteristics of patients, their illnesses, and of hospitals, and then derive the incremental value of adding a hospital to an MCO's network from the estimated utility of all patients who would choose the hospital after having become ill. However, unlike these previous studies that use this additional willingness-to-pay value as a proxy for the incremental profit earned by the MCO, we combine our demand estimates with data on hospital revenues and estimates of hospital costs to fully identify the bargaining position of each hospital, which is the additional surplus generated when the MCO adds the hospital to its provider network. The bargaining power of a hospital is then separately identified by using hospital revenue data to reveal the average share of the available contract surplus that the hospital captures in its negotiations with MCOs. With this approach we examine how bargaining power varies across hospitals by allowing this parameter to vary as a function of hospital, system, and market characteristics.[5] We also separately identify the degree to which a hospital's market power results from a stronger bargaining position compared to greater bargaining power.

Although it is well understood how system membership can improve a hospital's bargaining position it is less clear how its bargaining power may change. Theoretical bargaining models suggest that uncertainties in the value of a contract to the other party can weaken the uncertain party's bargaining power (Fudenberg and Tirole, 1983; Sobel and Takahashi, 1983). Thus, system hospitals may be able to improve their bargaining power by pooling information on MCOs and sharing the costs of creating a larger and more skilled team of contract negotiators. For example, in 2004 Tenet Healthcare—a national system of 73 hospitals—adopted a "national negotiating template and new technology to analyze payer-specific profit and loss data, giving negotiators ammunition during contract talks" (Colias, 2006).[6] The importance of information in the negotiation process has also been emphasized in other articles in the trade literature (Benko, 2003; Osten, 2011) suggesting

[5] As hospital data is aggregated across the MCOs that send patients to the hospital the bargaining power represents the hospital's average bargaining power vis-à-vis all of those MCOs.

[6] According to Tenet's CEO this initiative was necessary because Tenet was "being outgunned by the managed care companies in negotiations" (Colias, 2006).

that bargaining power differences could arise because individual hospitals may not have the size or resources to pursue such strategies.[7]

Alternatively, work by Kihlstrom, Roth and Schmeidler (1981) and Roth (1985) show that the relative risk aversion of the players affects the share of surplus each player receives in equilibrium (i.e., higher relative risk aversion lowers bargaining power). Consequently if system negotiators are less risk averse than negotiators at individual hospitals, then they may be able to secure a larger share of the contract surplus. Moreover, Binmore, Rubinstein and Wolinsky (1986) and Rubinstein, Safra and Thomson (1992) show that the negotiating parties' bargaining power will differ if they have differing beliefs in the probability that the other party will stop negotiating. The MCOs' negotiators may believe that there is a higher probability for breakdown when negotiating with a system compared to an individual hospital, again resulting in a difference in the relative bargaining power of the two types of hospital. Supporting this notion, the managed care trade literature specifically cites the ability to credibly threaten to cut-off negotiations as a way a hospital can achieve better outcomes in the negotiation process (Rollins, 2000; Lowes, 2008).

Our results indicate that there is considerable variation in hospital bargaining power and that there are specific hospital characteristics associated with the large differences in bargaining power. For example, hospitals affiliated with physicians groups and certified trauma centers have higher bargaining power. On the other hand, we find no evidence that the bargaining power of a hospital or system varies with its size or market share in a local market indicating that price differences associated with these characteristics result entirely from an advantage in bargaining position. Importantly, we find that system membership is associated with higher bargaining power—even when there are no other same system members in the local patient market. We additionally uncover evidence that the bargaining power of a system hospital is associated with the number of system hospitals located outside of that local market as well as how dispersed the system is across states. On average this bargaining power difference translates into system hospitals extracting an additional 25% of

[7]For example, Benko (2003) provides a quote from one hospital advisor saying: "Negotiating is all about knowledge. The better informed you are, the more leverage you have."

the surplus they generate by contracting with an MCO. As Dranove and White (1998) first point out, this latter finding underscores a need to move beyond the traditional definition for a hospital's market in assessing system formation and growth.

We find that on average the higher bargaining power associated with system membership contributes significantly more to a system hospital's markup than is generated as a result of the system's stronger bargaining position. For example, the additional markup in the per diem reimbursement for the average system hospital created by the system's additional bargaining power is about $855 (or ~23%) in contrast to the additional $150 (or ~4%) that is created by the stronger bargaining position derived from system membership for hospitals that have partners in the same patient market. This type of system effect has not previously been examined in the literature and indicates that the approaches currently used (by academics and antitrust authorities) to analyze hospital mergers may substantially underestimate the impact of a hospital merger or system acquisition on prices—particularly when the system has minimal presence in the same market as the acquired hospital.

In addition to advancing current understanding of hospital market power and the role of hospital systems, our study highlights the importance of explicitly incorporating bargaining into empirical analysis. Several recent studies have taken a similar approach to separately identify the effects of bargaining position and bargaining power on negotiated prices. In the marketing literature Draganska, Klapper and Villas-Boas (2011) and Meza and Sudhir (2010) estimate the relative bargaining power of manufacturers and retailers in the markets for coffee and breakfast cereals, respectively, and examine whether firms with certain characteristics have greater bargaining power. Grennan (2013) estimates a similar model allowing for asymmetric bargaining power in the market for coronary stents, and Crawford and Yurukoglu (2012) identify the relative bargaining power of the cable and satellite TV distributors in their negotiations with different cable channels. Both studies find significant variation in the bargaining power across firms but do not attempt to relate these differences to market or firm characteristics. Our results provide further evidence that differences in bargaining power across firms have substantial impacts on final transaction prices. We ad-

ditionally show that the factors that affect a firm's bargaining power can be different from those that determine its bargaining position.

The paper develops as follows. We provide some background on the evolution of the hospital-MCO relationship in Section I. We develop the estimation strategy in Section II and describe the data used in Section III. We present some of the estimates in Section IV and decompose the additional markups from system membership into those that come from changes in bargaining position and those that come from changes in bargaining position in Section V. Lastly, we conclude with some final remarks in Section VI.

I. Background

A. Market Structure

The relationship between hospitals and insurers has undergone significant change with the advent of managed care. Before MCOs—such as health maintenance organizations (HMOs)—came to prominence hospitals were paid on a fee-for-service basis yielding substantial power to hospitals to set their own prices. As HMO penetration rates increased through the 1990s hospitals were forced to become more competitive with their prices in order to secure HMO membership or risk substantial reductions in patient volume. With this paradigm change, hospital pricing became more payer-driven instead of patient-driven (Dranove et al., 1993).

Today consumers have come to prefer Preferred Provider Organizations (PPOs)—a less restrictive form of managed care—over HMOs to the extent that they are now the predominant form of not just managed care but of health insurance in general. Illustrating their recent sensational growth, PPO market share for employer provided insurance has increased from 28% in 1996 to 56% in 2012, while HMO market share has declined from its peak of 31% in 1996 to 16% in 2012.Insurance markets have also become more concentrated. For instance, in 31 states the leading insurer holds a market share over 50% in the individual insurance market, while 26 states exhibit similar dominance in the small group market in 2010 (Kaiser Family Foundation, 2011).

The hospital market has also experienced considerable change over the last couple of decades as hospital systems—groups of hospitals that are either jointly owned or contract managed by a third-party—have come into prominence. For example, there were an average of 73 hospital mergers and acquisitions each year from 1998 to 2008 (American Hospital Association, 2009). Today over 57% of all acute-care hospitals in the U.S. are in a system.

B. Contract Negotiations and Payment Variation

Whether hospitals and MCOs are negotiating a contract for the first time or renegotiating a contract the process can be very complicated. Hospitals and MCOs must determine quality targets, historical payer behavior with respect to claims denial and underpayments, as well as the expected case-mix across clinical areas and treatment settings (Boyd and Finman, 2010; Osten, 2011). Payments often take many different forms such as capitation, per diems, and fee-for-services reflecting the relative risks and preferences for taking on those risks. Furthermore, contracts may specify distinct payment rates for thousands of different Current Procedural Terminology (CPT) codes and can be hundreds of pages in length. The complexities of the contract require negotiators to have a substantial amount of information and skill in order to achieve a favorable outcome. In fact, Kongstvedt (2001) claims that the skills of the negotiator are the *most* important component for securing a favorable outcome in the negotiating process.

Given the complexities of these contracts and the significant differences across hospitals in size, services and market structure it is not surprising to find substantial variation in hospital reimbursement rates. A recent study by the Center for Studying Health System Change (Ginsburg, 2010) examined hospitals rates for eight metropolitan areas and found that the average rate ranged from 147% to 210% of the Medicare rate. More dramatically, the study found that within a patient market there is even more rate variation. For example, the study reports that in Los Angeles, the average rate varied from 84% of the Medicare rate for a hospital in the 25th percentile to 418% of the Medicare rate for the highest paid hospital. It is this exact type of variation in prices that helps to identify the relative importance

of bargaining power versus bargaining position in our investigation.

II. Model for Estimation

Our empirical strategy consists of two stages. In the first stage we estimate hospital cost functions and a hospital demand system that treats hospitals as differentiated products. The demand system utilizes patient-level discharge data and is used to calculate the incremental willingness-to-pay of patients to have access to each particular hospital and to predict the number of additional managed care patients that will visit a hospital when it joins an MCO's network. Coupled with the cost function—estimated using financial data—the estimated demand system is used to calculate the additional cost of treating an MCO's patients. In the second stage hospital revenue data is combined with the incremental willingness-to-pay and cost estimates to estimate the parameters of the bargaining model. In the following three sub-sections we describe the discrete choice model for hospital demand, the hospital cost function specification, and, lastly, discuss the motivation and setup of the bargaining model and its estimation.

A. Willingness-to-Pay

We utilize the option-demand framework developed by Capps et al. (2003) to estimate the market willingness-to-pay for having access to a hospital. We model patient i's *ex post* utility of receiving treatment from hospital h after falling ill as

$$\begin{aligned} U(H_h, X_i, \lambda_i) = &+ \alpha R_h + S_h' \Gamma_1 Z_i - \gamma(X_i) OPC(Z_i) \\ &+ T_h(\lambda_i) \cdot [\beta_0 + \beta_1 X_i + \beta_2 R_h + S_h' \Gamma_2 Z_i] + \epsilon_{ih}, \end{aligned}$$

where $H_h = [R_h, S_h]$ is a column vector of hospital h's characteristics which are common across all illnesses, R_h, and those characteristics which are illness specific, S_h. $X_i = [Y_i, Z_i]$ is a column vector of the patient's characteristics, Y_i, such as age, race, and gender as well as clinical attributes, Z_i, such as diagnostic category, whether or not the treatment

is surgical, length of stay and diagnostic related group (DRG) case weight.[8] The function $\gamma(X_i)$ converts money into *utils* for a patient with characteristics X_i, and $OPC(Z_i)$ are the out-of-pocket costs for patient i having clinical attributes Z_i at hospital h. In practice out-of-pocket costs could vary by hospital, but as we do not observe the patients' out-of-pocket costs we must assume they are the same for a given patient across hospitals similar to much of the literature (e.g., Capps et al., 2003; Ho, 2006, 2009) so that they do not impact a patient's choice of hospital. $T_h(\lambda_i)$ is the approximate travel time from patient i's location λ_i to hospital h. Lastly, the error term ϵ_{ih} is assumed to be an i.i.d. extreme value random variable representing the idiosyncratic component to patient i's utility for being treated at hospital h.

Hospital characteristics affecting service quality include properties such as research expenditures, teaching status, for-profit status, rural status, and system membership. The quality of care delivered by a hospital may also be affected by any physician arrangements used as part of an integrated healthcare delivery program, especially when those arrangements are selective about which physicians may become members; therefore we include indicators for two of the most common physician arrangements: Independent Practice Association (IPA) and Group Practice without walls (GPWW). A hospital's services include items such as high-technology imaging equipment and items specific to diagnostic categories such as a birthing room or the ability to perform heart surgery.

Using the *ex post* utility, $U(H_h, X_i, \lambda_i)$, patient i's interim utility of having hospital h in his choice set $\mathcal{M} = \{1, 2, \ldots, M\}$ can be expressed as

$$V(\mathcal{M} \mid H, X_i, \lambda_i) = E\left[\max_{m \in \mathcal{M}} \{U(H_m, X_i, \lambda_i)\}\right] = \ln\left[\sum_{m \in \mathcal{M}} \exp\{U(H_m, X_i, \lambda_i)\}\right],$$

where H is the vector of all H_m. Hospital h's contribution to patient i's interim utility

[8] One may be concerned that hospitals differ in their decisions to admit a given patient. However, such heterogeneity will largely manifest itself as differences in the observed case-mix of admissions across hospitals, so we include DRG weights and length of stay in the demand specification and include case mix in our cost model to account for such differences.

derived from MCO m's network $\mathcal{M}$ can therefore be expressed as

$$\begin{aligned}\Delta_h V(\mathcal{M} \mid H, X_i, \lambda_i) &= V(\mathcal{M} \mid H, X_i, \lambda_i) - V(\mathcal{M} \setminus h \mid H, X_i, \lambda_i) \\ &= \ln\left(\frac{1}{1 - s_h(\mathcal{M} \mid H, X_i, \lambda_i)}\right), \end{aligned} \tag{1}$$

where $s_h(\mathcal{M} \mid H, X_i, \lambda_i)$ is the probability that hospital h is chosen by patient i when included in network $\mathcal{M}$ given by the logit demand specification:

$$s_h(\mathcal{M} \mid H, X_i, \lambda_i) = \frac{\exp\{U(H_h, X_i, \lambda_i)\}}{\sum_{m \in \mathcal{M}} \exp\{U(H_m, X_i, \lambda_i)\}}.$$

There is no outside option because the data contain only those patients which have become sufficiently ill that they choose to visit a hospital. Integrating (1) over the population distribution of patient attributes, diseases, and patient locations produces the *ex ante* value of including hospital h in network M. Let $F(X_i, \lambda_i)$ denote the joint cumulative distribution of patient characteristics, diseases, and locations of all patients who will visit a hospital, then the total *ex ante* willingness-to-pay (WTP) for inclusion of hospital h in MCO m's network is

$$\Delta_h W_m(\mathcal{M}) = N_m \int_{X,\lambda} \frac{1}{\gamma_p} \ln\left(\frac{1}{1 - s_h(\mathcal{M} \mid H, X_i, \lambda_i)}\right) dF(X_i, \lambda_i), \tag{2}$$

where N_m is the number of enrollees with MCO m sufficiently ill that they visit a hospital in the choice set and γ_p is the (assumed) constant conversion factor for converting dollars into *utils*.[9]

B. Hospital Cost

Following the literature on estimating the cost function of multi-product firms and hospitals in particular (See Fournier and Mitchell (1997), Bamezai and Melnick (2006), and Capps, Dranove and Lindrooth (2010)) we use a form of the trans-log specification

[9] Capps et al. (2003) provide a detailed discussion of how the estimates may be biased when γ_p is not constant.

where hospital h's cost at time t is estimated as

$$\begin{aligned}\ln(Cost_{ht}) =&\alpha_0 + \beta_h^Y \ln(Y_{ht}) + \beta_h^{YY} \ln(Y_{ht}) \times \ln(Y_{ht}) + \beta^W \ln(W_{ht}) \\ &+ \beta^{WW} \ln(W_{ht}) \times \ln(W_{ht}) + \beta^{YW} \ln(Y_{ht}) \times \ln(W_{ht}) \\ &+ \beta^H \mu_h + t + \epsilon_{ht}.\end{aligned} \tag{3}$$

In Eq. (3) Y is a vector of hospital outputs, W is a vector of hospital inputs, μ_h are hospital fixed effects, t is a time trend, and ϵ_{ht} is an unobserved mean-zero random variable that may be correlated over time for a given hospital but are distributed independently (though not necessarily identically) across hospitals. The six different hospital outputs include its in-patient and out-patient care for each of the three payer types: Medicare, privately insured, and other (Medi-Cal, worker's compensation, etc). We allow for additional variation in marginal cost across hospital types by interacting the coefficients on output (β^Y and β^{YY}) with several hospital characteristics (ownership type, teaching status, trauma center status, system status). To control for differences in patient illness severities and their associated costs we consider two different measures of in-patient care: number of in-patient days and number of case-mix adjusted discharges. Further description of these are provided in section IV.B.

The number of staffed beds, nurses, management, and clerical staff for a hospital are used as inputs and capture the size of the hospital, and the efficiency of the hospital staffing. We control for wage differences between hospitals by allowing the marginal costs to vary by hospital ownership type, teaching status, rural status, and for certified trauma centers. In order to measure short-run costs we include hospital fixed-effects (Baltagi and Griffin, 1984).

C. Bargaining

There are several bargaining games that could arguably be employed to model MCO-hospital contract negotiations including models like Stole and Zwiebel (1996a) that consider strategic network formation. Conversations with a former contract negotiator for a

major national MCO indicate that the objective of MCOs was generally to get nearly every hospital in their PPO network.[10] Even for HMOs, which tend to have more restrictive networks, the provider network for the median HMO enrollee in our sample appears to include 84% of the sample hospitals and 90% of hospitals that are above the median in size.[11] Similarly Ho (2009) observes that on average 87% of hospital-HMO pairs establish a contract in 43 markets across the U.S. As a result, we believe that it is suitable and tractable to model negotiations between each MCO and hospital (or system) as independent where each MCO-hospital pair proceed under the expectation that all other hospital-MCO pairs will successfully negotiate contracts. This establishes a *contract equilibrium* á la Cremer and Riordan (1987) in which no party wants to renegotiate in equilibrium. Our contract equilibrium relies on the following assumptions:

A1. All hospitals (or systems) negotiate their contracts simultaneously with MCOs.

A2. The parties negotiate each contract under the assumption that in equilibrium all other MCOs and hospitals/systems will successfully negotiate contracts with the other hospitals/systems and MCOs operating in the patient market.

A3. The bargaining outcome between hospital h and MCO m does not influence the bargaining outcome between hospital h and any other MCO m', or any other hospital h' and MCO m.[12]

While contracts between MCOs and non-system hospitals are negotiated individually, in practice hospital systems negotiate a shared contract with the MCO that covers all the system's hospitals within a particular patient market or metropolitan area. If negotiations breakdown, then the enrollees of the MCO are essentially excluded from obtaining services at any of the system's hospitals until a deal is reached. To capture this, the unit contracting

[10] Capps et al. (2003) develop a simple theoretical model of network formation to show that adding every hospital to its network is the profit-maximizing strategy for an MCO.

[11] As we describe in Section III we do not observe actual contracts but infer them based on the discharge data.

[12] In equilibrium each party knows what the negotiated reimbursement rates will be, thus we are assuming that the hospitals and MCOs do not know when an off-equilibrium path rate is negotiated between any MCO-hospital pairs. In addition to simplifying the analysis, the reimbursement rates established between an MCO and hospital are private information.

with the MCO in our model will be either an individual non-system hospital or the set of hospitals associated with a particular system in a particular metropolitan area or patient market.[13] That is, we assume that a set of local system hospitals effectively acts as one hospital with multiple geographic locations. In practice, some larger hospital systems may negotiate a contract that covers hospitals in multiple metropolitan areas. Patients in one market will not view hospitals in another market as substitutes; however, so the surplus generated by the contract will be *equivalent* to the sum of the surpluses from each local patient market so its bargaining position *will be the same* relative to when contracts are negotiated separately across markets. To simplify the exposition of the model we will use the term *hospital*—be it a single non-system hospital or a group of system hospitals within the same patient market—to refer to the unit negotiating with the MCO.

Under assumptions A1–A3, every contract negotiation between a hospital (i.e., a single non-system hospital or a hospital system) and an MCO can be thought of as an independent bilateral bargaining game. We are interested in allowing hospitals and systems with different characteristics to have different degrees of bargaining power. To facilitate this we adopt an approach similar to Brooks et al. (1997) and Grennan (2013) and employ a version of the cooperative bargaining model developed by Nash (1950, 1953) which includes an asymmetric bargaining power parameter.[14]

The outcome of the bilateral bargaining game depends heavily on the party's disagreement points. In practice, these payoffs depend on how an MCO's enrollees will change their hospital choice if a hospital is removed from their provider network. We make the assumption that if a hospital does not contract with a particular MCO, then the hospital will no longer treat patients from that MCO, and the MCO's enrollees that would visit that hospital upon falling ill will instead visit a different hospital within the network. There are

[13] Patient markets are defined according to the U.S. Census Bureau's Metropolitan Statistical Areas (MSAs) with some further delineation by metropolitan divisions within the San Francisco Bay and Los Angeles MSAs. Using this definition, adjacent patient markets provide virtually no additional market power. For example, the aggregate willingness-to-pay for system hospitals in a particular patient market increases by less than 0.001% when any system affiliate outside the market is removed from patients' choice sets.

[14] Binmore et al. (1986) model the bilateral bargaining process as a strategic game of counter offers and show that at the limit the strategic game results in the same division of the surplus as Nash's cooperative bargaining game.

several reasons why we think this assumption is appropriate for this setting. First, since a majority of private insurance in the U.S. is provided by employers, individual enrollees are quite limited in their ability to switch MCOs in the short-run. Second, for most acute illnesses enrollees are not likely to have already determined a favored provider and will consult their MCO's current network provider list when they fall ill. Existing empirical evidence also suggests that few enrollees switch MCOs in response to a change in the provider network. For example Ho (2006) uses data on managed care plans and networks to estimate the demand for managed care coverage as a function of observables including the estimated utility of the associated hospital network. Applying her elasticity estimates to California suggests that, on average, an MCO will lose less than 1% of its enrollees to other MCOs when a system is removed from its network.[15] Confirming that the results are robust to this assumption, in Appendix C we use the elasticity estimates implied by Ho (2006) to estimate a more flexible empirical model that allows patients with less suitable alternatives to be more likely to stay with the hospital upon removal from the MCO's network and find that the point estimates only decrease by about 2 to 10 percent.

Following the institutional motivation above, we make the following assumptions regarding the nature of the bilateral bargaining game:

A4. Systems negotiate a shared contract on behalf of all member hospitals within a single patient market.

A5. When a hospital is removed from an MCO's network, the MCO's enrollees no longer visit that hospital and choose from the remaining hospitals in the MCO's network.

Applying assumptions A4 and A5, the disagreement point for hospital (or system) h negotiating with MCO m is the profit that h receives when it is not in MCO m's network $\mathcal{M}$, which we denote as $\Pi_h(\mathcal{H} \setminus m)$. Similarly the disagreement point for MCO m is the profit

[15] Ho (2006) estimates that the price elasticity of demand is -1.24 and that a one standard deviation increase in expected utility is equivalent to a $39 decrease in the premium. Together these suggest that a one standard deviation drop in the expected utility of a hospital network results in a loss of 31% of the enrollees. In California the standard deviation in the distribution of expected utility is 2.451 *utils* and the average change in the expected utility from removing a hospital or system from a choice set is 0.034 (0.212) and 0.079 (0.316) *utils*, respectively. These values suggest that the removal of a hospital or system will, on average, lower an MCO's demand by 0.4% and 0.9%, respectively.

m receives when h is not in its network, denoted as $\Pi_m(\mathcal{M} \setminus h)$. The profits received by the hospital and MCO when they successfully negotiate a contract are denoted as $\Pi_h(\mathcal{H})$ and $\Pi_m(\mathcal{M})$, respectively. The objective function for MCO m and hospital h can thus be expressed as

$$\max_{p_{hm}} \big[\Pi_m(\mathcal{M}) - \Pi_m(\mathcal{M} \setminus h)\big]^{1-\alpha_h} \big[\Pi_h(\mathcal{H}) - \Pi_h(\mathcal{H} \setminus m)\big]^{\alpha_h}, \tag{4}$$

where α_h is hospital h's bargaining power vis-à-vis MCO m and p_{hm} is the vector of prices agreed to by MCO m and hospital h.[16]

The additional profits earned by the hospital and MCO from successfully contracting can be expressed as:

$$\Delta_h \Pi_m(p_{hm}) = \Pi_m(\mathcal{M}) - \Pi_m(\mathcal{M} \setminus h) = \Delta_h W_m(\mathcal{M}) - \Delta_h R_m(P_{\mathcal{M}}), \tag{5a}$$

$$\Delta_m \Pi_h(p_{hm}) = \Pi_h(\mathcal{H}) - \Pi_h(\mathcal{H} \setminus m) = p_{hm} D_h(\mathcal{M}) - \Delta_m C_h\big(D_h(\mathcal{M})\big), \tag{5b}$$

where $\Delta_h W_m(\mathcal{M})$ is the change in willingness-to-pay as defined in eq. (2);[17] $\Delta_h R_m(P_{\mathcal{M}})$ is the difference in MCO m's reimbursements to hospitals that occurs when hospital h is removed and m's enrollees reallocate themselves to the remaining hospitals and the equilibrium reimbursement matrix is $P_{\mathcal{M}}$; [18] $D_h(\mathcal{M})$ is the expected demand for hospital h from enrollees in MCO m's network $\mathcal{M}$; and $\Delta_m C_h\big(D_h(\mathcal{M})\big)$ is the expected change in cost to hospital h when it joins MCO m's network causing an increase in demand from m's enrollees. When h represents a group of system hospitals operating in the same patient market then $\Delta_h W_m(\mathcal{M})$ represents the change in willingness-to-pay when the entire

[16] For simplicity we are assuming that both for-profit and not-for-profit hospitals want to maximize the joint surplus from treating privately insured managed care patients subject to their bargaining power. There is considerable evidence suggesting that for-profit and not-for-profit hospitals act similarly (Sloan, 2000), particularly with respect to financial incentives (Keeler et al., 1999; Duggan, 2000).

[17] Following the option-demand literature, Equation 5a assumes that any increase in enrollees' willingness-to-pay for the provider network is captured by the MCO through an increase in premiums. However, our final estimation model (discussed on page 17) only requires that changes in premiums are proportional to changes in willingness-to-pay. We find that this proportion is slightly different between rural and urban markets, though controlling for this difference has no impact on the point estimates for the bargaining parameter estimates and we found no statistically significant difference between regions such as southern California compared to middle and northern California.

[18] Formally: $\Delta_h R_m\big(P_{\mathcal{M}}\big) = \sum_{k \in \mathcal{M}} p_{km} D_k(\mathcal{M}) - \sum_{k \in \mathcal{M} \setminus h} p_{km} D_k(\mathcal{M} \setminus h)$.

system is removed from the choice set and $\Delta_h R_m(P_{\mathcal{M}})$ is the difference in MCO m's reimbursements to hospitals that occurs when all of the system members are removed from the network. Similarly the demand $D_h(\mathcal{M})$ and change in cost $\Delta_m C_h\big(D_h(\mathcal{M})\big)$ represent the aggregated demand and total change in cost for all hospitals in the system in that market.

By plugging the profits into (4) and taking the first-order condition, the bargaining outcome can be expressed as

$$\Delta\Pi_h(p_{hm}) = \alpha_h\big[\Delta_h W_m(\mathcal{M}) - \Delta_m C_h\big(D_h(\mathcal{M})\big) - \Delta_h R_m(P_{\mathcal{M}}) + p_{hm} D_h(\mathcal{M})\big]. \tag{6}$$

The term in brackets on the right-hand side represents the total amount of surplus generated by h and m successfully negotiating a contract. To simplify the notation somewhat, we will refer to this surplus as $\Delta S_{hm}(\mathcal{M})$. The surplus is a function of the value the hospital brings to an MCO's network, the hospital's treatment costs, and the reimbursement rates for alternative hospitals, which together constitute the hospital's bargaining position. The observed profit for a given hospital is therefore a function of the hospital's bargaining position (the surplus it generates) and its bargaining power α_h.

Estimates of the demand and cost functions can be used to generate predicted values for each term in the surplus except $\Delta_h W_m(\mathcal{M})$. As our patient choice data does not include out-of-pocket costs we cannot estimate γ_p in the demand specification and use that estimate to calculate the value of adding a hospital to an MCO in dollars ($\Delta_h W_m(\mathcal{M}) = \gamma_p^{-1}\Delta_h V_m(\mathcal{M})$). Instead we include $\gamma_p^{-1}\Delta_h V_m(\mathcal{M})$ in the bargaining regression and jointly estimate γ_p^{-1} with α_h. This is possible because γ_p^{-1} is identified by variation in the hospital's incremental utility relative to its reimbursement rate while α_h is identified by variation in the *entire* incremental surplus of the contract relative to the hospital's incremental profit.

To further identify how hospital, system, and market characteristics affect the bargaining power of hospital h the bargaining power, α_h, is further parameterized as

$$\alpha_h \equiv \alpha_0 + \beta H_h + \delta G_h + \eta M_h + \varepsilon_h, \tag{7}$$

where H_h is a vector of either the individual hospital's characteristics or the aggregate characteristics of the individual system hospitals within a single patient market that affect bargaining power (e.g., ownership type, physician arrangements, teaching status, system membership), G_h is a vector of system characteristics that affect bargaining power (e.g., the number of member hospitals, the number of markets in which the system operates, whether the system contains a teaching hospital), M_h is a vector of market characteristics for h's market that affect bargaining power (e.g., the concentration of MCOs), and ε_h is a mean zero, independently distributed, heteroskedastic random variable that captures unobserved heterogeneity that affects hospitals' relative bargaining power. The resulting first order condition becomes:

$$\Delta\Pi_h(p_{hm}) = \left(\alpha_0 + \beta H_h + \delta G_h + \eta M_h + \varepsilon_h\right) \times \Delta S_{hm}(\mathcal{M}). \tag{8}$$

Though we have imposed a significant amount of structure to the model the separate identification of bargaining position and bargaining power is relatively straightforward and does not rely heavily on any particular functional form. Identification results from the fact that each component of the model is estimated using its own independent source of observable variation in the data. Surplus, which identifies a hospital's bargaining position, is calculated using estimates from the first-stage demand and cost models. The parameters of the demand model, which are used to calculate willingness-to-pay, are identified by variation in the frequency with which patients choose to visit a hospital as a function of its observable characteristics. The cost model parameters are identified by relating variation in the reported operating costs to observable characteristics of the hospital and its inputs and outputs. The bargaining power parameters are then identified by relating the predicted surplus with additional data on average reimbursement rates used to calculate hospital profit. Although these different component regressions share some of the same independent variables, no strong exclusion restrictions are necessary as the separate identification of the parameters is driven by variation in the different dependent variables from each step. Nevertheless, the presence of excluded variables in each step helps to ensure that identification

is largely driven by the data rather than functional form.

With data on average negotiated reimbursement rates for each hospital-MCO pair and the identities of the MCOs to which each patient is enrolled the model in (8) could be estimated directly. Unfortunately we don't observe which patients are enrolled in which MCOs and only have data on the average negotiated reimbursement rates for each hospital rather than for each hospital-MCO pair. Consequently, we aggregate the hospital-MCO level model in (8) to the level of the data by summing across MCOs that the hospital negotiates with to generate the following estimation model:

$$(9) \qquad \sum_{k \in \mathcal{H}} \Delta_k \Pi_{ht}(p_{hkt}) = (\alpha_0 + \beta H_{ht} + \delta G_{ht} + \eta M_{ht} + \varepsilon_{ht}) \times \left[\sum_{k \in \mathcal{H}} \Delta S_{hkt}(\mathcal{M}) \right],$$

in which time subscripts are included to reflect that an observation in our estimation is a hospital in a given year and ε_{ht} may be correlated across time for each hospital.[19] When the incremental willingness-to-pay terms within the contract surplus for each hospital-MCO pair are summed across MCOs they represent the total willingness-to-pay for the hospital across all managed care patients predicted to visit the hospital in a given year. This value is estimated using the results of the demand model. The sum of the hospital's revenues from each MCO contract is the total revenues received by the hospital from managed care patients. Due to the nonlinearity of the cost function, however, the sum across MCOs of the hospital's incremental cost of treating each MCO's patients is not the same as the total incremental cost of treating all managed care patients. As we do not observe the number of patients each MCO sends to each hospital, we must approximate the sum of the hospital's incremental costs based on a hypothetical set of MCO patient shares. For example, if there are only five MCOs sending a similar number of patients to the hospital then the approximate incremental costs of treating these patients is the incremental cost of treating

[19] Eq (9) can also be expressed as:

$$\sum_{k \in \mathcal{H}} \Delta_k \Pi_{ht}(p_{hkt}) = (\alpha_0 + \beta H_{ht} + \delta G_{ht} + \eta M_{ht}) \times \left[\sum_{k \in \mathcal{H}} \Delta S_{hkt}(\mathcal{M}) \right] + \upsilon_{ht},$$

where υ_{ht} is a multiplicatively heteroskedastic error term that is independently distributed across hospitals.

20 percent of the MCO patients times five. We estimate the model under several different assumed MCO shares (7.5%, 15%, and 30%) to test the robustness of the results to the approximation.[20]

Equation (9) is estimated using the method of maximum likelihood. Despite aggregation to the hospital level, identification of the bargaining power parameters occurs in essentially the same way it would if (8) were estimated at the hospital-MCO level except that it is now based entirely on variation across hospitals in the average reimbursement rate and the incremental surplus generated by contracting with the average MCO. In addition, though the model as presented has assumed the hospital's bargaining power to be constant across MCOs, this is not necessary. If the true bargaining power of the hospital differs across MCOs, then the overall estimated bargaining power term α_{ht} in (9) represents an average of the hospital's MCO-specific relative bargaining power terms weighted by the incremental surplus generated by contracting with that MCO.[21] As a result, the hospital's MCO-specific bargaining power with larger MCOs or MCOs with more complex patients (since output reflects treatment severity) would have a larger influence on that hospital's overall estimated bargaining power.

III. Data

We utilize data from several sources. Hospital characteristics come from the American Hospital Association's (AHA) 2007 and 2008 Annual Survey of Hospitals, the AHA's Hospital Guide for 2007 and 2008, and the California Office of Statewide Health Planning and Development (OSHPD) Financial Disclosure Reports for 2001 through 2009. Financial data also come from the OSHPD Financial Disclosure Reports and discharge data come from the OSHPD Patient Discharge Reports for 2007 and 2008.

[20] Although there are nearly 50 MCOs in California, the market is predominately covered by a small number of insurers with the largest five insurers accounting for about 80 percent of the market (Table A-5 in Appendix A lists the top ten insurers and their market share).

[21] This is straightforward to show by replacing the α_h in (6) with a hospital-MCO specific term α_{hm}, aggregating across MCOs and then dividing through by the total aggregate surplus generated by contracting with all MCOs to get:

$$\frac{\sum_{k\in\mathcal{H}} \Delta_k \Pi_{hkt}(p_{hkt})}{\sum_{k\in\mathcal{H}} \Delta_k S_{hkt}(\mathcal{M})} = \sum_{k\in\mathcal{H}} \frac{\alpha_{hkt}\Delta S_{hkt}(\mathcal{M})}{\sum_{j\in\mathcal{H}} \Delta_j S_{hjt}(\mathcal{M})} = \alpha_{ht}.$$

The AHA survey has data for 399 of the 459 California hospitals. Our focus is on private, general acute-care hospitals so we exclude from the analysis Kaiser hospitals, which are integrated HMOs, Veteran's Administration and military hospitals, Shriner's hospitals for crippled children as well as psychiatric, chemical dependency, and long-term care hospitals. Non-federal government hospitals (city, district, county, University of California, and state) are included in the choice sets for demand estimation since they are available substitutes, but are not included in the second stage bargaining analysis. An additional 25 private, acute-care hospitals are excluded from the second stage because they did not report their revenues and/or costs. The demand estimates include a total of 343 hospitals and the second-stage bargaining estimation includes 249 hospitals.

The hospital characteristics reported by the AHA include properties of the hospital such as its ownership type (government, profit, and non-profit), teaching status, and system and network membership, as well as dummy variables for the services the hospital offers. Summary statistics can be found in Table A-3 in Appendix A.

The OSHPD Patient Discharge Reports contain 4,012,774 and 4,017,998 discharges for all hospitals in the state of California for 2007 and 2008, respectively. Only acute care discharges for patients enrolled in a private, managed care insurance plan or a Medicare Advantage plan are used in the demand estimation.[22] Furthermore, as our model is based on MCOs which form broad networks we include only the managed care patients enrolled in either a PPO plan or one of the top five HMO plans (excluding Kaiser Permanente). We do not explicitly observe the networks of contracted hospitals for each MCO; however, the OSHPD discharge abstracts identify patients' HMO (when enrolled with an HMO). We consider a hospital as being in a provider network if it treats at least 25 patients who were *not* admitted through the ER from that HMO.

We eliminate all discharges for intermediate and skilled nursing, psychiatric, chemical dependency, and physical rehabilitation care as well as all self-pay, worker's compensation

[22]Medicare Advantage plans are managed care plans provided by private insurers, but heavily subsidized by the federal government. They must offer a benefits package that is at least as good as traditional fee-for-service Medicare including first-dollar coverage and, like a regular private insurance plan, negotiate reimbursements with hospitals.

and Medi-Cal patients.[23] Of the 25 Major Diagnostic Categories (MDCs) defined by the Centers for Medicare Services (CMS), we eliminate those MDCs accounting for less than one half of a percent of the total discharges for the two patient groups as well as the discharges related to newborns and neonatal care leaving 18 MDCs.[24] We also exclude all discharges for other unknown types of admission, admissions for patients with a masked age category, admissions for patients not originating from the state of California, and admissions from hospitals over 90 minutes from the patient's zip code, which account for less than 2 percent of the discharges.[25] The final sample used to estimate the demand system contains 1,361,847 discharges.[26] About 17% (227,715) of these discharges are for patients insured by a Medicare Advantage plan with the remaining 83% representing normal privately insured patients.

The OSHPD Financial Reports include data on each hospital's total operating costs as well as the gross and net revenues by payer and insurance type—traditional Medicare, Medicare Advantage, private indemnity, private managed care, Medi-Cal indemnity, Medi-Cal managed care, etc. The reports also include data on the number of in-patient days, discharges, and out-patient visits by payer. The total annual operating expenses, in-patient days, and out-patient visits, and hospital characteristics (number of beds, nurses, and staff, teaching status, for-profit status, etc.) from the 2001 to 2009 reports are used to estimate the hospital cost functions.

To predict a hospital's revenues and the difference in the MCOs' reimbursements that occur when a hospital is removed and their enrollees reallocate themselves to the remaining hospitals ($\Delta_h R_m(P_{\mathcal{M}})$ in eq. 6) we use data from the OSHPD Discharge and Financial Reports to estimate the average revenue per in-patient day for each type of insurer (Medicare Advantage, private managed care), each MDC, and each admittance type (ER, non-ER) for

[23] Medi-Cal patients may have a very restricted choice-set and worker's compensation and self-pay patients may also have preferences differing significantly from the privately insured population.

[24] The seven MDCs eliminated include: eye diseases and disorders, mental diseases and disorders, burns, multiple significant trauma, human immunodeficiency virus infections, newborns and neonatal care, and alcohol-drug use and alcohol-drug induced mental diseases.

[25] Travel time is calculated using the Google Maps API and represents the travel time from the patient's home zip code centroid to the hospital taking into account traffic patterns, speed limits, and stop lights.

[26] Summary statistics can be found in Table A-7 in Appendix A

a total of $2 \times 18 \times 2 = 72$ reimbursements for each hospital-year. Because OSHPD reports both the gross charges (the list price for the services offered) and the net revenues (the actual amount received reflecting contractual discounts) as aggregates for each payer, the reimbursements are calculated by multiplying the deduction ratio (net revenues by payer divided by gross charges by payer) by the total gross charges for all discharges belonging to the specific MDC and having the specified admittance type. For example, the reimbursement for an in-patient day for a Medicare Advantage (MCA) patient who was admitted through the emergency room (MCA-ER) and has a diagnosis in MDC 1 is calculated as:

$$\text{Avg. Rev./Day} = \frac{\text{Net Rev. for MCA}}{\text{Gross Chrg. for MCA}} \times \frac{\text{Total I.P. Charges for MCA-ER in MDC1}}{\text{Total I.P. days for MCA-ER in MDC1}}.$$

Lastly, the demand estimation and one of the costs specifications also use the DRG weights published by the CMS for the years 2001–2009. The CMS constructs these relative weights to index the average cost of treating a diagnosis within each DRG to determine how much providers are paid for treating Medicare patients. We utilize these weights as indicators of the relative severity of observed discharges.

IV. Estimation and Results

A. Demand

The demand specification contains an array of 189 patient and hospital level characteristics. Patient (or discharge) level variables include gender, age category, race, zip code median income, travel time to the hospital, DRG-weight, and indicators for the MDC associated with the discharge. Hospital level characteristics include fifteen service related variables as well as variables related to ownership, for-profit status, system status, research expenditures per patient, and relationships with physicians' groups. We interact many of the MDCs with these services when relevant to the MDC to further account for the preference differences that occur because of differences in service offerings. For example, discharges for child birth are interacted with a dummy indicating if the hospital has a birthing room or provides specialty obstetrics services (see appendix table A-1 for a list of the in-

cluded services and the MDC with which they are interacted). We also include a dummy variable indicating if the particular DRG was associated with cancer to be interacted with hospital service dummies indicating if the hospital offers chemotherapy or has an oncology department. The effects of for-profit or government status are allowed to vary across MDCs and DRG-weights are interacted with hospital type and status, as well as the hospital's research expenditures to account for preference differences associated with illness severity. Demand is estimated separately for the privately insured, who mostly have employee sponsored insurance, and those enrolled in a Medicare Advantage plan to allow for different preferences between these two groups.

As our focus is on the factors that contribute to higher reimbursement rates for system hospitals, we include variables indicating whether a hospital is in a system, whether that system is for-profit, and whether that system is local or national in scope to account for any differences in patients' willingness-to-pay due to unobservable quality differences of system hospitals. These system membership variables are also interacted with MDC indicators to capture the possibility that system hospitals may focus on providing higher quality care for specific types of diagnoses. The inclusion of the various system types and interactions with diagnostic category also allows for more flexible substitution patterns based on system and disease characteristics ensuring that any differences in the demand for system hospitals are incorporated into the bargaining position of these hospitals rather than being mistakenly identified as a difference in bargaining power.

Each patient's choice set includes all hospitals that are within a 60 minute drive from the patient's zip code centroid but exclude hospitals that do not report any discharges from the MDC associated with the patients' diagnoses (these are typically specialty hospitals and surgical centers). Additionally, for patients belonging to one of the top five largest HMOs, we exclude any hospitals that appear to be outside their HMO's network of contracted hospitals as defined in the previous section.[27] An alternative approach taken by Capps et al.

[27]While this is somewhat inconsistent with the assumptions of the bargaining model it is more important that the demand estimates accurately reflect patient preferences since they are used to estimate the incremental willingness-to-pay for a hospital as well as to predict patient substitution patterns when a hospital is removed from a choice set.

(2003), Ho (2006), and Ho (2009) is to estimate demand using only indemnity patients who are not restricted to provider networks with the assumption that preferences over hospitals do not differ between those enrolled in traditional indemnity insurance and those enrolled in managed care plans. For robustness, we also estimate our model using this approach and find very similar results to our main analysis (see, Appendix B). In our judgement, however, very few privately insured patients have indemnity coverage (about 1 percent nationally) so the benefit of estimating demand using the same patients that are relevant for the bargaining model outweighs the potential for small biases that could be generated by some unobserved restrictions in the MCO patients' choice sets. Constructed this way, the average choice set contains 60 hospitals and the average travel time to a chosen hospital is 21 minutes while the average travel time to a hospital in one's choice set is 36 minutes.[28]

Table 1 reports coefficient estimates for a selection of hospital characteristics and services. The first column reports the base coefficient estimate while the second column reports the coefficient for the hospital characteristic or service interacted with the patient's travel time to a hospital in minutes. The final two columns of Table 1 help to illustrate the impact that each characteristic has on hospital choice. Column 3 reports the marginal effect of each hospital characteristic or service on the probability of choosing a hospital, evaluated at the average choice probability and mean travel time to chosen hospitals. Column 4 reports the average change in a patient's utility (in *utils*) or value for a hospital derived from that characteristic or service, again evaluated at the average travel time to chosen hospitals.

The estimates are of similar magnitude to those reported in Town and Vistnes (2001) and Ho (2006), also indicating that patients are more likely to go to closer hospitals and patients who are more severely ill (measured by their DRG weight) are generally willing to travel a little further. If we assume that the chosen hospital is the hospital with the highest predicted choice probability, then the model correctly predicts slightly more than 39% of the hospital choices indicating that it has reasonably good fit considering the large number of hospitals available to patients. The marginal effect estimates indicate that many hospi-

[28] Appendix table A-4 provides the frequency distribution of choice set sizes.

TABLE 1—SELECTED DEMAND ESTIMATES AND EFFECTS

	Estimates				Effects	
Characteristic	Intercept		Interaction w/ travel time		Marginal ($\partial P/\partial x$)	Util Diff. (ΔV)
Travel Time	-0.177	(0.001)	–	–	-0.132	-3.712
Research \$1000/Patient	0.067	(0.006)	0.016	(< 0.001)	0.002	0.403
$\times$DRG-weight	-0.052	(0.004)	0.001	(< 0.001)	-0.001	-0.025
Specialty	0.125	(0.035)	0.002	(0.001)	0.005	0.175
$\times$DRG-weight	-0.562	(0.027)	0.010	(0.001)	-0.009	-0.350
Trauma Center	-0.630	(0.009)	0.018	(0.000)	-0.005	-0.255
$\times$DRG-weight	0.146	(0.005)	-0.004	(0.000)	0.002	0.070
$\times$ER	0.663	(0.010)	-0.016	(0.000)	0.007	0.322
Hospital Services						
Neurological services	0.175	(0.028)	0.034	(0.001)	0.030	0.889
Adult diagnostic/invasive cath.	0.772	(0.024)	0.010	(0.001)	0.030	0.992
Adult cardiac surgery	0.297	(0.020)	0.004	(0.001)	0.012	0.382
Medical/surgical intensive care	0.696	(0.009)	-0.012	(< 0.001)	0.011	0.437
Orthopedic services	0.422	(0.016)	0.007	(0.000)	0.018	0.577
Obstetrics care	1.769	(0.021)	-0.016	(0.001)	0.039	1.431
Birthing room/LDR/LDRP room	0.493	(0.016)	-0.004	(0.001)	0.011	0.414
Oncology Services and Chemotherapy	0.696	(0.009)	-0.012	(< 0.001)	0.011	0.437

Note: All services are interacted with a specific diagnostic category. Table A-1 provides a list of the diagnostic categories used for each interacted service. The column "Interaction w/ travel time" reports the coefficient estimate for the hospital characteristic interacted with patient travel time. Marginal effects and *util* differences are evaluated at the mean travel time for the chosen hospital (21 min.) and for the marginal effects at the mean choice probability (.029) for all hospitals in a patient's choice set. Marginal effects and *util* differences account for both the intercept and interaction terms. The util difference represents the difference in *utils* of a hospital with the characteristic compared to an identical hospital without the characteristic.

tal characteristics can have a sizable impact on hospital choice probabilities. For example, every \$1,000 of research spent per patient makes a hospital about 7% more likely to be chosen by the average patient than an otherwise comparable hospital and patients are generally more willing to travel further to go to a hospital with significant research spending. Many service offerings have an even larger impact on the choice probabilities.[29] For example, the coefficient estimates imply that patients visiting a hospital for child birth are about 40 percent more likely to choose a hospital that has a dedicated birthing room.Because system status is also interacted with the diagnostic categories and profit status its effect on hospital

[29]Note that many of the service variables likely function as a proxy for other unobserved dimensions of quality that are correlated with the provision of that service. This is particularly true since most services are interacted with a specific MDC and hospitals may differentiate themselves by focusing on some specific MDCs.

choice cannot be easily separated. However, these extensive interactions allow for more flexible substitution patterns based on system and disease characteristics insuring that any differences in the demand for system hospitals are captured and incorporated into hospitals' bargaining position rather than mistakenly identified as a difference in bargaining power.

B. Cost

Recall that the estimated cost function is used to predict the marginal cost of providing inpatient care to an MCO's enrollees. Enrollees of different MCOs may have different case mixes or illness severities, which can impact a hospital's expected marginal costs. To account for this, we consider two measures of inpatient output. The first measure, patient days, will be appropriate if the costs of caring for an admitted patient are relatively similar across diagnoses and the additional costs associated with more severe patients are largely reflected in the length of stay. Given that costs may also vary significantly across patients having similar lengths of stay we also construct a second output measure using the DRG cost weights published by CMS. These weights are intended to reflect the average cost of treatment for an inpatient discharge within each fairly narrow diagnostic category. However, these weights only reflect the average severity of patients in a particular DRG. To account for the possibility that some hospitals tend to attract more (or less) severe patients than the average from a given DRG we create a case-mix adjusted DRG weight by multiplying the DRG weight by the average length of stay for a patient at that hospital having that DRG relative to the average length of stay for a patient having that DRG within California. We then construct our severity adjusted measure of inpatient output for each hospital as the average case-mix adjusted DRG weight across the hospital's observed managed care discharges. Our cost model also includes out-patient visits as a separate output.

Both inpatient and outpatient outputs enter the cost function separately for each of the three main payer types: Medicare, privately insured, and a catch-all for all other payers such as Medi-Cal, self-pay, and workers compensation. The coefficients of interest for the purposes of estimating the marginal costs of treating managed care patients are the coefficients associated with in-patient care for Medicare and privately insured patients. All of the

TABLE 2—SUMMARY STATISTICS FOR BARGAINING VARIABLES

Variable	N	Mean	Std. Dev.	Min.	Max.
Market Share	304	0.283	0.244	< 0.001	0.965
HHI^{Hosp} – HHI^{HMO}	304	0.024	0.181	-0.343	0.649
Predicted Patient Days (/1,000)	304	12.503	14.814	0.003	94.219
Physician Group	304	0.225	0.398	0	1
Specialty	304	0.057	0.231	0	1
Trauma Center	304	0.210	0.376	0	1
Teaching Hospital	304	0.036	0.159	0	1
Rural Hospital	304	0.100	0.287	0	1
For-Profit	304	0.322	0.468	0	1
% ER Discharges	304	0.728	0.240	0	1
System Member	304	0.569	0.496	0	1
System-Specific Variables	**N**	**Mean**	**Std. Dev.**	**Min.**	**Max.**
System Member					
$\times$ FP	173	.376	.236	0	1
$\times$ NFP	173	.624	.236	0	1
# Hospitals					
$\times$ FP	65	44.985	50.319	1	175
$\times$ NFP	108	19.231	13.824	2	43
# States					
$\times$ FP	65	9.889	9.084	1	28
$\times$ NFP	108	1.648	1.376	1	9
Geographic Concentration					
$\times$ FP	65	0.433	0.402	0.064	1
$\times$ NFP	108	0.898	0.195	0.263	1

Note: The summary statistics for system-specific variables are based on only system hospitals of the type specified. There are a total of 173 system hospital observations. There are 65 for-profit system hospital observations and 108 not-for-profit system hospital observations.

hospital outputs are also interacted with hospital ownership type, teaching status, trauma center status, rural status, and system status to account for any marginal cost differences between hospital types.

Our objective is to capture the observed variation in costs across hospitals and both specifications appear to accomplish this. As our main interest is in the bargaining power estimates we have relegated the reporting of the cost function estimates to Appendix B. However, in the next section we investigate how the cost specifications impact the bargaining power estimates.

C. Bargaining Power

The cost estimates are used to calculate the hospitals' expected costs and profits from treating an MCO's enrollees. Because the estimated cost function is nonlinear, however, the sum of a hospital's incremental costs of serving each MCO's enrollees is a function of the MCOs' market shares, which must be approximated due to lack of data. Given an assumed market share s, the change in a hospital's cost is calculated by subtracting the cost of treating $(100-s)\%$ of the predicted managed care patients from the cost of treating all of the managed care patients predicted to visit the hospital since the patients belonging to the MCO represent the hospital's marginal output. The revenues from contracting are calculated by summing the number of in-patient days (predicted using the demand estimates) for managed care patients for each MDC and type of admittance (ER, non-ER) multiplied by the average per diem reimbursement for that MDC and type of admittance. The alternative expenditures for an MCO are calculated by taking the managed care patients predicted to visit a specific hospital and using the demand estimates to simulate where those patients would go if that hospital is removed from their choice set and calculating the predicted revenues for those hospitals. The changes in costs, revenues, and aggregate expenditures are aggregated for system hospitals in the same patient market since these system partners negotiate as one unit while hospital characteristics used to parametrize bargaining power represent averages across system partners within a patient market with the exception of the number of predicted patient days, which reflects the total number of predicted days of inpatient care provided by the system in the local market. This aggregation lowers the final sample size for estimation of the bargaining power model to 304 hospitals/system-market pairs.

Table 3 reports the estimates of our most parsimonious bargaining specification using data constructed in six different ways. Cost estimates in the first three columns are based on using patient-days as the primary output, while costs in columns 4–6 are estimated using DRG-weighted discharges. For each of the two cost models we estimate the bargaining model using representative MCO market shares 7.5%, 15%, and 30%. In addition to the

TABLE 3—DETERMINANTS OF BARGAINING POWER

Dependent Var. $= \Delta\Pi_h$	Cost Specification					
Output:	Patient Days			DRG-Weighted Discharges		
Patient Proportion:	7.5%	15%	30%	7.5%	15%	30%
Base Bargaining Power	0.9859^{**}	1.0474^{**}	1.1041^{**}	0.9544^{***}	0.9567^{***}	0.9533^{***}
	(0.4126)	(0.4368)	(0.4636)	(0.3653)	(0.3621)	(0.3579)
Hosp. Market Share	0.2080	0.2530	0.3107	0.1657	0.1897	0.2489
	(0.2904)	(0.3104)	(0.3356)	(0.2735)	(0.2846)	(0.3129)
HHI^{Hosp} - HHI^{HMO}	0.0454	0.0706	0.1118	−0.0631	−0.0584	−0.0489
	(0.3228)	(0.3601)	(0.4167)	(0.2762)	(0.2884)	(0.3208)
Predicted Patient	-0.0539^{*}	-0.0296^{**}	-0.0166^{**}	-0.0492^{**}	-0.0254^{**}	-0.0137^{**}
Days ($/1000$)	(0.0277)	(0.0146)	(0.0078)	(0.0231)	(0.0118)	(0.0063)
Physician Group	0.2977^{**}	0.3303^{***}	0.3698^{***}	0.2549^{**}	0.2664^{**}	0.2948^{**}
	(0.1266)	(0.1267)	(0.1172)	(0.1061)	(0.1134)	(0.1293)
Specialty	−0.0325	−0.0825	−0.1864	−0.0648	−0.0921	−0.1665
	(0.2122)	(0.2211)	(0.2475)	(0.2026)	(0.2078)	(0.2234)
Trauma Center	0.1355	0.1300	0.1275	0.1395^{*}	0.1378	0.1319
	(0.0985)	(0.1042)	(0.1121)	(0.0804)	(0.0847)	(0.0963)
Teaching Hospital	0.3779	0.4459	0.5381^{**}	0.2483	0.2655	0.3112
	(0.3031)	(0.2945)	(0.2426)	(0.2453)	(0.2532)	(0.2716)
Rural Hospital	-0.2322^{*}	-0.2629^{*}	-0.3021^{**}	−0.1880	−0.1924	−0.2031
	(0.1342)	(0.1409)	(0.1497)	(0.1171)	(0.1207)	(0.1311)
For-Profit (FP)	−0.0450	−0.0407	−0.0387	−0.0254	−0.0198	−0.0049
	(0.0826)	(0.0858)	(0.0862)	(0.0710)	(0.0748)	(0.0841)
% ER Discharges	−0.7259	−0.7786	−0.8231	−0.5714	−0.5619	−0.5261
	(0.4788)	(0.5100)	(0.5462)	(0.4269)	(0.4287)	(0.4333)
System Member	0.2983^{***}	0.3226^{***}	0.3658^{***}	0.2719^{**}	0.2764^{**}	0.2873^{**}
	(0.1068)	(0.1125)	(0.1208)	(0.1222)	(0.1248)	(0.1316)
γ_p^{-1} ($\times 1000$)	2.7127^{**}	2.1777^{**}	1.5221^{**}	2.5091^{*}	2.2899^{*}	1.8097^{*}
	(1.0582)	(0.9068)	(0.7238)	(1.3825)	(1.2459)	(1.0341)
Bargaining Power						
Mean fitted value	0.5862	0.6219	0.6662	0.6537	0.6660	0.6956
Standard deviation	0.2922	0.3116	0.3367	0.2375	0.2395	0.2458
Adj. R^2	0.9181	0.9180	0.9187	0.9523	0.9519	0.9511
N	304	304	304	304	304	304

Note: All specifications include HSA fixed effects. Standard errors are clustered by hospital and adjusted to account for data generated by first-stage regressions following Murphy and Topel (1985).
Significance Levels:*** p $<$ .01, ** p$<$ .05, * p $<$ .1

variables listed in the table, each specification also includes a complement of 13 health service area dummies to further control for differences across markets. All standard errors are clustered by hospital and, following Murphy and Topel (1985), adjusted to account for the data generated from the first-stage cost and demand estimations. While the two approaches to controlling for case mix in the cost estimations appear to differ in how they control

for cost variation across hospitals, the parameter estimates are fairly consistent across cost specifications. Furthermore, the point estimates are also consistent across assumed MCO market shares, though the magnitudes of the point estimates for the bargaining power parameters tend to increase somewhat while the magnitude of the estimation for the price sensitivity of patients, γ_p^{-1}, decreases.

The base bargaining power reported in the first row of Table 3 represents the constant in the linear parameterization of bargaining power. The overall bargaining power for a hospital is found by adding the impact of each of the coefficient estimates for the hospital and market characteristics to this base bargaining power. To provide a sense of the bargaining power implied by the estimates, the mean fitted bargaining power and its standard deviation is reported in the bottom panel of the table. These estimates indicate that there is substantial variation in the bargaining power of hospitals, which is not terribly surprising given the tremendous variation in hospital characteristics as well as in the negotiated prices observed in California (Ginsburg, 2010).[30]

The second parameter is the coefficient on the estimated market share for the hospital. Market share is calculated by taking a weighted average of the market shares of the hospital predicted by the estimated demand in each zip code. Each zip code is weighted based on what percentage of the hospital's total demand that zip code represents. Although the point estimates are positive, there is no significant relationship between market share and bargaining power indicating that if high market share hospitals have higher reimbursement rates, then the additional market power stems from a better bargaining position.

Differences in the local competitiveness of hospitals relative to HMOs are captured by including the difference in hospital HHI to HMO HHI. The HHIs represent the average of the sum of the hospital or HMO market shares squared for each zip code weighted by the percentage of the hospital's total demand each zip code represents. The presumption is that a higher value indicates a more concentrated hospital market relative to the HMO market,

[30]Despite the large standard deviation, fitted values of the bargaining power parameterization rarely fall outside the [0,1] range. Moreover, it should not be surprising that some hospitals might occasionally earn negative profits or have received very attractive contracts that cause MCOs to lose money (temporarily) on the hospitals patients given the uncertainties both parties face when negotiating.

a lower share represents a more concentrated HMO market relative to the hospital market, and a value of zero indicates markets that are evenly balanced. The point estimates are near zero and change sign across cost specifications suggesting there is little relationship between relative concentration and bargaining power in California, which is not surprising given PPOs and the major HMOs in California do not appear to form restrictive networks.

To examine whether bargaining power varies with hospital size we include the predicted number of patient days provided by the hospital or system (in that market). The resulting coefficient estimates are all negative, indicating that larger hospitals have slightly less bargaining power. As with market share, this result does not mean that larger hospitals are unable to exercise market power via their better bargaining position to extract relatively more profit. Given the concavity in the incremental value of adding a hospital to an MCO's network with respect to number of patients, a larger hospital should generate proportionately more surplus than a smaller hospital (Horn and Wolinsky, 1988; Stole and Zwiebel, 1996b; Chipty and Snyder, 1999; Inderst and Wey, 2003); however, if larger hospitals secure higher reimbursements because of such convexities, then this is a consequence of having a better bargaining position.

The parameter, "Physician Group" represents a hospital's affiliation with any type of physician organization such as an independent practice association (IPA). Previous research, including Cuellar and Gertler (2006), has found evidence that hospital arrangements with physician groups lead to higher reimbursement rates, with evidence of increased quality in some cases. In addition, Devers et al. (2003) noted that hospitals were becoming increasingly more integrated with physicians groups highlighting in particular that "greater hospital-physician alignment strengthened hospitals' negotiating leverage and weakened plans' options." We find some evidence in our demand estimates that hospitals affiliated with a physician group tend to have a slightly better bargaining position. The results indicate that hospitals affiliated with a physician group are able to secure about 25% to 35% more of the surplus generated by the hospital-MCO relationship, which could be concerning given the recent emphasis by policy makers to strengthen the vertical relationship be-

tween physicians and hospitals through accountable care organizations.

Indicators for whether the hospital is a specialty hospital (as designated by the AHA), a certified trauma center, a teaching hospital, a for-profit hospital, or is in a rural location are included to further control for hospital differences that may lead to variation in bargaining power.[31] All of these indicators also appear in the demand model and impact hospitals' bargaining positions in various ways; however, including them in the bargaining model controls for any influence they may have on prices via the negotiation process. The results suggest that specialty, rural, and for-profit hospitals have lower bargaining power, though the estimates are generally only significant at the 10 percent level for rural hospitals and insignificant for specialty and for-profit. Teaching hospitals and trauma centers have higher bargaining power but the estimates are generally statistically insignificant.

The share of the hospital's discharges that come through the emergency room are also included to allow for the possibility that hospitals treating large numbers of emergency patients may differ in other unobserved ways or that emergency patients may be considered slightly differently in the underlying bargaining process. Our estimates suggest that hospitals with a higher share of emergency patients have slightly lower bargaining power, though the estimates are not statistically different from zero.

Lastly, some studies (e.g., Melnick and Keeler (2007); Ho (2009)) have found that system hospitals have higher reimbursement rates even after attempting to control for the effect of local market concentration. Our results also indicate that, in addition to improving their bargaining position by increasing concentration within a local patient market, system hospitals have significantly higher bargaining power and extract roughly 30% more of the surplus generated by the hospital-MCO relationship than comparable non-system hospitals. While these two sources of market power are theoretically distinct, one may be concerned that a possible underestimation of the strengthened bargaining position enjoyed by system hospitals could cause any remaining advantage in bargaining position to be mistakenly

[31] For hospital systems each of these variables represents the proportion of the system's hospitals in that local patient market for which the characteristic applies; e.g., a system consisting of four hospitals where 1 is a teaching hospital will have a value of .25.

TABLE 4—BARGAINING POWER WITH AND WITHOUT LOCAL PARTNERS

Dependent Var. $= \Delta\Pi_h$	Cost Specification					
Output:	Patient Days			DRG-Weighted Discharges		
Patient Proportion:	7.5%	15%	30%	7.5%	15%	30%
System Member ...						
with local partners	0.3506^{***}	0.3877^{***}	0.4557^{***}	0.2886^{**}	0.2956^{**}	0.3138^{**}
	(0.1270)	(0.1348)	(0.1466)	(0.1326)	(0.1366)	(0.1464)
without local partners	0.2110^{**}	0.2201^{**}	0.2382^{**}	0.2322^{**}	0.2346^{**}	0.2393^{**}
	(0.1014)	(0.1069)	(0.1131)	(0.1104)	(0.1132)	(0.1199)
$\Pr\left(\beta_{\text{Sys}}^{\text{No Partners}} = \beta_{\text{Sys}}^{\text{Local Partners}}\right)$	0.1282	0.0886	0.0441	0.4312	0.4059	0.3430

Note: Other than system membership, all specifications include the same covariates reported in Table 3. Standard errors are clustered by hospital and adjusted to account for data generated by first-stage regressions following Murphy and Topel (1985).
Significance Levels:*** p $<$ .01, ** p$<$ .05, * p $<$ .1

identified as additional bargaining power. To confirm that this is not driving the bargaining power result we run the same specifications reported in Table 3 but estimate separate bargaining power effects depending on whether or not a hospital has system partners within the same patient market. Table 4 reports the system membership estimates. The results show that even system members without local partners (i.e., those for which system membership generates no improvement in bargaining position) extract about 21 to 24 percent more of the contract surplus.

D. Hospital Systems and Bargaining Power

That system hospitals extract more of the surplus than equivalent non-system hospitals—with and without any local partners—is an important finding in its own right. However, it would be helpful to identify any system characteristics that are associated with bargaining power to better understand its underlying source. As we discussed in the introduction, the theoretical literature on bargaining suggests that information asymmetries, relative risk aversion, and beliefs about the probability of a breakdown in negotiations can all affect relative bargaining power. It is not entirely clear what observable system characteristics are associated with these properties but we believe that the systems size and geographic distribution may be important. For example, larger systems can pool more information together giving it a relative advantage over hospitals without such data (as supported by the Tenet

example discussed in the introduction). Similarly, systems that are diversified into multiple states could also have greater opportunities to gather information and hone negotiation skills because they have to negotiate contracts with many different MCOs in many different markets compared to a large, regionally concentrated system such as Catholic Healthcare West. In addition to the informational advantage, larger systems may both be able to more credibly threaten to walk away from a negotiation while those that are more geographically distributed may be exposed to less risk from a breakdown in negotiations with any one MCO or more generally if the conditions that impact its member hospitals profits are less correlated.

Table 5 reports three specifications incorporating these system characters. All are respectively estimated using the patient-days and DRG-weighted discharge cost specifications and assume the representative MCO has a market share of 15%. Table 5 reports only the system related parameter estimates (see Appendix Tables B-3 and B-4 for complete estimates and additional specifications).

The first specification includes the total number of hospitals affiliated with that hospital's system nationwide and allows the estimate to vary depending on whether it is a for-profit hospital/system or not. We find that not-for-profit systems generally secure about 8 to 9 percent more of the contract surplus for every 10 hospitals in the system. The average not-for-profit hospital system in the US includes 19 hospitals implying that the average system extracts an additional 14 to 20 percent of the surplus generated by the contract than non-system hospitals. Including the square of the system size indicates that the marginal effect of additional hospitals decreases. For the largest not-for-profit systems such as Catholic Healthcare West, which had 43 acute-care hospitals in 2008, this translates into a substantial difference in bargaining power over a smaller system with otherwise similar characteristics. For-profit systems do not exhibit such a strong relationship, though the relationship is likely more difficult to identify given that there are only a few large for-profit systems in our data.

The second specification includes the number of states in which the system has hospi-

TABLE 5—SYSTEM CHARACTERISTICS AND BARGAINING POWER

Output:	Patient Days			DRG-Weighted Discharges		
	I	II	III	I	II	III
FP × System Member	0.1099	0.0703	0.0383	0.0966	0.0795	0.1149
	(0.3306)	(0.3649)	(0.3522)	(0.2144)	(0.2225)	(0.2202)
NFP × System Member	0.1580	0.1287	0.7828***	0.1643	0.1213	0.6671***
	(0.1483)	(0.1299)	(0.1864)	(0.1512)	(0.1190)	(0.1968)
FP × # Hospitals (/10)	0.0007			0.0064		
	(0.0102)			(0.0074)		
NFP × # Hospitals (/10)	0.0879**			0.0752**		
	(0.0433)			(0.0372)		
FP × # States		−0.0029			0.0022	
		(0.0104)			(0.0079)	
NFP × # States		0.1065***			0.0860***	
		(0.0402)			(0.0323)	
FP × Geographic Conc.			−0.0180			−0.0629
			(0.1547)			(0.1395)
NFP × Geographic Conc.			−0.5587***			−0.4717***
			(0.1743)			(0.1422)
Bargaining Power						
Mean fitted value	0.6027	0.6301	0.6176	0.6027	0.6301	0.6176
Standard deviation	0.3103	0.3135	0.3069	0.3103	0.3135	0.3069
Adj. R^2	0.9223	0.9231	0.9244	0.9223	0.9231	0.9244
N	304	304	304	304	304	304

Note: All regressions use 15% of predicted managed care patients for the change in cost calculation. Not all regressors are reported as each specification includes the same controls reported in Table 3. The full results are reported in Appendix B. Standard errors are clustered by hospital and adjusted to account for data generated by first-stage regressions following Murphy and Topel (1985).
Significance Levels:*** p < .01, ** p< .05, * p < .1

tals. The estimated coefficients are positive and significant at the 5 percent level for not-for-profit hospitals and again reveal no systematic relationship for for-profit hospitals. Since some hospitals have a higher concentration of hospitals in certain states we also generate a *geographic concentration* index, which is an HHI-type measure of the sum of squares of the proportion of a system's hospitals in each state. For example, a system that concentrates within only one state (or a small number of states) will have a geographic concentration index of one (or nearly one) while a more geographically dispersed system will have a low geographic concentration. Specifications including the geographic concentration index suggest that geographically disperse not-for-profit systems have higher bargaining power while there continues to be no statistical difference for for-profit systems.

These results reveal that there is not only substantial variation in bargaining power

across hospitals but that system membership and the size of the affiliated system are strong predictors of bargaining power. Furthermore, because system size and geographic distribution represent characteristics that are independent of any individual patient market it is unlikely that the bargaining power differences actually represent some residual or unmeasured differences in bargaining position within the local patient market not captured by the option demand framework. Recall that there may be variation in an individual hospital's bargaining power across negotiations with different MCOs that we are unable to identify using our hospital level data. The fact that we identify higher *aggregate* bargaining power for system hospitals is a strong indication that system membership systematically impacts the bargaining process in important ways.[32]

V. Bargaining Position Versus Bargaining Power

An important advantage of our empirical model is that it enables us to separately identify and study the relative impact of bargaining position and bargaining power on the hospitals' reimbursement rates. The effect of a better bargaining position for a system represents the additional markup in the system's average daily reimbursement that is attributable to its ability to adjust the disagreement point by threatening to withdraw all system members. Similarly, the impact of bargaining power is represented by the additional markup in the system's average daily reimbursement that is attributable to the larger bargaining power parameter associated with system characteristics that would not be present if each member hospital had operated individually.[33]

For each hospital system in each patient market we utilize the parameter estimates of the model to measure the improvements in bargaining position and bargaining power that the hospitals enjoy as a result of being in that system, and then separately compute the impact of each of these effects on the system's markups. Table 6 reports the 75th, 50th,

[32]One might be concerned that unobserved MCO characteristics that are correlated with bargaining power are also correlated with hospital system status. We believe this to not be the case, however. In examining the networks of hospitals for the top five HMOs (excluding Kaiser Permanente), which account for 78% of HMO patients, we cannot reject the null hypothesis that the distribution of system status or system size are the same using a pair-wise Chi-squared test for system status and a Kruskal-Wallis test for the system size.

[33]The impact of bargaining power is calculated by changing the bargaining power parameter for the system while leaving the total surplus of the contract unchanged.

TABLE 6—MARKUP OF AVERAGE DAILY REIMBURSEMENT

		Bargaining Position							
		All System-Market Pairs				System-Market Pairs with Multiple Hospitals			
Output	Model	75th %	50th %	25th %	Mean	75th %	50th %	25th %	Mean
Patient Days	I	51.91	1.48	0.00	87.34	138.38	31.32	9.23	158.88
	II	42.30	1.12	0.00	75.38	114.45	25.93	8.10	137.12
	III	44.71	1.15	0.00	78.62	120.50	27.88	8.73	143.02
DRG-weighted Discharges	I	48.43	1.38	0.00	82.70	132.73	31.37	10.55	150.44
	II	45.29	1.35	0.00	83.99	127.02	30.46	10.24	152.79
	III	48.59	1.41	0.00	89.27	137.17	33.22	10.65	162.39
		Bargaining Power							
		All System-Market Pairs				System-Market Pairs with Multiple Hospitals			
Output	Model	75th %	50th %	25th %	Mean	75th %	50th %	25th %	Mean
Patient Days	I	1543.67	736.68	377.79	1026.56	1367.02	718.93	408.21	938.17
	II	1103.13	666.13	150.76	773.97	1078.73	679.55	184.15	752.16
	III	1081.11	629.91	130.84	749.45	997.19	660.59	130.84	719.73
DRG-weighted Discharges	I	1572.70	941.79	396.49	1022.55	1513.38	952.05	475.94	1028.56
	II	1244.99	767.72	302.54	841.33	1115.64	753.20	371.71	860.07
	III	1207.79	735.30	309.08	799.98	1072.05	737.84	405.30	832.36

Note: The unit of observation is a System-market. Markups represent the increase in a hospital's average daily reimbursement rate that is attributable to system membership. The average for the hospital average daily reimbursement rate for privately insured manage care patients is $3,616 in 2008. Output refers to which output is used to estimate the cost function. Statistics for Market Concentrated Systems are from those systems having more than one member hospital within the same patient market. There are 94 observations in the data consisting of systems having more than one hospital in a local patient market and 79 observations of systems only having one hospital in a local patient market.

and 25th percentiles as well as the average impacts of these two effects for each regression specification reported in Table 5. When there is just one system hospital in a particular patient market then system membership will not change a hospital's bargaining position as the disagreement point still involves removing only one hospital from patients' choice sets. Highlighting this, we separately calculate summary statistics using all system-market pairs and using only system-market pairs which have multiple hospitals within the same patient market.

The findings reveal that differences in bargaining power tend to contribute substantially more to a system's markup than differences in bargaining position. On average, differences

in bargaining power are responsible for adding about $850 using patient days and $888 using DRG-weighted discharges to the average per diem reimbursement whereas differences in bargaining position add about $146 using patient days and $155 using DRG-weighted discharges to the average per diem reimbursement for those hospitals having other local system partners. These lower bargaining position effects occur because most systems do not increase hospital concentration substantially in California. For example, the average change in willingness-to-pay for systems having multiple hospitals in the same patient market is only 2 percent. However, there are some systems, such as Cottage Health System in Santa Barbara or Catholic Healthcare West in the San Luis Obispo area, that do increase concentration enough that their average daily rate is expected to increase by more than $1,000.

While the greater bargaining power possessed by system hospitals allows them to earn substantially higher reimbursement rates, the magnitudes of these additional markups vary substantially across system hospitals. For example, in the DRG-weighed discharges specification there is about a $800 to $900 difference in the additional markup stemming from bargaining power for a hospital in the 75th percentile in comparison to a hospital in the 25th percentile. Nevertheless, differences in bargaining power across hospitals are clearly the strongest contributor to observed differences in reimbursement rates.

Before using these estimates to infer the impact of future mergers or acquisition it's important to note that these partial effects are based on observed differences in the equilibrium levels of bargaining power between system and non-system hospitals. While this raises the possibility that unobservable hospital characteristics may explain some of the variation, the overall magnitude of these differences still suggests that failing to account for bargaining power effects when analyzing the impact of a merger or system acquisition is likely to not only generate misleading predictions, but could *severely* underestimate the impact on prices when a system acquisition involves acquiring a hospital in a market in which the system has little to no presence.

VI. Conclusions

Our findings highlight an important, yet overlooked, channel through which hospital mergers may lead to higher reimbursement rates. While previous studies have shown that merging hospitals can increase their value to MCOs by reducing competition in the local market, our results suggest that mergers may also increase hospitals' bargaining power, allowing them to extract a larger proportion of their value from MCOs. After controlling for the differences in bargaining position we find that system hospitals do extract a larger proportion of their value to MCOs than similar non-system hospitals. Indeed, we find that on average differences in bargaining power contribute much more to the observed price differential between system and non-system hospitals than differences in hospital bargaining position.

The importance of the effect of bargaining power and its association with hospital systems raises important policy questions. Antitrust authorities have largely adopted the option demand approach developed by Town and Vistnes (2001) and Capps et al. (2003) for defining hospital markets and studying competition.[34] This methodology focuses entirely on identifying the effect of a change in bargaining position in the local patient market without considering the bargaining power effects we have identified. As a consequence, recent antitrust analysis has ignored how system affiliations outside the local market may impact prices. For example, an acquisition of a hospital by a large national chain may not increase concentration in the local market, but could increase prices if that hospital now has greater bargaining power due to its affiliation with the national system. Our results indicate that out-of-market acquisitions can generate price effects that merger simulations based on the option demand approach will not capture.

While our structural bargaining model uses economic theory to identify the bargaining power of individual hospitals, we do not rely on any particular theory in specifying the relationships between bargaining power and hospital characteristics. Our approach there-

[34] See Dranove and Sfekas (2009) for an overview of how these methods have been used in antitrust cases. See Farrell et al. (2011) for a description of how the method is used in hospital cases specifically.

fore can only identify correlations relating bargaining power to characteristics including: system membership, system size, and physician group affiliation. The findings, however, mirror several basic predictions from the theoretical bargaining literature. For example, if system hospitals have access to better skilled or informed negotiating teams, then they would exhibit more bargaining power compared to non-system hospitals. Additionally, system hospitals would have a bargaining advantage when negotiating with a risk averse MCO if they can more credibly signal a willingness to terminate negotiations or threaten to exclude all system members from the MCO's network. This latter argument in particular is consistent with concerns that hospital systems leverage their size, both within and across markets, by threatening significant disruption to a large number of the MCO's patients through network withdrawal. Nevertheless, future theoretical or empirical analysis of the mechanisms through which hospital systems or vertical integration more generally may impact bargaining power is likely to be particularly valuable.

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Online Appendix, Not for Publication

APPENDIX A.

TABLE A-1—INCLUDED SERVICES BY DIAGNOSTIC CATEGORY

Service Name	Diagnostic Category
Emergency Room	Unrestricted†
Magnetic resonance imaging	Unrestricted
Neurological services	Nervous System
Adult diagnostic/invasive catheterization	Circulatory System
Adult cardiac surgery	Circulatory System
Esophageal impedance study	Digestive System
Bariatric/weight control services	Digestive System
Medical/surgical intensive care	Unrestricted
Orthopedic services	Musculoskeletal System
Burn care	Skin, Subcutaneous Tissue & Breast
Nutrition programs	Endocrine, Nutritional, & Matabolic
Obstetrics care	Pregnancy & Childbirth
Ultrasound	Pregnancy & Childbirth
Birthing Room	Pregnancy & Childbirth
Oncology services	Any DRG associated with a cancer
Chemotherapy	Any DRG associated with a cancer

Note: † Included only for discharges that were not scheduled 24 hours in advance. All services also include an interaction with travel time in the demand model.

TABLE A-2—TOP 10 MANAGED CARE COMPANIES

HMO	Enrollment	Share
Blue Cross of California	3,913,413	0.2605
California Physicians' Service	2,617,096	0.1742
Health Net of California, Inc.	2,123,679	0.1414
PacifiCare of California	1,283,343	0.0854
Local Initiative Health Authority For L.A. County	773,455	0.0515
Aetna Health of California, Inc.	459,827	0.0306
Inland Empire Health Plan	382,265	0.0255
Orange County Health Authority	351,056	0.0234
Molina Healthcare of California	321,744	0.0214
Heritage Provider Network, Inc.	321,234	0.0214
Total	15,020,203	1.0000

Note: Kaiser Permanente is omitted because it is an integrated manage care network and is excluded from our data.

TABLE A-3—ALL HOSPITAL CHARACTERISTICS ($N = 343$)

Type	Characteristic	Frequency	Type	Characteristic	Frequency
Control	Government	.199	Conditional	Government	.093
	For-Profit	.271	on System	For-Profit	.324
	Non-Profit	.530	Membership	Non-Profit	.583
Status	Teaching	.073	Physician	GPWW	.021
	Rural	.184	Arrangement	IPA	.163

Note: There is no statistical difference between the probability of being a for-profit hospital conditional on being a private hospital in a system ($p < .10$).

TABLE A-4—CHOICE SET FREQUENCY DISTRIBUTION

# Hospitals	Freq.	Percent	Cum.
1 - 9	276,130	20.28	20.28
10 - 19	317,505	23.32	43.60
20 - 29	155,822	11.44	55.04
30 - 39	106,962	7.86	62.90
40 - 49	66,530	4.89	67.79
50 - 59	114,027	8.37	76.16
60 - 69	125,386	9.21	85.37
70 - 79	51,852	3.81	89.18
80 - 89	52,555	3.86	93.04
90 - 99	71,566	5.26	98.29
100 - 109	22,866	1.68	99.97
111 - 119	361	0.03	100.00
Total	1,361,562	100.00	

TABLE A-5—HMO HOSPITAL INCLUSION

	Percentile									
HMO	99th	95th	90th	75th	50th	25th	10th	5th	1st	Mean
Blue Shield	1.00	1.00	1.00	0.92	0.77	0.55	0.42	0.32	0.14	0.72
HPA/PacifiCare	1.00	1.00	1.00	1.00	0.92	0.65	0.54	0.36	0.20	0.82
Aetna	1.00	0.95	0.82	0.61	0.43	0.32	0.27	0.18	0.11	0.48
Health Net of CA	1.00	1.00	1.00	0.99	0.81	0.58	0.42	0.30	0.18	0.75
Blue Cross	1.00	1.00	1.00	1.00	0.94	0.71	0.55	0.45	0.20	0.84
Total	1.00	1.00	1.00	1.00	0.84	0.60	0.42	0.31	0.17	0.77

Note: This table reports the share of hospitals in a patient's provider network (by HMO) for the HMO patients used in the bargaining analysis. Observations are at the patient level.

FIGURE A-1. LOCALIZED SYSTEMS: AHMC, INC.

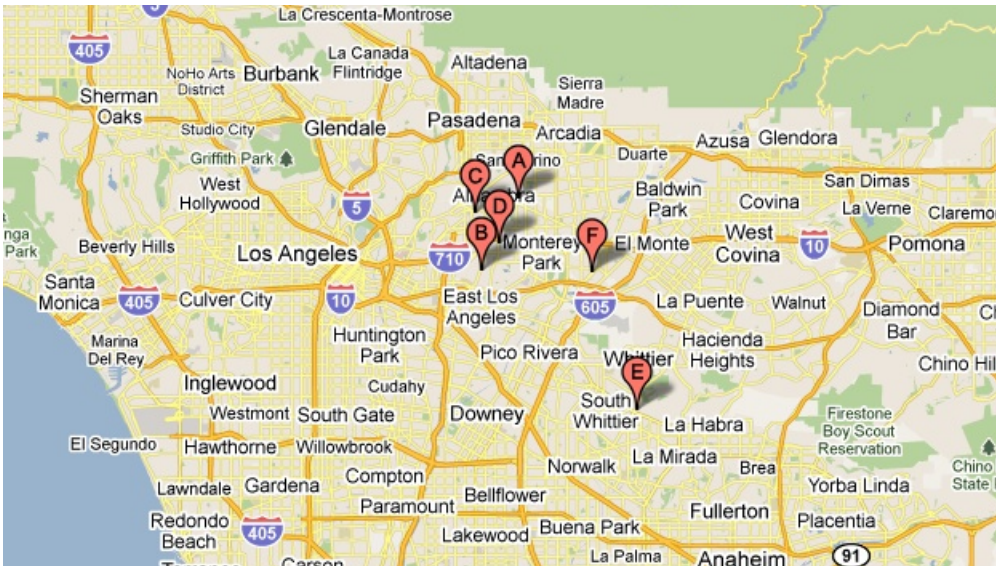


TABLE A-6—HOSPITAL SYSTEM SIZE FREQUENCY DISTRIBUTION

	System-Market Observations			Hospital Observations		
# System Members	N	Freq.	Cum.	N	Freq.	Cum.
1	133	43.75	43.75	133	27.2	27.2
2	10	3.29	47.04	16	3.27	30.47
3	7	2.3	49.34	19	3.89	34.36
4	11	3.62	52.96	38	7.77	42.13
5	9	2.96	55.92	24	4.91	47.03
6	11	3.62	59.54	28	5.73	52.76
8	5	1.64	61.18	5	1.02	53.78
9	11	3.62	64.8	21	4.29	58.08
11	3	0.99	65.79	3	0.61	58.69
12	13	4.28	70.07	25	5.11	63.8
20	5	1.64	71.71	11	2.25	66.05
22	10	3.29	75	20	4.09	70.14
23	10	3.29	78.29	20	4.09	74.23
24	4	1.32	79.61	6	1.23	75.46
27	1	0.33	79.93	4	0.82	76.28
30	1	0.33	80.26	4	0.82	77.1
36	15	4.93	85.2	30	6.13	83.23
39	14	4.61	89.8	29	5.93	89.16
43	2	0.66	90.46	2	0.41	89.57
55	6	1.97	92.43	8	1.64	91.21
62	5	1.64	94.08	12	2.45	93.66
63	3	0.99	95.07	5	1.02	94.68
71	2	0.66	95.72	2	0.41	95.09
74	5	1.64	97.37	12	2.45	97.55
118	2	0.66	98.03	2	0.41	97.96
166	3	0.99	99.01	5	1.02	98.98
175	3	0.99	100	5	1.02	100
	304	100	100	489	100	100

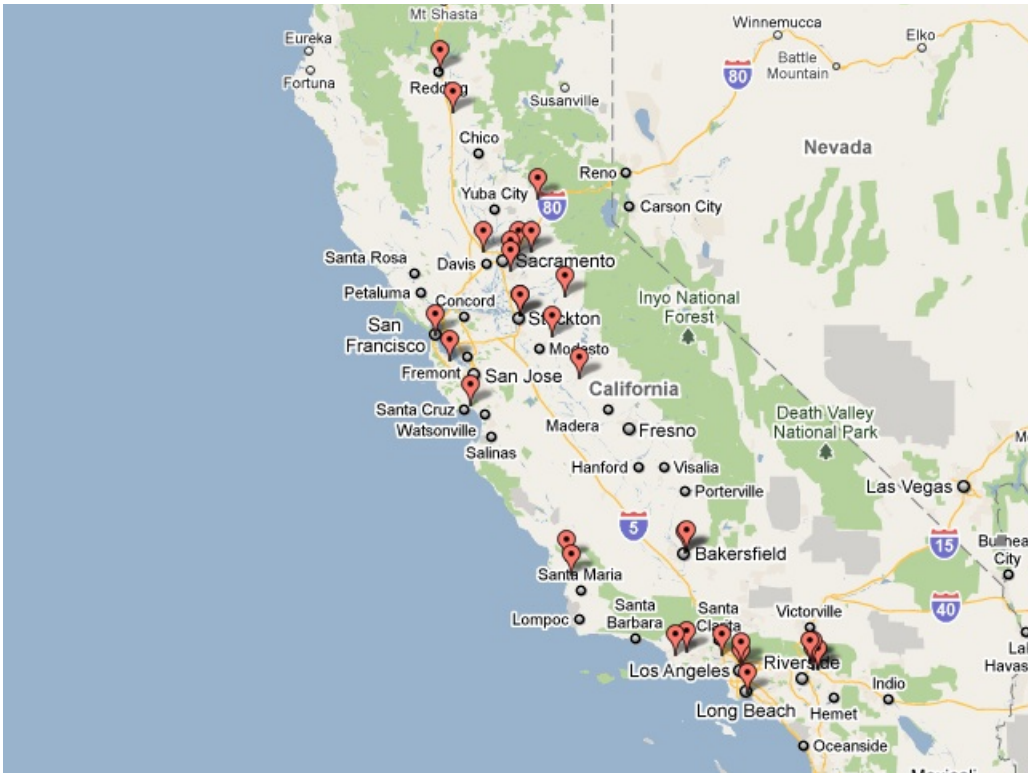
Note: The # of system members represent the total number of member hospitals. Because the data is aggregated together when a system has multiple members in the same patient market the System-Market observations columns represents the frequency and counts of the observations in the data while the Hospital observations represents the total number of hospitals that are represented in the System-Market aggregated data.

TABLE A-7—MANAGED CARE DISCHARGES ($N = 1,361,562$)

Category	Characteristic	Mean	S.D.	Min.	Max.
Insurer	Private	.833	.139	0	1
	Medicare Advantage	.167	.139	0	1
Choice Sets	Choice Set Size	59.00	28.04	2	111
	Travel Time (minutes to chosen hospital)	20.07	14.28	0	90
	Travel Time (minutes to all hospitals)	36.63	13.52	0	90
Diagnostic	Nervous System Diagnosis	.057	.054	0	1
Category	Ear, Nose, Mouth, & Throat	.014	.014	0	1
(Shares)	Respiratory System	.071	.066	0	1
	Circulatory System	.138	.119	0	1
	Digestive System	.111	.099	0	1
	Hepatobiliary System	.038	.037	0	1
	Musculoskeletal System	.099	.089	0	1
	Skin, Subcutaneous Tissue & Breast	.026	.025	0	1
	Endocrine, Nutritional, & Matabolic	.037	.036	0	1
	Kidney & Urinary Tract	.035	.034	0	1
	Male Reproductive	.008	.087	0	1
	Female Reproductive	.050	.048	0	1
	Pregnancy & Childbirth	.245	.185	0	1
	Blood & Immunological	.012	.112	0	1
	Myeloproliferative	.013	.013	0	1
	Infectious & Parasitic	.026	.025	0	1
	Injuries & Poisonings	.006	.006	0	1
	Type of Cancer	.062	.058	0	1
Diagnosis	Length of stay (days)	3.576	5.124	0	356
	Male	.281	.202	0	1
	Age < 18	.065	.061	0	1
	$18 \leq$ Age < 35	.238	.181	0	1
	$35 \leq$ Age < 65	.458	.248	0	1
	Age > 65	.239	.182	0	1
	White	.604	.239	0	1
	Black	.027	.026	0	1
	Asian	.055	.052	0	1
	Other/Unknown	.314	.215	0	1
	Rural	.029	.028	0	1
	Income ($1,000)	53.60	19.84	0	200

Note: Summary statistics are for all discharges used in the analysis. Only the discharges for managed care patients privately insured or in Medicare Advantage are used to estimate hospital demand. The DRGs used to indicate a discharge related to cancer include 23, 54, 55, 146, 147, 148, 180, 181, 182, 374, 375, 376, 435, 436, 437, 542, 543, 544, 582, 583, 597, 598, 599, 656, 657, 658, 686, 687, 688, 715, 716, 722, 723, 724, 736, 737, 738, 739, 740, 741, 742, 743, 754, 755, 756, 820, 821, 822, 823, 824, 825, 834, 835, 836, 837, 838, 839, 840, 841, 842, 846, 847, and 848.

FIGURE A-2. DISPERSED SYSTEMS: CATHOLIC HEALTHCARE WEST



APPENDIX B. COMPLETE COST AND BARGAINING ESTIMATES

TABLE B-1—COST ESTIMATES BASED ON IN-PATIENT DAYS AS OUTPUT

			×For-Profit		× Government	
	b	se	b	se	b	se
% ER	−0.1221	(0.1023)	0.1146	(0.1111)	0.0617	(0.1047)
% Mcar	0.0482	(0.0563)	−0.1352	(0.0595)	−0.0807	(0.0604)
Other OP	−0.2224	(0.0971)	−0.0080	(0.1420)	0.3705	(0.1675)
Other OP^2	0.0080	(0.0093)	0.0012	(0.0103)	0.0143	(0.0117)
Mcare OP	−0.0680	(0.1041)	0.0312	(0.1546)	0.2932	(0.1965)
Mcare OP^2	−0.0021	(0.0036)	0.0009	(0.0108)	0.0130	(0.0083)
Prvt FFS OP	0.0924	(0.0657)	−0.0494	(0.0573)	0.0685	(0.1147)
Prvt FFS OP^2	0.0004	(0.0019)	0.0018	(0.0022)	−0.0056	(0.0029)
Other IP × Mcare IP	0.0135	(0.0117)	0.0013	(0.0165)	−0.0495	(0.0211)
Other IP × Prvt MC OP	0.0004	(0.0039)	0.0025	(0.0043)	−0.0090	(0.0084)
Other IP × Prvt FFS OP	−0.0112	(0.0050)	0.0033	(0.0059)	−0.0033	(0.0067)
Mcare IP× Prvt MC IP	0.0004	(0.0040)	−0.0031	(0.0041)	0.0078	(0.0087)
Mcare IP× Prvt FFS OP	−0.0003	(0.0049)	0.0011	(0.0062)	0.0061	(0.0118)
# Beds	−0.1841	(0.7001)	1.1728	(0.8794)	−1.1596	(0.9162)
# Beds^2	−0.1039	(0.0552)	0.0485	(0.0612)	0.0631	(0.0510)
Fixed Assets	−0.2685	(0.3512)	0.2686	(0.2784)	0.0965	(0.3386)
Fixed Assets^2	0.0026	(0.0100)	0.0006	(0.0049)	0.0071	(0.0132)
# Beds × Assets	0.0711	(0.0553)	−0.0114	(0.0410)	−0.0019	(0.0387)
Employee Hours × Assets	−0.0096	(0.0309)	−0.0176	(0.0251)	−0.0249	(0.0314)
Employee Hours × # Beds	0.0068	(0.0901)	−0.1133	(0.0966)	0.0403	(0.0929)
Employee Hours × Mcare Days	−0.0393	(0.0181)	0.1452	(0.0527)	0.0385	(0.0187)
Employee Hours × Prvt Days	0.0104	(0.0209)	−0.0770	(0.0305)	−0.0089	(0.0212)
Management Hours	0.3469	(0.2795)	0.3516	(0.4174)	−0.0383	(0.3946)
Management Hours^2	−0.0134	(0.0121)	−0.0170	(0.0184)	0.0009	(0.0170)
Clerical Hours	0.2742	(0.4064)	−0.8488	(0.3656)	0.0879	(0.4675)
Clerical Hours^2	−0.0083	(0.0160)	0.0330	(0.0152)	−0.0057	(0.0187)
RN Hours	−0.4090	(0.4170)	0.5578	(0.4624)	−0.0250	(0.4001)
RN Hours^2	0.0056	(0.0188)	−0.0290	(0.0176)	−0.0051	(0.0114)
RN Hours × Staff Hours	0.0281	(0.0163)	0.0092	(0.0249)	0.0029	(0.0258)
Other IP	0.1726	(0.1833)	−0.5053	(0.1851)	0.2984	(0.3238)
Other IP^2	−0.0047	(0.0078)	0.0033	(0.0082)	0.0090	(0.0099)
Mcare IP	0.2744	(0.1450)	−0.7613	(0.4280)	−0.4577	(0.3152)
Mcare IP^2	0.0152	(0.0036)	0.0062	(0.0192)	−0.0176	(0.0141)
Prvt IP	−0.1395	(0.2200)	0.2382	(0.3275)	0.0526	(0.3024)
Prvt IP^2	0.0092	(0.0037)	0.0137	(0.0087)	0.0048	(0.0085)
All IP× Other OP	0.0021	(0.0125)	0.0459	(0.0144)	−0.0424	(0.0314)
All IP × Mcar. OP	0.0119	(0.0149)	−0.1079	(0.0205)	0.0245	(0.0308)
All IP × Prvt OP	−0.0028	(0.0162)	0.0572	(0.0169)	−0.0016	(0.0380)
Other IP × Mcare IP	0.0031	(0.0063)	−0.0041	(0.0063)	0.0028	(0.0062)
Other IP × Prvt IP	−0.0058	(0.0049)	−0.0012	(0.0054)	0.0096	(0.0084)
Mcare IP × Prvt IP	0.0038	(0.0052)	0.0006	(0.0049)	−0.0056	(0.0086)

Note: All outputs and inputs are in logs. OP=Out Patient, IP=In Patient, Prvt.=Privately Insured, MCare=Medicare, MC=Managed Care, FFS=Fee for service. Standard errors are in parentheses and are clustered by hospital. Specification includes hospital fixed effects and a time trend and has an adjusted R^2 greater than 0.97.

TABLE B-1—COST ESTIMATES BASED ON IN-PATIENT DAYS AS OUTPUT, CONTINUED

	×Trauma Center		×System Member		× Rural	
	b	se	b	se	b	se
% ER	−0.1417	(0.1170)	−0.0326	(0.0997)	−0.0506	(0.1123)
% Mcar	0.0660	(0.0499)	0.0119	(0.0552)	−0.0230	(0.0506)
Other OP	−0.2385	(0.4060)	0.3336	(0.1271)	−0.0891	(0.3415)
Other OP^2	0.0512	(0.0216)	−0.0046	(0.0124)	0.0136	(0.0240)
Mcare OP	0.8262	(0.3007)	0.0935	(0.1679)	0.1704	(0.4406)
Mcare OP^2	−0.0030	(0.0092)	0.0138	(0.0098)	−0.0015	(0.0263)
Prvt FFS OP	0.1557	(0.0953)	−0.0505	(0.0657)	−0.1880	(0.1226)
Prvt FFS OP^2	0.0005	(0.0016)	−0.0012	(0.0020)	0.0030	(0.0027)
Other IP × Mcare IP	−0.0596	(0.0231)	−0.0314	(0.0171)	−0.0309	(0.0354)
Other IP × Prvt MC OP	0.0045	(0.0046)	−0.0009	(0.0033)	0.0008	(0.0062)
Other IP × Prvt FFS OP	−0.0121	(0.0086)	0.0106	(0.0058)	0.0086	(0.0126)
Mcare IP× Prvt MC IP	−0.0048	(0.0045)	−0.0008	(0.0034)	−0.0015	(0.0064)
Mcare IP× Prvt FFS OP	−0.0027	(0.0041)	−0.0022	(0.0057)	0.0091	(0.0148)
# Beds	0.3284	(1.5208)	−0.3860	(0.8450)	0.9604	(1.2910)
# Beds^2	0.0898	(0.0563)	0.1037	(0.0520)	0.0426	(0.0498)
Fixed Assets	0.4616	(0.4615)	−0.1221	(0.2309)	0.2141	(0.5010)
Fixed Assets^2	−0.0073	(0.0106)	−0.0018	(0.0080)	−0.0146	(0.0163)
# Beds × Assets	−0.0640	(0.0445)	−0.0649	(0.0294)	−0.1023	(0.0468)
Employee Hours × Assets	0.0090	(0.0370)	0.0357	(0.0277)	0.0560	(0.0476)
Employee Hours × # Beds	−0.0120	(0.1299)	0.0230	(0.0929)	0.0163	(0.1022)
Employee Hours × Mcare Days	0.0300	(0.0323)	−0.0786	(0.0347)	−0.0226	(0.0618)
Employee Hours × Prvt Days	−0.0947	(0.0658)	0.0635	(0.0260)	−0.0275	(0.0332)
Management Hours	1.0286	(0.5927)	−0.4467	(0.3435)	−0.0644	(0.5248)
Management Hours^2	−0.0462	(0.0248)	0.0196	(0.0149)	0.0054	(0.0238)
Clerical Hours	−0.6024	(0.5937)	0.5403	(0.3538)	−0.8781	(0.6178)
Clerical Hours^2	0.0237	(0.0227)	−0.0219	(0.0143)	0.0360	(0.0268)
RN Hours	−1.4926	(0.7128)	−0.1537	(0.4352)	0.7222	(0.7626)
RN Hours^2	0.0401	(0.0234)	0.0158	(0.0163)	−0.0120	(0.0240)
RN Hours × Staff Hours	0.0387	(0.0323)	−0.0258	(0.0247)	−0.0338	(0.0472)
Other IP	1.2967	(0.4693)	0.1327	(0.1511)	−0.4415	(0.3235)
Other IP^2	−0.0236	(0.0215)	0.0180	(0.0067)	0.0185	(0.0107)
Mcare IP	−0.8202	(0.4643)	0.5129	(0.5034)	0.2713	(0.5161)
Mcare IP^2	−0.0002	(0.0054)	−0.0134	(0.0094)	0.0009	(0.0219)
Prvt IP	0.7601	(0.5793)	−0.1221	(0.2926)	0.1101	(0.4372)
Prvt IP^2	0.0182	(0.0200)	−0.0159	(0.0084)	−0.0079	(0.0103)
All IP× Other OP	−0.0761	(0.0306)	−0.0387	(0.0139)	0.0067	(0.0307)
All IP × Mcar. OP	0.0328	(0.0258)	0.0713	(0.0202)	−0.0119	(0.0407)
All IP × Prvt OP	0.0182	(0.0323)	−0.0468	(0.0195)	0.0279	(0.0502)
Other IP × Mcare IP	0.0008	(0.0057)	0.0032	(0.0049)	0.0053	(0.0065)
Other IP × Prvt IP	0.0038	(0.0053)	0.0059	(0.0047)	−0.0061	(0.0088)
Mcare IP × Prvt IP	−0.0027	(0.0054)	−0.0015	(0.0045)	0.0086	(0.0092)

Note: All outputs and inputs are in logs. OP=Out Patient, IP=In Patient, Prvt.=Privately Insured, MCare=Medicare, MC=Managed Care, FFS=Fee for service. Standard errors are in parentheses and are clustered by hospital. Specification includes hospital fixed effects and a time trend and has an adjusted R^2 greater than 0.97.

TABLE B-1—COST ESTIMATES BASED ON IN-PATIENT DAYS AS OUTPUT, CONTINUED

	×Teaching Hospital	
	b	se
% ER	0.0747	(0.2087)
% Mcar	−0.0715	(0.0802)
Other OP	0.2284	(0.5479)
Other OP^2	−0.0322	(0.0285)
Mcare OP	0.2705	(0.7253)
Mcare OP^2	−0.0066	(0.0471)
Prvt FFS OP	−0.2782	(0.2004)
Prvt FFS OP^2	0.0138	(0.0107)
Other IP × Mcare IP	0.0168	(0.0482)
Other IP × Prvt MC OP	−0.0001	(0.0132)
Other IP × Prvt FFS OP	0.0390	(0.0191)
Mcare IP× Prvt MC IP	0.0066	(0.0143)
Mcare IP× Prvt FFS OP	−0.0361	(0.0232)
# Beds	0.7183	(2.2872)
# Beds^2	0.1561	(0.2560)
Fixed Assets	−0.2775	(0.9832)
# Beds × Assets	0.0610	(0.0749)
Employee Hours × Assets	−0.0047	(0.0781)
Employee Hours × # Beds	−0.2303	(0.2532)
Employee Hours × Mcare Days	0.1819	(0.1441)
Employee Hours × Prvt Days	−0.1264	(0.1298)
Management Hours	−1.6601	(0.6172)
Management Hours^2	0.0672	(0.0248)
Clerical Hours	−0.2458	(1.6737)
Clerical Hours^2	0.0114	(0.0615)
RN Hours	2.5833	(1.7395)
RN Hours^2	−0.1160	(0.0452)
RN Hours × Staff Hours	0.0457	(0.0860)
Other IP	−1.1059	(1.0820)
Other IP^2	−0.0065	(0.0425)
Mcare IP	−2.1683	(1.8006)
Mcare IP^2	0.0548	(0.0588)
Prvt IP	0.3491	(1.6427)
Prvt IP^2	0.0609	(0.0282)
All IP× Other OP	0.1032	(0.0635)
All IP × Mcar. OP	−0.1467	(0.1119)
All IP × Prvt OP	0.0410	(0.0761)
Other IP × Mcare IP	0.0017	(0.0088)
Other IP × Prvt IP	−0.0011	(0.0086)
Mcare IP × Prvt IP	−0.0082	(0.0094)

Note: All outputs and inputs are in logs. OP=Out Patient, IP=In Patient, Prvt.=Privately Insured, MCare=Medicare, MC=Managed Care, FFS=Fee for service. Standard errors are in parentheses and are clustered by hospital. Specification includes hospital fixed effects and a time trend and has an adjusted R^2 greater than 0.97.

TABLE B-2—COST ESTIMATES BASED ON DISCHARGES AS OUTPUT

			×For-Profit		× Government	
	b	se	b	se	b	se
% ER	−0.1402	(0.1155)	0.0870	(0.1359)	0.0409	(0.1303)
% Mcar	0.0225	(0.0630)	−0.0616	(0.0612)	−0.0203	(0.0610)
Other OP	−0.2102	(0.1384)	0.0348	(0.1610)	0.2418	(0.1743)
Other OP^2	0.0048	(0.0096)	−0.0008	(0.0109)	0.0006	(0.0119)
Mcare OP	−0.1439	(0.1047)	0.0121	(0.1736)	0.0969	(0.1888)
Mcare OP^2	−0.0029	(0.0060)	0.0002	(0.0091)	0.0180	(0.0111)
Prvt FFS OP	0.0864	(0.0664)	−0.1485	(0.0606)	0.0144	(0.1120)
Prvt FFS OP^2	−0.0006	(0.0023)	0.0004	(0.0021)	−0.0047	(0.0032)
Other IP × Mcare IP	0.0179	(0.0140)	−0.0047	(0.0140)	−0.0299	(0.0218)
Other IP × Prvt MC OP	−0.0019	(0.0042)	0.0002	(0.0040)	−0.0027	(0.0076)
Other IP × Prvt FFS OP	−0.0087	(0.0057)	0.0064	(0.0061)	0.0081	(0.0066)
Mcare IP× Prvt MC IP	0.0023	(0.0043)	−0.0019	(0.0042)	0.0024	(0.0082)
Mcare IP× Prvt FFS OP	−0.0005	(0.0057)	0.0088	(0.0064)	−0.0028	(0.0116)
# Beds	−0.2087	(0.9291)	0.6919	(0.9395)	−1.5533	(1.1132)
# Beds^2	−0.0927	(0.0623)	0.0182	(0.0662)	0.0483	(0.0567)
Fixed Assets	−0.0282	(0.3319)	0.0958	(0.2601)	0.1936	(0.3441)
Fixed Assets^2	0.0118	(0.0109)	−0.0043	(0.0041)	−0.0190	(0.0151)
# Beds × Assets	0.0872	(0.0546)	−0.0130	(0.0423)	−0.0101	(0.0398)
Employee Hours × Assets	−0.0546	(0.0307)	0.0084	(0.0214)	0.0343	(0.0301)
Employee Hours × # Beds	−0.0104	(0.1046)	−0.0552	(0.0991)	0.0898	(0.1084)
Employee Hours × Mcar IP	0.0010	(0.0305)	0.0992	(0.0676)	−0.0175	(0.0344)
Employee Hours × Prvt IP	0.0715	(0.0422)	−0.1152	(0.0508)	−0.0730	(0.0423)
Management Hours	0.3804	(0.3264)	0.3202	(0.4839)	0.3768	(0.5055)
Management Hours^2	−0.0154	(0.0141)	−0.0154	(0.0211)	−0.0166	(0.0215)
Clerical Hours	0.2965	(0.3232)	−0.8542	(0.3648)	−0.4568	(0.5011)
Clerical Hours^2	−0.0091	(0.0127)	0.0335	(0.0153)	0.0146	(0.0200)
RN Hours	−0.5185	(0.3883)	0.9544	(0.5300)	−0.0050	(0.3437)
RN Hours^2	0.0131	(0.0193)	−0.0453	(0.0199)	−0.0018	(0.0126)
RN Hours × Staff Hours	0.0225	(0.0178)	0.0143	(0.0259)	−0.0047	(0.0225)
Other IP	0.3206	(0.1958)	−0.1091	(0.2194)	−0.1715	(0.1646)
Other IP^2	−0.0060	(0.0132)	0.0057	(0.0118)	−0.0454	(0.0257)
Mcare IP	0.0545	(0.3011)	−0.6099	(0.5812)	0.2884	(0.5031)
Mcare IP^2	0.0039	(0.0064)	0.0194	(0.0262)	−0.0798	(0.0365)
Prvt IP	−0.7814	(0.4048)	0.7694	(0.4987)	0.7974	(0.5317)
Prvt IP^2	0.0016	(0.0053)	0.0223	(0.0137)	0.0141	(0.0137)
All IP× Other OP	0.0131	(0.0030)	0.0021	(0.0041)	−0.0010	(0.0045)
All IP × Mcar. OP	0.0096	(0.0144)	−0.0459	(0.0263)	−0.0024	(0.0403)
All IP × Prvt OP	−0.0002	(0.0159)	0.0487	(0.0239)	−0.0223	(0.0513)
Other IP × Mcare IP	−0.0182	(0.0284)	−0.0385	(0.0326)	0.1120	(0.0478)
Other IP × Prvt IP	−0.0172	(0.0293)	0.0338	(0.0251)	0.0015	(0.0270)
Mcare IP × Prvt IP	−0.0026	(0.0215)	−0.0300	(0.0294)	0.0443	(0.0334)

Note: All outputs and inputs are in logs. OP=Out Patient, IP=In Patient, Prvt.=Privately Insured, MCare=Medicare, MC=Managed Care, FFS=Fee for service. Standard errors are in parentheses and are clustered by hospital. Specification includes hospital fixed effects and a time trend and has an adjusted R^2 greater than 0.97.

TABLE B-2—COST ESTIMATES BASED ON DISCHARGES AS OUTPUT, CONTINUED

	×Trauma Center		×System Member		× Rural	
	b	se	b	se	b	se
% ER	−0.1146	(0.1277)	−0.0527	(0.1131)	0.0457	(0.1220)
% Mcar	0.1182	(0.0484)	0.0068	(0.0635)	−0.0616	(0.0549)
Other OP	0.6307	(0.4134)	0.1725	(0.1705)	0.0199	(0.3362)
Other OP^2	−0.0066	(0.0199)	−0.0030	(0.0128)	0.0276	(0.0251)
Mcare OP	0.5350	(0.2701)	0.0681	(0.1810)	0.4598	(0.4665)
Mcare OP^2	0.0022	(0.0094)	0.0034	(0.0111)	−0.0007	(0.0294)
Prvt FFS OP	0.1424	(0.0990)	−0.0124	(0.0639)	−0.1128	(0.1118)
Prvt FFS OP^2	0.0015	(0.0018)	−0.0015	(0.0022)	0.0022	(0.0030)
Other IP × Mcare IP	−0.0360	(0.0216)	−0.0137	(0.0186)	−0.0571	(0.0365)
Other IP × Prvt MC OP	0.0071	(0.0045)	0.0009	(0.0034)	0.0028	(0.0059)
Other IP × Prvt FFS OP	−0.0072	(0.0093)	−0.0001	(0.0067)	0.0001	(0.0115)
Mcare IP× Prvt MC IP	−0.0073	(0.0047)	−0.0010	(0.0033)	−0.0029	(0.0060)
Mcare IP× Prvt FFS OP	−0.0078	(0.0046)	0.0043	(0.0063)	0.0101	(0.0132)
# Beds	−0.8674	(1.3059)	0.3721	(0.9448)	0.5640	(1.3072)
# Beds^2	0.0555	(0.0581)	0.1089	(0.0520)	0.0389	(0.0541)
Fixed Assets	0.3481	(0.4397)	−0.1902	(0.2443)	0.1120	(0.5069)
Fixed Assets^2	−0.0012	(0.0114)	−0.0034	(0.0097)	0.0015	(0.0176)
# Beds × Assets	−0.0507	(0.0427)	−0.0632	(0.0283)	−0.1264	(0.0444)
Employee Hours × Assets	−0.0033	(0.0359)	0.0436	(0.0298)	0.0321	(0.0473)
Employee Hours × # Beds	0.0810	(0.1204)	−0.0378	(0.0948)	0.0707	(0.1046)
Employee Hours × Mcar IP	−0.0014	(0.0488)	−0.0968	(0.0458)	−0.0347	(0.0734)
Employee Hours × Prvt IP	−0.0981	(0.0808)	0.0678	(0.0430)	−0.0437	(0.0397)
Management Hours	0.9983	(0.5551)	−0.4474	(0.3739)	−0.2184	(0.6618)
Management Hours^2	−0.0439	(0.0233)	0.0207	(0.0162)	0.0107	(0.0300)
Clerical Hours	−0.9471	(0.5637)	0.4941	(0.3170)	−0.7888	(0.6869)
Clerical Hours^2	0.0364	(0.0220)	−0.0201	(0.0129)	0.0319	(0.0297)
RN Hours	−1.1834	(0.8365)	−0.2730	(0.5059)	0.6162	(0.6860)
RN Hours^2	0.0320	(0.0267)	0.0135	(0.0192)	−0.0189	(0.0236)
RN Hours × Staff Hours	0.0309	(0.0354)	−0.0091	(0.0261)	−0.0104	(0.0417)
Other IP	0.0669	(0.2663)	0.0607	(0.1562)	−0.2702	(0.2424)
Other IP^2	−0.0148	(0.0229)	0.0063	(0.0135)	−0.0146	(0.0303)
Mcare IP	−0.4711	(0.5530)	1.0078	(0.4847)	0.1554	(0.6917)
Mcare IP^2	0.0094	(0.0078)	−0.0070	(0.0097)	−0.0003	(0.0401)
Prvt IP	1.6751	(0.7696)	−0.0157	(0.4201)	0.3722	(0.4794)
Prvt IP^2	−0.0113	(0.0221)	−0.0175	(0.0136)	−0.0018	(0.0143)
All IP× Other OP	−0.0047	(0.0045)	−0.0028	(0.0028)	−0.0066	(0.0042)
All IP × Mcar. OP	0.0122	(0.0317)	0.0392	(0.0253)	0.0001	(0.0463)
All IP × Prvt OP	−0.0323	(0.0332)	−0.0496	(0.0274)	0.0202	(0.0539)
Other IP × Mcare IP	0.0109	(0.0390)	0.0075	(0.0293)	0.0586	(0.0452)
Other IP × Prvt IP	0.0136	(0.0340)	−0.0134	(0.0261)	−0.0049	(0.0297)
Mcare IP × Prvt IP	0.0205	(0.0259)	−0.0067	(0.0216)	−0.0057	(0.0311)

Note: All outputs and inputs are in logs. OP=Out Patient, IP=In Patient, Prvt.=Privately Insured, MCare=Medicare, MC=Managed Care, FFS=Fee for service. Standard errors are in parentheses and are clustered by hospital. Specification includes hospital fixed effects and a time trend and has an adjusted R^2 greater than 0.97.

TABLE B-2—COST ESTIMATES BASED ON DISCHARGES AS OUTPUT, CONTINUED

	×Teaching Hospital	
	b	se
% ER	0.1201	(0.2160)
% Mcar	−0.1316	(0.0807)
Other OP	−0.7318	(0.5502)
Other OP^2	0.0150	(0.0312)
Mcare OP	0.6855	(0.7265)
Mcare OP^2	−0.0307	(0.0375)
Prvt FFS OP	0.0645	(0.2487)
Prvt FFS OP^2	0.0065	(0.0101)
Other IP × Mcare IP	0.0285	(0.0514)
Other IP × Prvt MC OP	−0.0018	(0.0106)
Other IP × Prvt FFS OP	0.0239	(0.0211)
Mcare IP× Prvt MC IP	0.0007	(0.0126)
Mcare IP× Prvt FFS OP	−0.0371	(0.0246)
# Beds	2.3283	(1.9702)
# Beds^2	−0.0099	(0.2631)
Fixed Assets	−0.2725	(0.9038)
# Beds × Assets	0.0593	(0.0845)
Employee Hours × Assets	−0.0058	(0.0783)
Employee Hours × # Beds	−0.2105	(0.2181)
Employee Hours × Mcar IP	0.2296	(0.1814)
Employee Hours × Prvt IP	−0.1892	(0.1633)
Management Hours	−1.5151	(0.6123)
Management Hours^2	0.0613	(0.0245)
Clerical Hours	1.1695	(1.6887)
Clerical Hours^2	−0.0411	(0.0619)
RN Hours	2.8894	(2.1673)
RN Hours^2	−0.1261	(0.0575)
RN Hours × Staff Hours	0.0548	(0.0842)
Other IP	0.4597	(1.0807)
Other IP^2	0.0424	(0.0493)
Mcare IP	−3.4781	(1.8673)
Mcare IP^2	0.0198	(0.0635)
Prvt IP	2.0764	(1.8859)
Prvt IP^2	0.0373	(0.0344)
All IP× Other OP	−0.0032	(0.0077)
All IP × Mcar. OP	0.0231	(0.0920)
All IP × Prvt OP	−0.0200	(0.0792)
Other IP × Mcare IP	−0.1405	(0.1165)
Other IP × Prvt IP	0.0233	(0.0683)
Mcare IP × Prvt IP	0.0407	(0.0754)

Note: All outputs and inputs are in logs. OP=Out Patient, IP=In Patient, Prvt.=Privately Insured, MCare=Medicare, MC=Managed Care, FFS=Fee for service. Standard errors are in parentheses and are clustered by hospital. Specification includes hospital fixed effects and a time trend and has an adjusted R^2 greater than 0.97.

TABLE B-3—SYSTEM CHARACTERISTICS AND BARGAINING POWER USING PATIENT DAYS

Dependent Var. $= \Delta\Pi_h$	Cost Estimated Using Patient Days						
	A	B	C	D	E	F	G
Base Bargaining Pwr.	1.0308^{**}	0.9773^{**}	0.7353	0.9405^{**}	0.9057^{**}	0.9093^{**}	0.8689^{**}
	(0.4402)	(0.4090)	(0.4601)	(0.4654)	(0.4284)	(0.4482)	(0.4107)
Hosp. Market Share	0.2590	0.1305	0.1670	0.4224	0.2955	0.4179	0.3155
	(0.3114)	(0.3269)	(0.3193)	(0.3297)	(0.3311)	(0.3138)	(0.3339)
HHI^{Hosp} - HHI^{HMO}	0.0680	0.2341	0.1004	-0.1317	0.0343	-0.1528	-0.0363
	(0.3616)	(0.3992)	(0.3280)	(0.3580)	(0.4108)	(0.3388)	(0.3941)
Predicted Patient	-0.1980^{**}	-0.1923^{**}	-0.2223^{***}	-0.2463^{***}	-0.2362^{***}	-0.2638^{***}	-0.2566^{***}
Days ($/1000$)	(0.0979)	(0.0901)	(0.0836)	(0.0813)	(0.0797)	(0.0848)	(0.0848)
Physician Group	0.3313^{***}	0.3134^{***}	0.3178^{***}	0.2681^{**}	0.2612^{**}	0.2650^{**}	0.2525^{**}
	(0.1274)	(0.1133)	(0.1004)	(0.1274)	(0.1185)	(0.1276)	(0.1177)
Trauma Center	0.1325	0.1888	0.2473^{**}	0.1997^{*}	0.2439^{**}	0.2001^{*}	0.2509^{**}
	(0.1049)	(0.1165)	(0.1047)	(0.1167)	(0.1219)	(0.1113)	(0.1221)
Specialty	-0.0819	-0.1175	-0.0558	-0.1845	-0.2002	-0.1580	-0.1672
	(0.2225)	(0.2226)	(0.2012)	(0.2599)	(0.2502)	(0.2482)	(0.2481)
Teaching Hospital	0.4477	0.5269^{*}	0.5909^{**}	0.5368^{*}	0.5948^{**}	0.5458^{*}	0.5935^{**}
	(0.2959)	(0.2743)	(0.2516)	(0.3052)	(0.2807)	(0.2959)	(0.2803)
Rural Hospital	-0.2669^{*}	-0.1556	-0.2341	-0.3293^{**}	-0.2186	-0.3034^{**}	-0.1805
	(0.1422)	(0.1557)	(0.1426)	(0.1342)	(0.1470)	(0.1315)	(0.1460)
For-Profit (FP)	0.1601	0.1560	0.1606	0.2030	0.1931	0.1991	0.1837
	(0.3317)	(0.3258)	(0.3388)	(0.3544)	(0.3511)	(0.3455)	(0.3446)
% ER Discharges	-0.7635	-0.7608	-0.5200	-0.7665	-0.7691	-0.7555	-0.7567
	(0.5123)	(0.4814)	(0.5301)	(0.5255)	(0.4873)	(0.5033)	(0.4702)
FP×System Member	0.1198	0.1099	0.0726	0.0703	0.0860	0.0383	0.1036
	(0.3342)	(0.3306)	(0.3423)	(0.3649)	(0.3557)	(0.3522)	(0.3594)
NFP×System Member	0.3268^{***}	0.1580	-0.0396	0.1287	0.0001	0.7828^{***}	0.5847^{***}
	(0.1141)	(0.1483)	(0.2115)	(0.1299)	(0.1584)	(0.1864)	(0.1953)
FP×# Hospitals (/10)		0.0007	0.0033		0.0004		-0.0052
		(0.0102)	(0.0255)		(0.0164)		(0.0115)
NFP×# Hospitals (/10)		0.0879^{**}	0.4436^{**}		0.0796^{**}		0.0779^{**}
		(0.0433)	(0.1860)		(0.0399)		(0.0383)
FP×# Hosp. Sqrd. (/100)			-0.0004				
			(0.0015)				
NFP×# Hosp. Sqrd. (/100)			-0.0889^{**}				
			(0.0408)				
FP×# States				-0.0029	-0.0042		
				(0.0104)	(0.0139)		
NFP×# States				0.1065^{***}	0.0933^{***}		
				(0.0402)	(0.0347)		
FP×Geographic Conc.						-0.0180	-0.0784
						(0.1547)	(0.1592)
NFP×Geographic Conc.						-0.5587^{***}	-0.5044^{***}
						(0.1743)	(0.1448)
γ_p^{-1} ($\times 1000$)	2.1627^{**}	2.4388^{**}	2.5739^{**}	2.0332^{**}	2.2708^{**}	2.1957^{**}	2.4619^{**}
	(0.9028)	(0.9739)	(1.2021)	(0.9363)	(0.9615)	(0.9621)	(0.9847)
Bargaining Power							
Mean fitted value	0.6412	0.6027	0.5788	0.6301	0.5977	0.6176	0.5847
Standard deviation	0.3075	0.3103	0.2922	0.3135	0.3129	0.3069	0.3073
Adj. R^2	0.9180	0.9223	0.9269	0.9231	0.9264	0.9244	0.9277
N	304	304	304	304	304	304	

Note: This table reports the all of the estimates except the HSA fixed effects for the results reported in Table 5. All regressions use 15% of predicted managed care patients for the change in cost calculation. Errors are clustered by hospital and adjusted to account for data generated by first-stage regressions following Murphy and Topel (1985).
Significance Levels:*** p $<$ .01, ** p$<$ .05, * p $<$ .1

TABLE B-4—SYSTEM CHARACTERISTICS AND BARGAINING POWER USING CASE-WEIGHTED DISCHARGES

Dependent Var. $= \Delta\Pi_h$	Cost Estimated Using DRG-weighted Discharges						
	A	B	C	D	E	F	G
Base Bargaining Pwr.	0.9436^{***}	0.9563^{***}	0.7593^{**}	0.9096^{**}	0.9089^{**}	0.8845^{**}	0.8792^{**}
	(0.3631)	(0.3492)	(0.3771)	(0.3715)	(0.3615)	(0.3696)	(0.3558)
Hosp. Market Share	0.1914	0.0962	0.1858	0.3168	0.2285	0.3145	0.2349
	(0.2849)	(0.2954)	(0.3174)	(0.2969)	(0.2962)	(0.2830)	(0.2929)
HHI^{Hosp} - HHI^{HMO}	−0.0592	0.1304	0.0121	−0.1641	−0.0312	−0.2098	−0.0976
	(0.2888)	(0.3601)	(0.3151)	(0.2992)	(0.3564)	(0.2481)	(0.3401)
Predicted Patient	-0.1689^{**}	-0.1786^{**}	-0.2220^{***}	-0.2137^{***}	-0.2125^{***}	-0.2316^{***}	-0.2303^{***}
Days (/1000)	(0.0793)	(0.0735)	(0.0716)	(0.0676)	(0.0679)	(0.0691)	(0.0714)
Physician Group	0.2663^{**}	0.2764^{**}	0.3094^{***}	0.2131^{*}	0.2237^{*}	0.2033^{*}	0.2099^{*}
	(0.1138)	(0.1111)	(0.1132)	(0.1230)	(0.1195)	(0.1182)	(0.1166)
Trauma Center	0.1401	0.1628^{*}	0.2139^{**}	0.1733^{*}	0.1966^{**}	0.1794^{**}	0.2049^{**}
	(0.0858)	(0.0978)	(0.0895)	(0.0996)	(0.0980)	(0.0912)	(0.0963)
Specialty	−0.0899	−0.1447	−0.0812	−0.1743	−0.1912	−0.1412	−0.1613
	(0.2086)	(0.2135)	(0.2046)	(0.2209)	(0.2197)	(0.2122)	(0.2205)
Teaching Hospital	0.2646	0.3945	0.4990^{*}	0.3314	0.4107	0.3306	0.4060
	(0.2544)	(0.2556)	(0.2675)	(0.2646)	(0.2618)	(0.2507)	(0.2544)
Rural Hospital	−0.1941	−0.1355	-0.2343^{*}	-0.2469^{**}	−0.1769	-0.2168^{*}	−0.1473
	(0.1216)	(0.1415)	(0.1351)	(0.1188)	(0.1349)	(0.1113)	(0.1314)
For-Profit (FP)	0.1179	0.1386	0.1462	0.1335	0.1445	0.1238	0.1335
	(0.2240)	(0.2199)	(0.2293)	(0.2224)	(0.2208)	(0.2191)	(0.2171)
% ER Discharges	−0.5504	−0.5969	−0.3964	−0.5834	−0.6115	−0.5893	−0.6122
	(0.4286)	(0.4030)	(0.4230)	(0.4249)	(0.4053)	(0.4215)	(0.3992)
FP×System Member	0.1363	0.0966	0.1094	0.0795	0.1067	0.1149	0.1182
	(0.2193)	(0.2144)	(0.2361)	(0.2225)	(0.2152)	(0.2202)	(0.2268)
NFP×System Member	0.2789^{**}	0.1643	−0.0209	0.1213	0.0481	0.6672^{***}	0.5214^{**}
	(0.1269)	(0.1512)	(0.2075)	(0.1190)	(0.1428)	(0.1968)	(0.2310)
FP×# Hospitals (/10)		0.0064	−0.0015		0.0064		0.0005
		(0.0074)	(0.0285)		(0.0151)		(0.0083)
NFP×# Hospitals (/10)		0.0752^{**}	0.4344^{***}		0.0609^{*}		0.0581^{*}
		(0.0372)	(0.1672)		(0.0348)		(0.0331)
FP×# Hosp. Sqrd. (/100)			0.0001				
			(0.0015)				
NFP×# Hosp. Sqrd. (/100)			-0.0897^{**}				
			(0.0358)				
FP×# States				0.0022	−0.0043		
				(0.0079)	(0.0143)		
NFP×# States				0.0860^{***}	0.0722^{**}		
				(0.0323)	(0.0317)		
FP×Geographic Conc.						−0.0629	−0.0511
						(0.1395)	(0.1488)
NFP×Geographic Conc.						-0.4717^{***}	-0.4111^{***}
						(0.1422)	(0.1404)
γ_p^{-1} (×1000)	2.2925^{*}	2.2662^{*}	2.0237^{*}	2.2446^{*}	2.3291^{*}	2.4890^{*}	2.6034^{*}
	(1.2473)	(1.2429)	(1.2274)	(1.2706)	(1.3250)	(1.3257)	(1.3819)
Bargaining Power							
Mean fitted value	0.6780	0.6674	0.6736	0.6698	0.6531	0.6515	0.6367
Standard deviation	0.2361	0.2569	0.2540	0.2458	0.2507	0.2373	0.2464
Adj. R^2	0.9519	0.9544	0.9576	0.9550	0.9565	0.9558	0.9572
N	304	304	304	304	304	304	304

Note: This table reports the all of the estimates except the HSA fixed effects for the results reported in Table 5. Specifications B, D, and F correspond with I, II, and III in Table 5. All regressions use 15% of predicted managed care patients for the change in cost calculation. Errors are clustered by hospital and adjusted to account for data generated by first-stage regressions following Murphy and Topel (1985). Significance Levels:*** p < .01, ** p< .05, * p < .1

TABLE B-5—SYSTEM CHARACTERISTICS AND BARGAINING POWER: DEMAND ESTIMATED USING INDEMNITY PATIENTS

Dependent Var. $= \Delta\Pi_h$	Cost Estimated Using DRG-weighted Discharges						
	A	B	C	D	E	F	G
Base Bargaining Pwr.	1.1596^{***}	0.9829^{***}	0.7942^{**}	1.0709^{**}	0.9660^{**}	1.0362^{**}	0.9251^{**}
	(0.3982)	(0.3489)	(0.3864)	(0.4181)	(0.3821)	(0.3994)	(0.3618)
Hosp. Market Share	0.1459	−0.0129	−0.0053	0.3783	0.2044	0.3992	0.2236
	(0.2726)	(0.2509)	(0.2376)	(0.2936)	(0.2817)	(0.3006)	(0.2898)
HHI^{Hosp} - HHI^{HMO}	0.0507	0.2162	0.1054	−0.1432	0.0452	−0.1951	−0.0071
	(0.3769)	(0.3756)	(0.3178)	(0.3772)	(0.4180)	(0.3697)	(0.4205)
Predicted Patient	-0.0270^{***}	-0.0240^{***}	-0.0253^{***}	-0.0364^{***}	-0.0319^{***}	-0.0390^{***}	-0.0341^{***}
Days (/1000)	(0.0096)	(0.0081)	(0.0078)	(0.0097)	(0.0088)	(0.0108)	(0.0097)
Physician Group	0.2903^{**}	0.2627^{**}	0.2548^{***}	0.2168^{*}	0.2205^{*}	0.2216^{*}	0.2200^{*}
	(0.1254)	(0.1045)	(0.0949)	(0.1231)	(0.1130)	(0.1241)	(0.1130)
Trauma Center	0.1771^{*}	0.2269^{**}	0.2673^{***}	0.2487^{**}	0.2768^{**}	0.2499^{**}	0.2762^{**}
	(0.0933)	(0.1006)	(0.0921)	(0.1110)	(0.1107)	(0.1039)	(0.1100)
Specialty	0.2889	0.2000	0.2409	0.1837	0.1422	0.2383	0.1831
	(0.2245)	(0.1969)	(0.1868)	(0.2730)	(0.2421)	(0.2657)	(0.2440)
Teaching Hospital	0.1647	0.2783	0.3217	0.3256	0.3791	0.3349	0.3880
	(0.2764)	(0.2507)	(0.2456)	(0.2841)	(0.2622)	(0.2746)	(0.2626)
Rural Hospital	-0.2765^{*}	−0.1543	−0.2104	-0.3792^{***}	-0.2612^{*}	-0.3421^{***}	−0.2346
	(0.1400)	(0.1420)	(0.1283)	(0.1376)	(0.1468)	(0.1306)	(0.1436)
For-Profit (FP)	−0.0876	−0.0741	−0.0790	−0.0391	−0.0389	−0.0414	−0.0387
	(0.2113)	(0.1708)	(0.1604)	(0.2015)	(0.1791)	(0.1973)	(0.1740)
% ER Discharges	-0.8584^{*}	-0.7359^{*}	−0.5351	-0.8718^{*}	-0.7931^{*}	-0.8730^{**}	-0.7789^{*}
	(0.4436)	(0.3867)	(0.4237)	(0.4621)	(0.4188)	(0.4406)	(0.3983)
FP×System Member	0.4116^{*}	0.3114^{*}	0.2707	0.3218	0.3104	0.3652^{*}	0.2862
	(0.2264)	(0.1831)	(0.1768)	(0.2199)	(0.1977)	(0.2124)	(0.1930)
NFP×System Member	0.3643^{***}	0.1542	−0.0268	0.1411	0.0229	0.9199^{***}	0.6397^{***}
	(0.1025)	(0.1323)	(0.1974)	(0.1237)	(0.1489)	(0.1746)	(0.1953)
FP×# Hospitals (/10)		0.0042	0.0060		0.0093		0.0030
		(0.0073)	(0.0194)		(0.0167)		(0.0090)
NFP×# Hospitals (/10)		0.0949^{**}	0.3884^{**}		0.0791^{**}		0.0767^{**}
		(0.0405)	(0.1821)		(0.0382)		(0.0371)
FP×# Hosp. Sqrd. (/100)			−0.0003				
			(0.0011)				
NFP×# Hosp. Sqrd. (/100)			-0.0742^{*}				
			(0.0404)				
FP×# States				0.0035	−0.0065		
				(0.0078)	(0.0152)		
NFP×# States				0.1293^{***}	0.1003^{***}		
				(0.0378)	(0.0326)		
FP×Geographic Conc.						−0.0747	−0.0180
						(0.1223)	(0.1444)
NFP×Geographic Conc.						-0.6615^{***}	-0.5259^{***}
						(0.1662)	(0.1441)
γ_p^{-1} (×1000)	2.2896^{**}	3.1282^{***}	3.2525^{***}	1.6846^{**}	2.2578^{***}	1.8224^{**}	2.4314^{***}
	(0.9475)	(1.1070)	(1.2319)	(0.7301)	(0.8169)	(0.7845)	(0.8517)
Bargaining Power							
Mean fitted value	0.6586	0.5747	0.5616	0.6779	0.6098	0.6652	0.6021
Standard deviation	0.3445	0.3158	0.2887	0.3569	0.3256	0.3482	0.3230
Adj. R^2	0.9323	0.9376	0.9412	0.9393	0.9423	0.9404	0.9433
N	305	305	305	303	303	303	303

Note: This table reports the results of the second-stage bargaining model after predicting demand using indemnity patients who have unrestricted choice-sets. All regressions use 15% of predicted managed care patients for the change in cost calculation. Errors are clustered by hospital.

Significance Levels:*** p $<$ .01, ** p$<$ .05, * p $<$ .1

TABLE B-6—SYSTEM CHARACTERISTICS AND BARGAINING POWER: DEMAND ESTIMATED USING INDEMNITY PATIENTS

Dependent Var. $= \Delta\Pi_h$	Cost Estimated Using DRG-weighted Discharges						
	A	B	C	D	E	F	G
Base Bargaining Pwr.	0.9830***	0.9498***	0.8225***	0.9793***	0.9394***	0.9245***	0.8967***
	(0.2607)	(0.2601)	(0.2907)	(0.2735)	(0.2776)	(0.2622)	(0.2644)
Hosp. Market Share	0.0282	−0.0703	−0.0324	0.2305	0.1163	0.2382	0.1273
	(0.2205)	(0.2063)	(0.2088)	(0.2299)	(0.2198)	(0.2269)	(0.2209)
HHI^{Hosp} - HHI^{HMO}	−0.0950	0.0896	0.0029	−0.1961	−0.0563	−0.2714	−0.1163
	(0.2657)	(0.3063)	(0.2832)	(0.2759)	(0.3252)	(0.2407)	(0.3252)
Predicted Patient	−0.0208***	−0.0215***	−0.0240***	−0.0289***	−0.0270***	−0.0307***	−0.0288***
Days (/1000)	(0.0064)	(0.0057)	(0.0058)	(0.0064)	(0.0063)	(0.0069)	(0.0069)
Physician Group	0.2017**	0.2122**	0.2231**	0.1511	0.1667	0.1431	0.1582
	(0.0946)	(0.0870)	(0.0873)	(0.1123)	(0.1065)	(0.1055)	(0.1039)
Trauma Center	0.1998***	0.2159***	0.2521***	0.2285**	0.2418***	0.2341***	0.2421***
	(0.0706)	(0.0798)	(0.0746)	(0.0880)	(0.0844)	(0.0770)	(0.0818)
Specialty	0.2723	0.1926	0.2472	0.2136	0.1746	0.2621	0.2091
	(0.1676)	(0.1628)	(0.1587)	(0.1767)	(0.1737)	(0.1651)	(0.1781)
Teaching Hospital	0.0222	0.1823	0.2410	0.1124	0.1990	0.1104	0.2014
	(0.1975)	(0.2048)	(0.2244)	(0.2176)	(0.2261)	(0.1982)	(0.2189)
Rural Hospital	−0.1873*	−0.1290	−0.1971*	−0.2681***	−0.2020*	−0.2315***	−0.1811*
	(0.0962)	(0.1177)	(0.1085)	(0.0991)	(0.1145)	(0.0866)	(0.1091)
For-Profit (FP)	−0.0117	−0.0002	−0.0053	0.0156	0.0202	0.0125	0.0172
	(0.1540)	(0.1389)	(0.1358)	(0.1455)	(0.1373)	(0.1399)	(0.1326)
% ER Discharges	−0.6537**	−0.6415**	−0.4965	−0.7068**	−0.6846**	−0.6957**	−0.6732**
	(0.3197)	(0.3040)	(0.3322)	(0.3339)	(0.3243)	(0.3179)	(0.3100)
FP×System Member	0.2821*	0.2297	0.2029	0.2173	0.2321	0.2651*	0.2114
	(0.1578)	(0.1406)	(0.1397)	(0.1522)	(0.1447)	(0.1418)	(0.1444)
NFP×System Member	0.3286***	0.1995	0.0481	0.1642	0.0966	0.7553***	0.5931**
	(0.0998)	(0.1325)	(0.1846)	(0.1016)	(0.1293)	(0.1614)	(0.2300)
FP×# Hospitals (/10)		0.0060	0.0101		0.0105		0.0041
		(0.0065)	(0.0196)		(0.0142)		(0.0073)
NFP×# Hospitals (/10)		0.0714**	0.3335**		0.0526		0.0490
		(0.0325)	(0.1548)		(0.0344)		(0.0334)
FP×# Hosp. Sqrd. (/100)			−0.0004				
			(0.0011)				
NFP×# Hosp. Sqrd. (/100)			−0.0660*				
			(0.0341)				
FP×# States				0.0045	−0.0061		
				(0.0063)	(0.0132)		
NFP×# States				0.0956***	0.0767**		
				(0.0284)	(0.0308)		
FP×Geographic Conc.						−0.0728	−0.0127
						(0.0930)	(0.1164)
NFP×Geographic Conc.						−0.5123***	−0.4285***
						(0.1157)	(0.1366)
γ_p^{-1} (×1000)	3.2218***	3.4349***	3.1522***	2.4495***	2.8369***	2.8245***	3.1351***
	(1.0779)	(1.2553)	(1.1468)	(0.8268)	(1.0594)	(0.8731)	(1.0711)
Mean fitted value	0.6354	0.6107	0.6213	0.6689	0.6309	0.6425	0.6177
Standard deviation	0.2774	0.2777	0.2668	0.2914	0.2742	0.2816	0.2738
Adj. R^2	0.9570	0.9598	0.9620	0.9614	0.9626	0.9623	0.9634
N	305	303	305	303	303	303	

Note: This table reports the results of the second-stage bargaining model after predicting demand using indemnity patients who have unrestricted choice-sets. All regressions use 15% of predicted managed care patients for the change in cost calculation. Errors are clustered by hospital.

Significance Levels:*** p < .01, ** p< .05, * p < .1

APPENDIX C. ALTERNATIVE BARGAINING MODEL

In Eq. (9) market power differences are controlled for via the differences in surplus hospitals produce. The change in the enrollees' willingness-to-pay will be higher when an entire system can be withdrawn from an MCO's network when those system hospitals are also in the enrollees' choice-set. Furthermore, using assumption A4, hospitals lose all of the demand from those enrollees when they fail to negotiate a contract with an MCO so are not in the enrollees' choice-set. However, if some enrollees have sufficiently strong preferences that they will switch MCOs in order to continue to have access to their preferred hospital (or system)—even after the MCO reduces its premium to reflect the enrollees' reduced willingness-to-pay—then the surplus calculation is incorrect, biasing the bargaining power estimates.

To see how assumption A4 could bias the bargaining power results, consider the following change to the model. Let $\phi_h(\mathcal{M})$ represent the proportion of enrollees who will switch from the MCO having network $\mathcal{M}$ when hospital h is removed from the network. Observe that the proportion of enrollees who will switch MCOs in order to have access to hospital h depends on whether there are suitable substitutes in network $\mathcal{M}$ so is dependent on both the network and the hospital's characteristics. The objective function for hospital h and MCO m is now expressed as

$$\max_{p_{hm}} \left[\Pi_m(\mathcal{M}) - \Pi_m\big(\mathcal{M} \setminus h; \phi_h(\mathcal{M})\big)\right]^{1-\alpha_h} \left[\Pi_h(\mathcal{H}) - \Pi_h\big(\mathcal{H} \setminus m; \phi_h(\mathcal{M})\big)\right]^{\alpha_h}, \tag{C-1}$$

where $\Pi_m\big(\mathcal{M}\setminus h; \phi_h(\mathcal{M})\big)$ is the MCO's profit when hospital h is not in its network causing it to have $\phi_h(\mathcal{M})D_h(\mathcal{M})$ fewer enrollees; and $\Pi_h\big(\mathcal{H}\setminus m; \phi_h(\mathcal{M})$ is hospital h's profit when it is no longer in MCO m's network but it still treats $\phi_h(\mathcal{M})D_h(\mathcal{M})$ of the patients that were enrolled with MCO m. The FOC of the Nash bargaining product can be expressed as

$$\begin{aligned} \Delta\Pi_h(p_{hm}) =& \alpha_h\left[\Delta_h W_m(\mathcal{M}) - \Delta_m C_h\big(D_h(\mathcal{M})\big) + \Delta_h R_m(\mathcal{M} \setminus h)\right] \\ &+ \alpha_h\big[\phi_h(\mathcal{M})D_h(\mathcal{M})\big(W_m(\mathcal{M} \setminus h) - p_m\big) - \big(\phi_h(\mathcal{M})D_h(\mathcal{M})p_h \\ &- C_h\big(\phi_h(\mathcal{M})D_h(\mathcal{M})\big)\big)\big], \end{aligned} \tag{C-2}$$

where $W_m(\mathcal{M} \setminus h)$ is the willingness to pay to have access to network $\mathcal{M} \setminus h$; p_m represents the vector of reimbursements from MCO m to the hospitals that its enrollees who would have chosen hospital h now select when h is not in the network, p_h represents the vector of reimbursements that hospital h receives from the MCOs that the $\phi_h(\mathcal{M})D_h(\mathcal{M})$ enrollees from MCO m switch to in order to still have access to the hospital. The first term in brackets in eq. (C-2) represents the baseline contract surplus calculated in the paper, while the second term in brackets represents the potential bias to that baseline analysis created by enrollees switching MCOs. Intuitively the value of a contract to the MCO increases by $\phi_h(\mathcal{M})D_h(\mathcal{M})\big(W_m(\mathcal{M} \setminus h) - p_m\big)$ because that represents profit that is now at risk when a contract is not agreed to; and, similarly, the value of a contract to the hospital decreases by $\phi_h(\mathcal{M})D_h(\mathcal{M})p_h - C_h\big(\phi_h(\mathcal{M})D_h(\mathcal{M})\big)$ because those profits are not at risk as those

patients will remain with the hospital if it does not agree to a contract with MCO m. When the difference between these two terms is positive the bargaining power estimates will be biased upwards and when negative the bias will be downwards.

TABLE C-1—DETERMINANTS OF BARGAINING POWER

Dependent Var. $= \Delta\Pi_h$	Cost Specification					
Output:	Patient Days			DRG-Weighted Discharges		
Revenue Associated w/ Discharge	\$5,000	\$10,000	\$20,000	\$5,000	\$10,000	\$20,000
Base Bargaining Pwr.	0.9397**	0.9731**	0.9598**	0.9232**	0.9432**	0.9427***
	(0.4072)	(0.4298)	(0.4449)	(0.3610)	(0.3671)	(0.3658)
Hosp. Market Share	0.2461	0.2080	0.1046	0.2208	0.1910	0.0846
	(0.2993)	(0.2955)	(0.2728)	(0.2898)	(0.2827)	(0.2564)
HHI^{Hosp} - HHI^{HMO}	0.1667	0.1548	0.0889	0.0428	0.0242	−0.0352
	(0.3531)	(0.3600)	(0.3275)	(0.3082)	(0.3099)	(0.2818)
Predicted Patient	−0.0277**	−0.0284**	−0.0275**	−0.0261**	−0.0267**	−0.0262**
Days (/1000)	(0.0138)	(0.0141)	(0.0138)	(0.0118)	(0.0119)	(0.0115)
Physician Group	0.2762**	0.2890**	0.2838**	0.2349**	0.2474**	0.2511**
	(0.1263)	(0.1262)	(0.1214)	(0.1127)	(0.1108)	(0.1006)
Specialty	−0.0786	−0.0769	−0.0438	−0.0980	−0.1029	−0.0862
	(0.2083)	(0.2100)	(0.2099)	(0.1931)	(0.1958)	(0.1915)
Trauma Center	0.1594	0.1398	0.1147	0.1622*	0.1430*	0.1179
	(0.1005)	(0.0999)	(0.0932)	(0.0864)	(0.0842)	(0.0774)
Teaching Hospital	0.3966	0.4095	0.3897	0.2547	0.2639	0.2670
	(0.2935)	(0.2909)	(0.2810)	(0.2480)	(0.2472)	(0.2336)
Rural Hospital	−0.2109	−0.2249	−0.2206	−0.1666	−0.1787	−0.1841
	(0.1364)	(0.1410)	(0.1386)	(0.1189)	(0.1217)	(0.1188)
For-Profit (FP)	−0.0488	−0.0535	−0.0633	−0.0260	−0.0264	−0.0369
	(0.0818)	(0.0827)	(0.0802)	(0.0740)	(0.0737)	(0.0713)
% ER Discharges	−0.7109	−0.7069	−0.6319	−0.5644	−0.5491	−0.4996
	(0.4750)	(0.4942)	(0.4936)	(0.4277)	(0.4302)	(0.4192)
System Member	0.2917***	0.2991***	0.2880***	0.2703**	0.2746**	0.2739**
	(0.1031)	(0.1077)	(0.1091)	(0.1234)	(0.1274)	(0.1281)
γ_p^{-1} (×1000)	3.5148***	3.1047***	2.8875**	3.1606**	2.7776**	2.5062
	(1.1353)	(1.1896)	(1.4161)	(1.3368)	(1.3907)	(1.5290)
Mean Fitted Bargaining Power	0.5891	0.5980	0.6120	0.6688	0.6767	0.6889
Adj. R^2	0.9180	0.9179	0.9176	0.9511	0.9511	0.9510
N	304	304	304	304	304	304

Note: All specifications include HSA fixed effects and use 15% of predicted managed care patients adjusted by the proportion of patients predicted to switch MCOs for the change in cost calculation. Errors are clustered by hospital.
Significance Levels:*** p < .01, ** p< .05, * p < .1

Ho (2006) uses data on managed care plans and networks to estimate the demand for managed care coverage as a function of observables including the estimated utility of the associated hospital network. Ho's demand estimates suggest the number may be quite small. For instance, she reports that a one standard deviation drop in the expected utility of

an MCO's network will cause the MCO to lose about 31% of its enrollees.[35] In our data, a one standard deviation change in expected utility of a choice-set is 2.966 *utils* and the average change in *utils* from removing a hospital and an entire system is 0.033 (0.212) and 0.079 (0.316) *utils*, respectively. Assuming a similar demand for insurance in California, these data suggest that the removal of one hospital or one system will, on average, lower an MCO's demand by 0.3% and .8%, respectively. Although the switching probabilities indicated by the demand estimates in Ho (2006) are low on average we predict that the removal of certain hospitals in our data can result in MCOs losing as much as 60% of their enrollees within the local patient market, suggesting that not accounting for this in the surplus calculation could results in biased results. To determine how much this impacts the results we estimate (C-2) using the elasticity implied by Ho (2006). As in the main analysis our data is aggregated at the hospital level. Eq. (C-2) presents in additional challenge in that we do not observe $W_m(\mathcal{M} \setminus h)$, which essentially represents the MCO's revenues from premiums, deductibles, and co-pays that are associated with a given discharge. Given that the average total premium paid for an individual health plan is on the order of $5,000 and deductibles range from a few hundred to several thousand dollars we estimate the model using values of $5,000, $10,000, $20,000 for $W_m(\mathcal{M} \setminus h)$. The results of this exercise are reported in Table C-1.

The results show that the coefficient estimates are very similar across revenue amounts and almost all are nearly identical to those in the baseline analysis. The system coefficients are slightly lower and, as a result, statistically insignificant in the DRG-weight specification; but, when interacted with not-for-profit status and the number of system hospitals the coefficient is similar to the result in the paper and statistically significant. This may indicate that system hospitals are somewhat more likely to keep patients, perhaps from providing more value than other non-system hospitals in that market or as a consequence of the system having multiple hospitals in the same patient market.

[35] Ho (2006) reports that a one standard deviation increase in the expected utility is equivalent to a $39 decrease in the premium. She also reports a price elasticity of demand of -1.24 suggesting that a $5 increase of a $141 premium results in 4 percent reduction in the probability of being chosen thus a one standard deviation drop in expected utility from the network should result in about a 31 percent reduction in the probability of being chosen.

APPENDIX D. ANALYSIS USING ONLY PRIVATELY INSURED PATIENTS

TABLE D-1—DETERMINANTS OF BARGAINING POWER

Dependent Var. $= \Delta\Pi_h$	Cost Specification					
Output:	Patient Days			DRG-Weighted Discharges		
Patient Proportion:	7.5%	15%	30%	7.5%	15%	30%
Base Bargaining Pwr.	1.0222**	1.0273**	1.0045**	0.8134**	0.7822**	0.7119*
	(0.4983)	(0.5030)	(0.4974)	(0.4033)	(0.3936)	(0.3746)
Predicted Patient	−0.0842*	−0.0438*	−0.0227*	−0.0643*	−0.0321*	−0.0158
Days (/1000)	(0.0502)	(0.0255)	(0.0129)	(0.0386)	(0.0192)	(0.0096)
Hosp. Market Share	0.4910	0.5163	0.5375	0.4414	0.4545	0.4767
	(0.3285)	(0.3327)	(0.3366)	(0.3169)	(0.3113)	(0.2951)
HHI^{Hosp} - HHI^{HMO}	−0.0028	−0.0007	0.0037	−0.1709	−0.1807	−0.2032
	(0.3922)	(0.4088)	(0.4307)	(0.3238)	(0.3326)	(0.3538)
Physician Group	0.3633***	0.3737***	0.3734***	0.3415**	0.3506**	0.3670**
	(0.1203)	(0.1169)	(0.1109)	(0.1468)	(0.1501)	(0.1519)
Specialty	−0.2387	−0.2828	−0.3564	−0.3110	−0.3436	−0.3879*
	(0.2081)	(0.2146)	(0.2473)	(0.2358)	(0.2365)	(0.2116)
Trauma Center	0.0980	0.0979	0.1086	0.0853	0.0828	0.0803
	(0.1185)	(0.1216)	(0.1267)	(0.1206)	(0.1253)	(0.1330)
Teaching Hospital	0.5945**	0.6294***	0.6528***	0.4861*	0.5136*	0.5680**
	(0.2643)	(0.2366)	(0.1817)	(0.2769)	(0.2792)	(0.2754)
Rural Hospital	−0.3005*	−0.3125*	−0.3193*	−0.2071	−0.2031	−0.1898
	(0.1553)	(0.1595)	(0.1667)	(0.1601)	(0.1651)	(0.1752)
For-Profit (FP)	0.0002	−0.0019	−0.0146	0.0396	0.0475	0.0642
	(0.0938)	(0.0935)	(0.0927)	(0.1073)	(0.1105)	(0.1161)
System Member	0.2919**	0.3086**	0.3420***	0.2399*	0.2447*	0.2563*
	(0.1193)	(0.1220)	(0.1263)	(0.1264)	(0.1288)	(0.1331)
% ER Discharges	−0.6622	−0.6578	−0.6227	−0.2401	−0.1880	−0.0725
	(0.5744)	(0.5816)	(0.5782)	(0.4789)	(0.4741)	(0.4617)
γ_p^{-1} (×1000)	1.9580**	1.7298**	1.4337*	1.3860	1.2327	0.9430
	(0.9269)	(0.8541)	(0.7578)	(1.2001)	(1.1223)	(0.9394)
Mean Fitted Bargaining Pwr.	0.6824	0.6968	0.7087	0.7691	0.7797	0.8018
Adj. R^2	0.9194	0.9198	0.9211	0.9558	0.9559	0.9564
N	289	289	289	289	289	289

Note: All specifications include HSA fixed effects. Errors are clustered by hospital and adjusted to account for data generated by first-stage regressions following Murphy and Topel (1985).
Significance Levels:*** p < .01, ** p< .05, * p < .1

TABLE D-2—DETERMINANTS OF BARGAINING POWER

Dependent Var. $= \Delta\Pi_h$	Cost Specification					
Output:	Patient Days			DRG-Weighted Discharges		
Revenue Associated w/ Discharge	\$5,000	\$10,000	\$20,000	\$5,000	\$10,000	\$20,000
Base Bargaining Pwr.	0.9093^{*}	0.9343^{*}	0.9790^{*}	0.7720^{*}	0.7772^{*}	0.7850^{*}
	(0.4719)	(0.4833)	(0.5039)	(0.4117)	(0.4113)	(0.4098)
Predicted Patient	-0.0059	-0.0061	-0.0063	-0.0052^{*}	-0.0053^{*}	-0.0053^{*}
Days $(/1000)$	(0.0036)	(0.0037)	(0.0038)	(0.0030)	(0.0030)	(0.0031)
Hosp. Market Share	0.5231	0.5242	0.5168	0.5345	0.5411	0.5433
	(0.3377)	(0.3420)	(0.3490)	(0.3626)	(0.3611)	(0.3557)
HHI^{Hosp} - HHI^{HMO}	0.1578	0.1587	0.1567	-0.0273	-0.0351	-0.0516
	(0.4074)	(0.4185)	(0.4377)	(0.3576)	(0.3630)	(0.3715)
Physician Group	0.3047^{**}	0.3156^{***}	0.3355^{***}	0.2918^{**}	0.3021^{**}	0.3201^{**}
	(0.1187)	(0.1191)	(0.1196)	(0.1454)	(0.1481)	(0.1529)
Specialty	-0.2423	-0.2532	-0.2739	-0.2928	-0.3077	-0.3377
	(0.1996)	(0.2019)	(0.2058)	(0.2006)	(0.2082)	(0.2243)
Trauma Center	0.1530	0.1435	0.1242	0.1418	0.1309	0.1102
	(0.1201)	(0.1209)	(0.1220)	(0.1224)	(0.1245)	(0.1283)
Teaching Hospital	0.5463^{**}	0.5645^{**}	0.5974^{**}	0.4648^{*}	0.4780^{*}	0.5010^{*}
	(0.2560)	(0.2541)	(0.2496)	(0.2671)	(0.2713)	(0.2789)
Rural Hospital	-0.2307	-0.2454	-0.2726^{*}	-0.1499	-0.1598	-0.1781
	(0.1467)	(0.1506)	(0.1588)	(0.1492)	(0.1541)	(0.1634)
For-Profit (FP)	0.0010	-0.0021	-0.0089	0.0374	0.0408	0.0462
	(0.0898)	(0.0912)	(0.0939)	(0.1059)	(0.1075)	(0.1103)
System Member	0.2627^{**}	0.2711^{**}	0.2868^{**}	0.2285^{*}	0.2313^{*}	0.2367^{*}
	(0.1120)	(0.1147)	(0.1203)	(0.1236)	(0.1262)	(0.1310)
% ER Discharges	-0.6342	-0.6437	-0.6561	-0.2771	-0.2614	-0.2286
	(0.5508)	(0.5623)	(0.5823)	(0.4871)	(0.4880)	(0.4893)
γ_p^{-1} $(\times 1000)$	3.3559^{***}	3.1009^{***}	2.6458^{**}	2.4561^{*}	2.2282^{*}	1.8271
	(1.0465)	(1.0346)	(1.0321)	(1.2450)	(1.2284)	(1.2070)
Mean Fitted Bargaining Pwr.	0.6815	0.6962	0.7215	0.7954	0.8084	0.8289
Adj. R^2	0.9184	0.9185	0.9184	0.9541	0.9543	0.9545
N	289	289	289	289	289	289

Note: All specifications include HSA fixed effects and use 15% of predicted managed care patients adjusted by the proportion of patients predicted to switch MCOs for the change in cost calculation. Errors are clustered by hospital.
Significance Levels:*** p $<$ .01, ** p$<$ .05, * p $<$ .1