Hospital Systems and Bargaining Power: Evidence from Out-of-Market Acquisitions*

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Competition analyses frequently focus on how mergers alter local market concentration. As multi-market hospital systems often play a role in their members' negotiations with insurers, however, this could overlook an important cross-market interdependence in the bargaining outcome. We use out-of-market hospital mergers to investigate the cross-market price effects of system membership. Based on acquisitions occurring across the U.S. during 2000-2010, we find that the negotiated prices of hospitals acquired by out-of-market systems increase by 14 to 18% compared to independent hospitals. The findings reveal that systems can affect hospital market power in ways not considered by researchers and antitrust authorities.

JEL Codes: L10, L41, I11

Over the last two decades the hospital industry in the United States has undergone an unprecedented wave of consolidation as numerous hospital mergers and acquisitions have generated significant growth in the role of hospital systems. Not surprisingly, there has been significant public concern that this consolidation has resulted in higher prices, a notion that is particularly salient given the ever-escalating prices for health care services. In response, economists have investigated the impact of hospital consolidations on the prices of hospital services utilizing a variety of different strategies. More traditional studies have approached the formation of a system as that of a classic horizontal merger (e.g., Dranove et al., 1993; Lynk, 1995; Melnick et al., 1992; Connor et al., 1998; Simpson and Shin, 1998; Dranove and Ludwick, 1999; Keeler et al., 1999; Cuellar and Gertler, 2005; Melnick and Keeler, 2007) by analyzing the relationship between prices (i.e., reimbursement rates) and various measures of market concentration (usually the Herfindahl-Hirschman Index [HHI]). These

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studies simulated the impact of a merger between two hospitals in a market by estimating the price effect associated with the implied increase in the HHI.[1] More recently, researchers (Brooks, Dor, and Wong, 1997; Town and Vistnes, 2001; Capps, Dranove, and Satterthwaite, 2003; Ho, 2009; Lewis and Pflum, 2014; Gowrisankaran, Nevo, and Town, 2014) have utilized structural models that incorporate the fact that reimbursement rates are largely determined through bilateral negotiations between hospitals (or hospital systems) and managed care organizations (MCOs). By estimating a discrete choice model of patients' demand for different hospitals, these analyses identify the market power of each hospital as a function of the amount MCO enrollees would be willing to pay for the option of being able to go to that hospital instead of their next best alternative if they are in need of hospital care. Such approaches have now been widely adopted by antitrust authorities in evaluating potential mergers (Farrell, Balan, Brand, and Wendling, 2011).

Though the more traditional concentration-based and structural bargaining-based approaches are quite different, almost all of these studies share an important limitation: They all restrict their examination of the effects of system acquisitions and mergers to local patient markets, despite the fact that large regional and national hospital systems are becoming more common. Although it is often appropriate for competition analyses to restrict attention to the relevant consumer market, this may not be the case for hospital care as reimbursement rates are negotiated between hospitals and MCOs. For example, multi-market hospital systems often play an important role in the negotiations of their member hospitals and Vistnes and Sarafidis (2013) identify several ways in which the presence of hospitals in multiple patient markets may create an interdependence between the outcome of negotiations in one patient market and the profits earned in another. Furthermore, as highlighted by Lewis and Pflum (2014), the negotiated reimbursement rate determines how the hospital and MCO split the surplus generated by a successful contract, and multi-market hospital systems may be better equipped to negotiate a larger share of that surplus (i.e., multi-market systems may have higher bargaining power). In consequence, studies that focus only on local market structure ignore the potential price effects of multi-market system formation, which in many cases

[1]Several studies have also examined what MCO characteristics lead to lower reimbursement rates. Sorensen (2003) examines how an HMO's ability to channel patients affects its ability to secure lower reimbursements and Wu (2009) considers the degree to which the hospitals' cost differential, the ability of MCOs to channel patients, and the excess capacity of hospitals contribute to the per diem price differential of hospitals.

could also result in biased estimates of in-market effects.

In this study we directly investigate the cross-market effects that system membership may have on the negotiated reimbursement rates of their member hospitals. Rather than attempting to specify and test a particular model of this cross-market system effect we utilize a difference-in-differences approach to examine the impact of actual system acquisitions and isolate the cross-market effect by focusing on out-of-market mergers that had no impact on the local market structure. Based on 143 such hospital acquisitions occurring across the United States during the years 2000–2010, we find that these hospitals exhibit significant increases of about 14 to 18 percent in their net reimbursement rates after joining an out-of-market hospital system.

Since the local market conditions that influence hospital pricing may also be correlated with the likelihood of a hospital being acquired, we adopt a variety of strategies to control for unobservable market conditions. To ensure that treatment effects are not driven by differing price trends, we estimate specifications that allow for separate sets of year fixed effects for acquired hospitals and control hospitals and that include leads and lags of the treatment variable to reveal discrete jumps or kinks in price trends at the time of acquisition. We also estimate a difference-in-difference-in-differences (triple-differences) specification which compares the difference-in-differences estimate of the price change experienced by acquired hospitals with the difference-in-differences estimate of the change in price experienced by other hospitals in the markets where these hospitals are acquired. In all cases, estimates of the price increases associated with acquisitions remain fairly similar.

We also consider the possibility that the identified increases in reimbursement rates are associated with other cost-related changes that may occur at hospitals during acquisition. A collection of auxiliary regressions show that the observed price increases do not appear to be a result of changes in patient case-mix, hospital quality, or the cost of providing care generally. In addition, we find that these acquisitions increased the reimbursement rates of nearby rival hospitals, suggesting the presence of a competitive price effect rather than a simple change in operations following acquisition. Together the findings reveal that systems can have a significant impact on the market power of hospitals in ways that have not been studied or taken into consideration in recent antitrust analysis.

I. Theoretical Motivation and Empirical Strategy

The structural models that have become standard practice for analyzing hospital competition in recent years are all based on the same general bargaining framework. In this section we outline a general bargaining model that encapsulates many of the models used in the literature. The model illustrates how system membership can impact negotiated reimbursement rates, and is used to motivate our empirical strategy.

A. A Simple Model of Hospital-MCO Bargaining

Much of the literature (e.g., Brooks, Dor, and Wong, 1997; Capps, Dranove, and Satterthwaite, 2003; Ho, 2009; Halbersma, Mikkers, Motchenkova, and Seinen, 2010; Grennan, 2013; Lewis and Pflum, 2014; Ho and Lee, 2013; Gowrisankaran, Nevo, and Town, 2014) has utilized the asymmetric Nash bargaining solution to model the price negotiation game between hospitals and MCOs.[2] These papers differ mainly with respect to how the how the contract surplus is defined, which is partially a function of the assumptions on the behavior of enrollees. Here we generalize the model so that it nests each of the special cases previously considered in the literature.

In the Nash bargaining game the players cooperate to choose the payment that maximizes their joint surplus.[3] In this application, the surplus an MCO gains by accepting a contract with a hospital is the difference in the profit the MCO would make if that hospital is in its network of providers net the profit it would make if that hospital is not in its network of providers. Similarly a hospital's surplus generated by accepting a contract with an MCO is the difference in the profit it earns by being including in that MCO's network of providers and the profit it would make when it is not.

Let $\mathcal{M}$ represent the set of hospitals in MCO m's network of providers when m and hospital h agree to a contract and let $\mathcal{H}$ represent the set of MCO provider networks to which h belongs. The respective surpluses generated by m and h when they successfully negotiate

[2]Outside of hospital markets Svejnar (1986) applied the asymmetric Nash bargaining model to labor markets and Draganska, Klapper, and Villas-Boas (2010) applied the model to the German market for coffee.

[3]Binmore, Rubinstein, and Wolinsky (1986) show that at the limit a strategic game of counteroffers results in the same division of the surplus as Nash's cooperative bargaining game.

a contract can then be expressed as:

$$\Pi_m(\mathcal{M}) - \Pi_m(\mathcal{M} \setminus h) = \Delta R_h - [r_{h,m} - r_{-h,m}]D_h^E(\mathcal{M}) - r_{h,m}D_h^N(\mathcal{M}),$$
$$\Pi_h(\mathcal{H}) - \Pi_h(\mathcal{H} \setminus m) = [r_{h,m} - r_{h,-m}]D_h^N(\mathcal{M}) + r_{h,m}D_h^E(\mathcal{M}) - C_h\big(D_h^E(\mathcal{M})\big),$$

where $\Delta R_h = P(\mathcal{M}) - P(\mathcal{M} \setminus h)$ is the total change in revenues (premiums) collected by m when hospital h is added to the network;[4] $r_{h,m}$ is the reimbursement price from m to h; $r_{-h,m}$ is the average reimbursement payment to the hospitals in MCO m's network that are the second choice by patients who prefer treatment at h; $r_{h,-m}$ is the average reimbursement payment to the hospital from the MCOs of those patients who would switch from MCO m when h is not in m's network; $D_h^E(\mathcal{M})$ are the number of patients insured by m regardless of whether or not h is in-network who prefer h over all other hospitals in m's provider network; $D_h^N(\mathcal{M})$ are the additional enrollees to MCO m when it has hospital h in its network; and $C_h\big(D_h^E(\mathcal{M})\big)$ are h's additional costs from treating the patients that will seek treatment at h if and only if it is in m's provider network.

Much of the literature assumes that $D_h^N(\mathcal{M}) = 0$ (e.g., Brooks et al., 1997; Capps et al., 2003; Halbersma et al., 2010; Grennan, 2013; Lewis and Pflum, 2014). In this case the added value of a hospital to an MCO is predominantly driven by the increased willingness to pay of enrollees while the value of a contract to a hospital is the increase in demand from the MCO's patients. Some hospitals are particularly attractive, however, so may not experience much of an increase in demand by joining an MCO's provider network as patients would substitute to an MCO that has that hospital in network anyway. Gowrisankaran et al. (2014) explicitly allow for some MCO substitution while Lewis and Pflum (2014) explore the impact of such substitution on their main results in an appendix.

The objective function for the asymmetric Nash bargaining game is simply the product of the two parties' surpluses weighted by their relative bargaining power and can be

[4]Much of the existing literature has assumed that this term represents the enrollees' marginal willingness-to-pay for the additional hospital/system; however, in a market with competitive MCOs, this term will more generally be something less than enrollees' marginal willingness-to-pay as it represents a residual based on the substitutability of MCOs.

expressed as

$$\max_{r_{h,m}} \left[\Pi_m(\mathcal{M}) - \Pi_m(\mathcal{M} \setminus h)\right]^{1-\beta_h} \left[\Pi_h(\mathcal{H}) - \Pi_h(\mathcal{H} \setminus m)\right]^{\beta_h}, \tag{2}$$

where β_h is hospital h's bargaining power vis-à-vis MCO m. The optimal reimbursement price is found by taking the first-order condition with respect to the reimbursement price to get:

$$\begin{aligned} r_{h,m} =& \frac{C_h\big(D_h^E(\mathcal{M})\big) + r_{h,-m} D_h^N(\mathcal{M})}{D_h^E(\mathcal{M}) + D_h^N(\mathcal{M})} \\ &+ \beta_h \left[\frac{\Delta R_h + r_{-h,m} D_h^E(\mathcal{M}) - r_{h,-m} D_h^N(\mathcal{M}) - C_h\big(D_h^E(\mathcal{M})\big)}{D_h^E(\mathcal{M}) + D_h^N(\mathcal{M})} \right]. \end{aligned} \tag{3}$$

The first term on the right-hand side of (3) represents the average (opportunity) cost to the hospital from treating the patients from MCO m that choose h over all other hospitals in m's network of providers. In addition to covering the cost of care, the hospital and MCO split the total surplus generated by the contract with the hospital getting a share equal to β_h. The total surplus from the contract is the difference in the premium revenues the MCO receives plus the payments the MCO would have to make on those enrollees who switch to their second-best hospital minus the revenue the hospital would have received from those patients who switch to MCO m net the additional cost of treating those patients. The bracketed term on the right-hand side of (3) represents the per patient average of this surplus. For each patient from MCO m that h treats it will receive a markup over cost equal to the average surplus generated by the contract weighted by its bargaining power.

Expression (3) helps illustrate the variety of factors that impact a hospital's reimbursement price that we directly incorporate into our empirical analysis. For example, it shows that because price is directly related to the cost of treatment we would expect hospitals that tend to treat sicker patients will receive higher average reimbursements per discharge. It also indicates that the negotiated reimbursement between hospital h and MCO m is a function of the reimbursements paid by m to those hospitals that are viewed as the closest substitutes to h by the patients who prefer h. This follows because these reimbursements are part of the MCO's opportunity cost of failing to reach an agreement. Reimbursement prices also

increase when the addition of h to m's network allows the MCO to collect higher premiums from its enrollees. By including a hospital in its provider network, enrollees have the option to seek treatment at that hospital upon falling ill.[5] This option becomes more valuable to enrollees when there are fewer close substitute hospitals within the MCO's existing provider network. An increase in the attractiveness of the network allows the MCO to increase premiums and attract more enrollees.[6] Hospitals that are perceived as particularly valuable or desirable to enrollees will generate the largest difference in premiums and we would expect these higher value hospitals to also have higher reimbursement prices, *ceteris paribus*. Controlling for these factors is necessary to isolate a causal effect of system membership.

The model also helps to illustrate the two main channels through which systems can impact the negotiated price. First, when two or more hospitals merge to form a system, they typically offer MCOs an all-or-nothing choice such that the MCO must either agree to a contract that includes all of the system members or it does not agree and none of the hospitals are added to its provider network. Because enrollees cannot substitute between system member hospitals when none are in-network, the option value to enrollees of having access to all of those system members is higher than the sum of the option values of having access to any one of the members given the others are in the MCO's network. By negotiating as one, the system members increase the surplus generated by their inclusion (by increasing ΔR_h) and, thus, improve their *bargaining position*. It is clear that any system acquisition that increases the concentration of hospitals within a local patient market will improve its members' bargaining position and as a consequence both researchers and antitrust authorities have focused on mergers that impact the concentration of hospitals within a local patient market. However, as Vistnes and Sarafidis (2013) point out, mergers that do not alter the concentration of hospitals with a local patient market (i.e., out-of-market mergers) also have the potential to affect bargaining position when the relevant consumer is a firm that has employees in several different patient markets. Though individuals will not view hospitals in different markets as substitutes, the firm, wanting to ensure it has covered all of the markets in which its employees reside, will find greater value in a system that has hospitals in those

[5]Enrollees can still visit hospitals that are out of network, however, they will have to pay substantially higher coinsurance rates. In some cases they may have to pay the full amount billed by the hospital creating an enormous disincentive to seek care at out of network hospitals.

[6]This is the source of market-power identified by the option-demand framework developed by Capps et al. (2003).

markets.[7]

The second channel through which system membership can impact the negotiated price is by altering the *bargaining power* of a member hospital (i.e., β_h). A hospital's bargaining power identifies the proportion of the contract surplus that it extracts for itself. While this bargaining power is represented by an exogenous parameter in the Nash model, several findings from the theoretical bargaining literature (including Fudenberg and Tirole (1983) and Sobel and Takahashi (1983)) suggest that bargaining power may depend on factors such as the amount of information one party has regarding the value of the contract to the other party. A hospital's bargaining power might therefore increase after joining a system if the system shares the costs of creating a larger and more skilled team of contract negotiators or if it pools information from previous contract negotiations giving the member hospital more information to use in the bargaining process as in the case of Tenet Healthcare—a national system of 73 hospitals—which adopted a "national negotiating template and new technology to analyze payer-specific profit and loss data, giving negotiators ammunition during contract talks" (Colias, 2006). For these reasons system membership has the potential to increase an acquired hospital's bargaining power and, again without altering the concentration of hospitals in the local market, a system hospital will extract more of the surplus generated by joining an MCO's provider network resulting in a higher reimbursement price. In fact, in the model outlined above, if patients are the relevant consumer of insurance as assumed by much of the literature, then the only way a hospital's profit margins can increase when acquired by an out-of-market system would be through an increase in its bargaining power.

B. Discussion and Empirical Strategy

The existing structural studies and recent antitrust analyses have assumed that bargaining power is fixed and that enrollee willingness-to-pay is derived only from local hospital and market characteristics. As a result, if there are any cross-market interdependencies in bargaining position for systems or if system membership alters a member hospital's bargaining power, then these studies will fail to capture the resulting price changes or mistakenly characterize them as resulting from a change in local concentration. Melnick and Keeler

[7] Vistnes and Sarafidis (2013) also outline several other ways in which there can be a cross-market interdependence that allows hospitals to improve their bargaining position via out-of-market mergers.

(2007) discuss the possibility that there might be cross-market effects and present suggestive reduced-form evidence that the higher prices that system hospitals receive are a result of more than changes in local market concentration. Lewis and Pflum (2014) utilize a form of the model outlined above to separately identify bargaining power from (local market) bargaining position while also allowing bargaining power to vary across hospitals as a function of observable characteristics such as system membership. They find evidence that system hospitals tend to have significantly higher bargaining power than non-system hospitals, all else equal. As both of these studies rely largely on cross-sectional variation, however, they are only able to establish evidence of a correlation between system membership and cross-market price effects.

So that we can more directly estimate a causal effect of system affiliation on reimbursement prices we examine the observed changes in reimbursement rates associated with actual system acquisitions using a difference-in-differences approach. Rather than relying on a specific structural model (which may fail to account for cross-market interdependencies), we focus our investigation on out-of-market system acquisitions. The price effects of these acquisitions can only be the result of cross-market interdependencies since there is no change in concentration of hospitals in the acquired hospital's local patient market. Importantly, the data allow us to control for hospital characteristics like patient case-mix and the hospital's average cost of care to assure that we are not mistakenly interpreting any changes in hospital operation that might occur during a system acquisition and that might impact reimbursement rates.[8] With this approach we provide the first direct empirical evidence for cross-market interdependencies; that is, we find strong evidence that system affiliation allows member hospitals to command higher reimbursement rates even when the system has no other local market presence.

Difference-in-differences estimation approaches have been used to better identify the causal effects hospital mergers in several case studies that focus on individual mergers (e.g.; Vita and Sacher, 2001; Tenn, 2011) and by Dafny (2009) to analyze mergers of co-located hospitals (within .5 miles). All of these studies examine the price impact of mergers between

[8]In fact, we find little evidence of significant changes in the patients that hospitals treat, but we do uncover some evidence that hospitals' slightly reduce their operating costs after joining an out-of-market system. These findings are discussed near the end of Section V.

local competitors, however, so do not consider cross-market competitive effects. Dafny's study is also unique in that it incorporates an instrumental variables (IV) estimation in an attempt to further control for the potential endogeneity of being chosen for acquisition. Unfortunately, since even the best instruments available to predict the likelihood of acquisition do not vary significantly over time, using IV estimation requires collapsing the data to adopt a cross-sectional approach (as Dafny (2009) does), ignoring panel variation in the timing of the observed mergers. As a result, identification requires the potentially strong assumption that expected price trends (in the absence of a merger) are uncorrelated with the market characteristics (i.e., instruments) that make acquisition more likely. In contrast, by using a panel our difference-in-differences approach relies more heavily on the timing of the merger, allowing price trends to be correlated with the likelihood of a merger and only requiring that the exact timing of the merger is uncorrelated with unobserved factors influencing prices.

As in Dafny (2009) and other observational merger studies, our estimates can only reveal the impact of system acquisitions that firms have chosen to undertake. It is likely that acquisitions of other hospitals might not generate the same changes in reimbursement rates or profit margins. However, given that these out-of-market mergers have become more common and have been largely ignored in previous analysis, measuring the effects of these mergers is crucial first step in understanding the influence of systems across markets and informing future work that may be able to more accurately predict the effects of a broader set of proposed mergers.

II. DATA

We construct a panel spanning the years 1998 to 2009 using data from the American Hospital Association's (AHA) Annual Survey of Hospitals and the Healthcare Cost Report Information System (HCRIS) maintained by the Centers for Medicare and Medicaid Services' (CMS).[9] Data from the two sources are matched using the CMS Medicare provider numbers and observations are at the hospital-year level.

Data on hospital system status come from the AHA annual survey of hospitals, 1998-2010. The AHA annually surveys all of the approximately 6,000 hospitals within the U.S.

[9]Subsequent years of HCRIS data are not used because the cost reporting forms changed, making it difficult to assure consistency across years.

and its territories soliciting information such as system membership, ownership type, and service offerings. We only consider hospitals from the non-territorial United States that provide general short term care. A hospital is only included in our analysis if it was never part of a system during our sample period, or is observed to have joined a system during the period from 2000–2010 and remained in a system for the rest of the sample period. This selection assures that the sample includes at least two years of observations before a hospital joins a system and although the panel ends in 2009, the 2010 data allow us to identify the status of a hospital immediately after the panel ends and help control for any pre-acquisition effects.

We want to distinguish between those system acquisitions in which the system has no presence in the patient market of the acquired hospital—out-of-market acquisitions—and those in which the acquiring system already has other member hospitals—in-market acquisitions. Identifying patient markets is often done by examining patient flow data (e.g., Melnick et al., 1992; Melnick and Keeler, 2007; Capps et al., 2003); however, as we do not have discharge data for all of the hospitals in the sample and because we are not using the market definition to measure market shares or HHI we simply categorize hospitals as belonging to the same patient market if they are within 45 miles from one another.[10] Distance is calculated as the straight-line distance between hospitals' latitude and longitude. Figure 1 reports the number of out-of-market and in-market system acquisitions from 2000 to 2010.

All Medicare-certified hospitals must submit an annual cost report to CMS. The data from the reports are maintained in HCRIS and are available for download by the public on the HCRIS website at cms.gov. Included in the data from HCRIS are the total gross charges of each hospital in each year, reported separately for inpatient and outpatient care. Gross charges represent the revenue the hospital would receive if it was paid its list price; however, as Medicare and Medicaid pay an administratively established rate and most insurers negotiate special rates that are less than the list price, a hospital receives its list price for very few, if any, discharges. HCRIS also contains the total revenues of each hospital net of any

[10]Based on the discharge abstracts for 2000-2009 provided by the California Office of Statewide Health Planning and Development, fewer than 1% of the patients would be predicted to choose a hospital more than 45 miles from their chosen hospital if it was removed from their choice set. This suggests such distant hospitals would not experience much of a change in bargaining position if they were to merge. Nevertheless, explore the robustness of our analysis to larger distance cutoffs in Appendix Table D1.

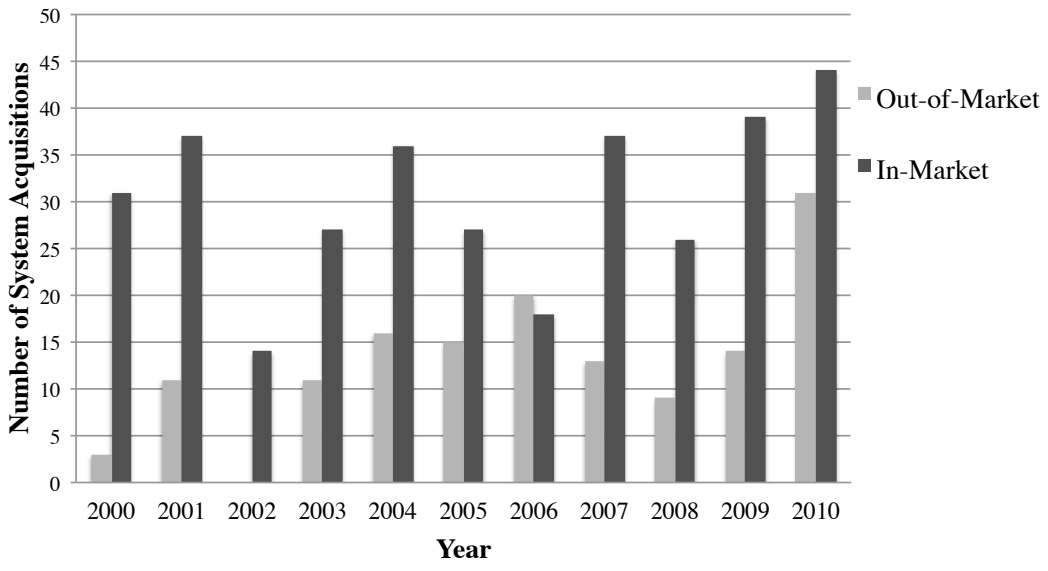


FIGURE 1. SYSTEM ACQUISITIONS BY TREATMENT GROUP, 2000-2010

contractual deductions from list price, though these are not reported separately for inpatient and outpatient charges.

We take a similar approach to the procedure used by Dafny (2009) and construct a measure of the net revenues from inpatient discharges for a hospital in a given year by multiplying a hospital's gross charges for inpatient care by the ratio of the hospital's total net revenues to gross charges. We then subtract the total (net) amount received from Medicare for inpatient services from the total net inpatient revenue to calculate the total net inpatient revenue from non-Medicare patients.[11] Information on the number of inpatient discharges (as well as inpatient days) are reported by payer type. To obtain our measure of average price per discharge for non-Medicare patients, we then divide the total net inpatient revenue from non-Medicare patients by the observed number of non-Medicare inpatient discharges. This essentially represents a weighted average of the price per discharge for privately insured and Medicaid patients weighted by the share of inpatient discharges coming from each type.[12]

Although we are unable to net out Medicaid patient revenues like we do for Medicare, in most cases Medicaid patients represent a relatively small share of a hospital's discharges, so the average net revenue per discharge largely reflects negotiated prices paid on behalf of

[11]The HCRIS data on revenue and gross charges are not separated by payer type, except that the total (net) amount received from Medicare for inpatient services is observed.

[12]A detailed description of the price derivation we use is provided in Appendix A.

privately-insured managed care patients. Moreover, as described in the next section, we adjust the treatment effects to correct for the presence of Medicaid discharges at the hospital when analyzing the estimated impact of hospital mergers on these average prices. Nevertheless, to insure that the hospitals in the sample have a sufficient number of privately insured patients so that their revenues substantially reflect the outcomes of price negotiations, we include only those hospitals in which at least 10% of the patient population is privately insured.[13]

We also utilize the Medicare case mix index (CMI) assigned by the CMS in some specifications to help control for differences over time in the illness severities of the patient population treated by a hospital. The CMI measures the relative weight for all of the Medicare discharges at a hospital for a given year and represents the differences in clinical complexity and resource use required to treat discharges belonging to different diagnosis-related groups (DRGs). The CMIs are collected from Medicare's inpatient prospective payment system (PPS) final rules which are also available online at cms.gov.

To eliminate outliers generated by data entry errors we trim the upper and lower tails at the 2.5th and 97.5th percentiles of the price distribution. We test the robustness of the results to the trimming levels by also performing the analysis with data that has not been trimmed and with data that has been trimmed at the 5th and 95th percentiles. The trim levels did not have a substantive impact on the results and the estimates from these analyses are reported in Appendix D. Table 1 reports the summary statistics for the hospitals in our sample.

III. ESTIMATION

The main treatment group, *Group1*, consists of the 143 stand-alone hospitals that become affiliated with a system that is completely out-of-market to that hospital in the period 2000-2010. By definition these are hospitals that have no affiliated partner hospitals within their local market at any time before or after merger during the sample period.[14] These 143

[13] Although 10% appears to represent a small share, the price that we are able to calculate nets out Medicare payments so the more important number is the private share of non-Medicare patients. Only 1% of the sample has a non-Medicare private share below 29% and the sample average is 77%. Nevertheless, the results are robust to a 25% private share cut-off as well.

[14] We classify hospitals that are observed to have a joined a system in 2009 and 2010 as treatment hospitals rather than control hospitals to better control for issues relating to the endogenous selection of hospitals and the timing of acquisition. Identification of the treatment effect comes from the 98 hospitals that are acquired before 2009 since the treatment dummy does not turn on until one year after the acquisition.

TABLE 1—HOSPITAL SUMMARY STATISTICS

	Full Sample ($N = 21{,}868$)			
	Mean	Standard Dev.	Min.	Max.
ln(Price/Discharge)	8.740	0.667	6.773	11.281
ln(Price/Day)	7.372	0.697	1.002	10.546
ln(Cost/Discharge)	9.021	0.473	6.670	12.599
ln(CMI)	0.246	0.193	−1.242	1.122
ln(Cost/Day)	7.497	0.467	4.904	11.797
ln(Avg. Length of Stay)	1.368	0.529	−1.014	8.146
ln(# Beds)	4.705	1.016	0.693	9.746
Bed Utilization	0.419	0.210	0.001	1.000
% Private	0.355	0.149	0.100	1.000
% Medicare	0.518	0.165	0.000	0.893
% Medicaid	0.124	0.106	0.000	0.824
% OP Revenue	0.492	0.155	0.000	0.997
	Hospitals Acquired by Out-Of-Market Systems ($N = 1283$)			
	Mean	Standard Dev.	Min.	Max.
ln(Price/Discharge)	8.817	0.674	6.817	11.093
ln(Price/Day)	7.484	0.657	4.293	9.523
ln(Cost/Discharge)	9.050	0.454	7.624	11.453
ln(CMI)	0.274	0.189	−1.242	0.800
ln(Cost/Day)	7.566	0.407	6.253	9.548
ln(Avg. Length of Stay)	1.333	0.379	−0.754	4.197
ln(# Beds)	4.811	0.957	2.079	6.870
Bed Utilization	0.424	0.198	0.012	1.000
% Private	0.371	0.145	0.100	0.996
% Medicare	0.499	0.156	0.002	0.879
% Medicaid	0.129	0.099	0.000	0.820
% OP Revenue	0.465	0.149	0.000	0.888

Notes: Summary statistics are based the sample used in the main analysis in which the tails of the Log(Price/Discharge) distribution have been trimmed at the 2.5th percentiles. Average costs are frequently higher than the average reimbursements due to the fact that average costs are likely biased upward slightly as we do not observe inpatient costs separately and instead disaggregate total operating costs based on the proportion of total patient revenues generated by inpatient care, while average reimbursements are biased downward slightly due to the presence of Medicaid patients.

hospitals are acquired by 88 distinct systems. For comparison purposes we also consider a second treatment group, *Group2*, that includes the 336 stand-alone hospitals that join a system in which there are other same system members within the same patient market at the time they joined. These 336 hospitals are acquired by a total of 173 systems, 40 of which are also involved in out-of-market acquisitions. In addition to a potential change in bargaining power these hospitals may also enjoy a strengthening of their bargaining position as they now negotiate reimbursement rates jointly with other local partners.

Our model for estimation can be expressed as:

$$r_{ht} = \alpha + \beta_1 \boldsymbol{T1}_{ht} + \beta_2 \boldsymbol{T2}_{ht} + d_{ht}\delta + g_{ht}\gamma + \kappa_{ht} + \eta \boldsymbol{FP}_{ht} + \mu_t + \xi_h + \epsilon_{ht}. \tag{4}$$

The dependent variable, r_{ht}, is the natural log of hospital h's reimbursement price at time t. $T1_{ht}$ is an indicator taking the value of 1 when hospital h is in *Group1* and is in a system at time t. In other words, $T1_{ht}$ represents the interaction of the indicator $Group1_h$ and an indicator $System_{ht}$, which is 1 when hospital h is in a system in year t and 0 otherwise. Similarly, $T2_{ht}$ is an indicator taking the value of 1 when hospital h is in *Group2* and is in a system in year t (i.e., $T2_{ht} = Group2_h \times System_{ht}$). The $j \times 1$ vector d_{ht} represents characteristics of hospital h's discharges at time t that impact the cost of care; the $k \times 1$ vector g_{ht} represents characteristics of hospital h's patient population at time t that may bias the estimated reimbursement price; κ_{ht} is an indicator variable that takes the value of one if hospital h joined a system in year t and zero otherwise;[15] FP_{ht} is a dummy indicating whether or not hospital h is for-profit at time t to control for any confounding effects of changing objectives;[16] μ_t are time controls; ξ_h are hospital fixed effects; and ϵ_{ht} is a mean zero, heteroskedastic disturbance term capturing unobserved heterogeneity in hospitals' prices. We assume this disturbance, ϵ_{ht}, is independent across hospitals but may be correlated across years for a given hospital. For robustness, we also estimate alternative specifications that allow the time fixed effects to differ between treatment hospitals and control hospitals by interacting the year fixed effects with the *Group1* and *Group2* indicators. The sample used for estimation includes all 2,133 general acute care hospitals that are not in a system at the beginning of our sample period, so the control group for our analysis becomes all hospitals that do not join a system at any time between 1998 and 2010.

The specification reported in (4) includes two groups of control variables. The d_{iht} includes the hospitals' CMI, average cost per inpatient day and average length of stay (all in natural logs, which is denoted using ln). Average cost per inpatient day is calculated by multiplying the hospital's total operating expenses by the ratio of gross inpatient revenues to total gross revenues and dividing by the number of inpatient days. All three controls capture different aspects of cost. The average length of stay captures differences in the cost of treatment that come from bed utilization. Some hospitals will tend to keep patients of the

[15]The change-year dummy is included because the timing of system acquisitions are not precisely known so the difference-in-differences compares reimbursement prices before merger to prices in the years following the merger.

[16]Of the hospitals in our sample, 18 acquired by an out-of-market system and 31 acquired by an in-market system change to for-profit status after acquisition. An additional 7 acquired by an out-of-market system and 8 acquired by an in-market system change status at least two years before acquisition and 65 of the control hospitals change to for-profit status.

same illness severity longer than others, potentially impacting their average discharge price if they are paid a per diem for some of their discharges.[17] The CMI captures differences in the cost of treatment that come from resource intensity differences related to other resources such as surgical time, more rigorous monitoring, and heavier staff utilization. With the inclusion of the other controls, the average cost per day captures differences in hospital efficiency that are unrelated to patient population illness severities and bed utilization.

The second set of control variables, the g_{jht}, control for factors that will bias the measure of reimbursement price due to the limitations of the data used in its estimation. The HCRIS reports only an overall measure of contractual deductions from list prices that is aggregated across in- and outpatient revenues from all payer types while gross charges are reported separately for in- and outpatient visits but not by payer type. We are able to net out Medicare inpatient revenues, but our calculated measure of net inpatient revenue for privately insured patients will still be distorted by the fact that the contractual discount measure is based partially on revenues from outpatient care, which also includes Medicare and Medicaid outpatient revenues. If contractual discount rates for outpatient care systematically differ from those for inpatient care, then our measure of inpatient net revenue will be biased in the direction of the difference and, even if the private contractual discounts do not differ between inpatient and outpatient care, the inclusion of outpatient revenue from Medicare and Medicaid will likely bias the contractual discount. To help control for these distortions our specification allows the average reimbursement rate measure to vary as a function of the fraction of the hospital's patients insured by Medicare and Medicaid and the fraction of revenues from outpatient care. As HCRIS does not report the number of outpatient visits, we use the overall proportion of gross revenues that outpatient revenues represent and the proportion of inpatient discharges that are from patients insured by Medicare and Medicaid to proxy for their outpatient proportions.

Recall that since only Medicare inpatient revenues are netted out, the average price per discharge represents a discharges-weighted average of the private and Medicaid reimbursements. In consequence, the treatment effects are also attenuated by the presence of inpatient

[17]Per diems and sliding scale per diems are common payment arrangements between MCOs and hospitals. Other arrangements include DRG payments, case rates and package pricing, capitation and straight discounts from list price (Kongstvedt, 2001).

discharges from Medicaid patients in our average revenue measure. As reimbursement rates paid by Medicaid are set by state regulators, any increase in market power resulting from a system acquisition will impact only the share of patients that are privately insured; therefore, the extent to which the true treatment effect for privately insured patients is reflected in this average price will be proportional to the share of the hospital's non-Medicare discharges that are privately insured. Assuming that system acquisitions have no impact on rates paid by Medicaid patients, we can correctly identify the treatment effect on prices for the privately insured by interacting the treatment indicator variables with the share of the hospital's non-Medicare discharges that are privately insured.

When this correction is implemented it results in the following alternative model:

$$r_{ht} = \alpha + [\beta_1 \textit{T1}_{ht} + \beta_2 \textit{T2}_{ht}] \times \textit{PrvtShare}_{ht} + d_{ht}\delta + g_{ht}\gamma + \kappa_{ht} + \eta \textit{FP}_{ht} + \mu_t + \xi_h + \epsilon_{ht}, \tag{5}$$

where $\textit{PrvtShare}_{ht}$ represents the share of a hospital h's non-Medicare inpatient discharges that are from privately insured patients at time t and the other variables are the same as in eq. (4). The estimated values of β_1 and β_2 from this this corrected model should more accurately represent the impact of system acquisition on the prices a hospital negotiates with MCOs.

The identification of treatment effects in our difference-in-differences model also relies on the assumption that the hospitals in the sample that were not acquired by a system within the previous year represent a valid counterfactual for how prices would have changed at hospitals in the treatment group had they not been acquired by a system. In particular we want to be sure that we control for both market-wide trends in prices and any differences in trends between the treatment and control groups that are not explained by observable hospital characteristics. Fortunately, as there is considerable variation in the years that our treatment hospitals are acquired by systems, we are able to flexibly control for differential trends by including separate sets of time fixed effects for the treatment group and control group.[18] After allowing for differential trends, any endogeneity in the treatment would likely require that certain stand-alone hospitals periodically experience exogenous, permanent jumps in

[18] In these specifications, the counterfactual change in price for a hospital that has been acquired by a system becomes the average change in price that is observed at other hospitals that will soon be acquired or have recently been acquired by a system but were not acquired in this particular year.

their average reimbursement rates and that systems identify these jumps and systematically acquire these hospitals. While this is unlikely we also estimate alternative specifications in section VI showing that there do not appear to be any pre-treatment price jumps in the data that would suggest the possibility of reverse causality.

IV. Results

Table 2 reports the results of several specifications based on eq. (4). The results in each column of the top and bottom panels contain the same specifications with the top panel specifications additionally including time fixed effects and the bottom panel specifications additionally including treatment-specific time fixed effects. All specifications also include hospital fixed effects. Specifications (1) and (7) include no additional controls while all of the other specifications include controls for the proportion of patients that are insured by Medicare and Medicaid and the proportion of a hospital's gross revenues that can be attributed to outpatient care as well as the hospitals' average operating cost per in-patient day and the average length of stay. As no CMI was provided for 761 hospitals in the PPS final rule files provided by CMS, the log of CMI is included in only specifications (3), (6), (9) and (12). As the reported accounting costs are not necessarily the full opportunity cost of providing treatment specifications (4) and (10) include an indicator identifying if the hospital has a utilization rate above 75% and specifications (5), (6), (11), and (12) include the utilization rate and utilization rate squared to capture the hospital's opportunity costs that may come from providing treatment when it is near its capacity limit.

The estimated treatment effects are fairly consistent across specifications. When only time fixed effects are used the estimated treatment effects are all significant at the 5% level and indicate that out-of-market acquisitions generate about a 9 to 10.5 percent increase in reimbursements while in-market acquisitions similarly generate about a 10 percent increase. There is slightly more variation in the estimates for the specifications including treatment-specific time fixed effects. Estimated price effects in the most basic specification are positive; though, not surprising, smaller given the omission of important cost-related variables. With the inclusion of the patient population and cost controls, however, the estimates are consistent with the time fixed effects specifications. Specifications (8) – (12) indicate that out-of-

TABLE 2—THE IMPACT OF SYSTEM MEMBERSHIP ON THE PRICE/DISCHARGE

ln(Price/Discharge)	(1)	(2)	(3)	(4)	(5)	(6)
T1	0.092^{b}	0.095^{c}	0.097^{c}	0.096^{c}	0.102^{c}	0.105^{c}
	(0.044)	(0.035)	(0.038)	(0.035)	(0.035)	(0.038)
T2	0.105^{c}	0.106^{c}	0.105^{c}	0.103^{c}	0.101^{c}	0.100^{c}
	(0.024)	(0.017)	(0.018)	(0.017)	(0.017)	(0.018)
For-Profit	−0.016	−0.022	−0.009	−0.021	−0.014	0.000
	(0.037)	(0.032)	(0.034)	(0.032)	(0.033)	(0.035)
% Medicare		1.368^{c}	0.771^{c}	1.363^{c}	1.354^{c}	0.764^{c}
		(0.075)	(0.079)	(0.075)	(0.076)	(0.079)
% Medicaid		-0.121^{a}	-0.130^{a}	-0.121^{a}	-0.127^{a}	-0.137^{b}
		(0.069)	(0.070)	(0.069)	(0.069)	(0.069)
% OP Revenue		-1.741^{c}	-1.679^{c}	-1.714^{c}	-1.578^{c}	-1.494^{c}
		(0.073)	(0.080)	(0.072)	(0.075)	(0.083)
ln(Cost/Day)		0.877^{c}	1.017^{c}	0.879^{c}	0.934^{c}	1.089^{c}
		(0.031)	(0.030)	(0.031)	(0.033)	(0.034)
ln(Avg. Length of Stay)		0.849^{c}	0.918^{c}	0.848^{c}	0.842^{c}	0.906^{c}
		(0.017)	(0.019)	(0.017)	(0.017)	(0.019)
ln(CMI)			0.061			0.014
			(0.059)			(0.059)
High Bed Utilization ($> 75\%$)				0.045^{c}		
				(0.013)		
Bed Utilization					0.400^{c}	0.382^{c}
					(0.080)	(0.073)
Bed Utilization Sqrd.					−0.060	−0.004
					(0.047)	(0.025)
Adj. R^2	0.048	0.478	0.506	0.478	0.481	0.510
N	21,868	21,868	17,332	21,868	21,868	17,332
ln(Price/Discharge)	(7)	(8)	(9)	(10)	(11)	(12)
T1	0.042	0.094^{b}	0.113^{b}	0.094^{b}	0.100^{b}	0.121^{b}
	(0.056)	(0.047)	(0.051)	(0.047)	(0.047)	(0.051)
T2	0.063^{a}	0.094^{c}	0.106^{c}	0.090^{c}	0.090^{c}	0.103^{c}
	(0.033)	(0.022)	(0.023)	(0.022)	(0.022)	(0.023)
For-Profit	−0.019	−0.023	−0.009	−0.022	−0.015	0.000
	(0.037)	(0.032)	(0.034)	(0.033)	(0.033)	(0.035)
% Medicare		1.369^{c}	0.770^{c}	1.364^{c}	1.354^{c}	0.764^{c}
		(0.075)	(0.079)	(0.075)	(0.075)	(0.079)
% Medicaid		-0.122^{a}	-0.129^{a}	-0.121^{a}	-0.128^{a}	-0.136^{a}
		(0.069)	(0.070)	(0.069)	(0.069)	(0.069)
% OP Revenue		-1.739^{c}	-1.679^{c}	-1.713^{c}	-1.577^{c}	-1.495^{c}
		(0.072)	(0.080)	(0.072)	(0.075)	(0.082)
ln(Cost/Day)		0.877^{c}	1.018^{c}	0.879^{c}	0.934^{c}	1.089^{c}
		(0.031)	(0.030)	(0.031)	(0.033)	(0.033)
ln(Avg. Length of Stay)		0.849^{c}	0.917^{c}	0.848^{c}	0.842^{c}	0.906^{c}
		(0.017)	(0.019)	(0.017)	(0.017)	(0.019)
ln(CMI)			0.063			0.016
			(0.059)			(0.059)
High Bed Utilization ($> 75\%$)				0.045^{c}		
				(0.013)		
Bed Utilization					0.400^{c}	0.379^{c}
					(0.080)	(0.073)
Bed Utilization Sqrd.					−0.061	−0.004
					(0.047)	(0.025)
Adj. R^2	0.048	0.478	0.506	0.478	0.481	0.510
N	21,868	21,868	17,332	21,868	21,868	17,332

Notes: All specifications include hospital and year fixed effects while the bottom panel also includes treatment-specific time fixed effects. Standard errors in parentheses are clustered by hospital. Significance Levels: a =p $< .10$, b =p$< .05$, c =p $< .01$

market acquisitions generate a 9 to 12 percent increase in reimbursements while in-market acquisitions generate an 8 to to 10 percent increase. The standard errors are all slightly larger but most of the estimates are significant at the 5% level.

Interestingly, the price effect for in-market system acquisitions is generally very similar to the out-of-market price effect, despite the fact that within market mergers can potentially strengthen the hospitals' bargaining position as well as alter their bargaining power. This similarity likely reflects a selection effect. Acquisitions of either type only occur if they generate additional profit that exceeds some threshold, but the source of this additional profit likely varies. For example, we might expect that out-of-market acquisitions disproportionately target hospitals that have low bargaining power and could benefit most from being in a system, while in-market acquisitions may be motivated by other factors such as a desire to achieve cost economies of scale or to strengthen local market position. As a result, increases in local concentration may contribute to price increases from in-market mergers while other factors (such as improvements in bargaining power) may have a smaller impact than in out-of-market mergers. However, it should also be noted that within market mergers between neighboring hospitals or hospitals that are direct competitors are relatively rare in our data, most likely because they face a very high probability of being challenged by antitrust authorities.[19] In fact, most of the within market mergers that we observe in the sample occur in larger cities or involve hospitals that are reasonably far from one other.[20] In these cases the market will not experience a substantial change in concentration and the merging hospitals will have only marginally improved their bargaining position. As an illustration of this fact we generated a rough measure of HHI based on hospital discharge shares within a 45 mile radius of the acquired hospitals. The average acquisition in our sample resulted in an increase in HHI of around 0.0055, and for about 95 percent of the in-market acquisitions the increase in HHI is less than 0.0100, well below the threshold for further scrutiny under the FTC merger guidelines. Nevertheless, we have estimated a couple alternative specifications attempting to identify additional price effects from mergers that substantially increase the level of local concentration (these results are reported in Appendix Table B5).

[19]The Federal Trade Commission (2012) reports several proposed mergers of hospitals that were dropped after the FTC challenged them. Recent examples include the proposed acquisition of Prince William Hospital by Inova Health System (D. 9326) and OSF Healthcare System's proposed acquisition of Rockford Health System (D. 9349).

[20]The average distance between all in-market acquisitions is 22 miles.

The coefficient estimates suggest that mergers generating larger increases in HHI may also generate larger price increases, but since we observe very few of these mergers the effect is imprecisely estimated and only statistically significant at the 10% level. The result is consistent with the notion that mergers that more substantially alter local concentration result in larger price effects, but the lack of such mergers in our data cause the estimated price effects for both types of acquisition to be fairly similar. Regardless of the mechanism driving the increases in market power, the fact that price increases resulting from out-of-market acquisitions are comparable in magnitude to those generated by in-market mergers further underscores the relative importance of such considering cross-market effects.

The patient population controls indicate that prices are increasing with the share of a hospital's patients that are insured by Medicare; and, as expected, an increase in the proportion of patients insured by Medicaid results in a lower estimated reimbursement price. The magnitude of the estimate for the Medicare share is lower when the CMI is included suggesting that there is a strong correlation between a hospital's costs and the portion of its patients that are insured by Medicare. The negative coefficient on the Medicaid share follows from the fact that we are not able to net out Medicaid payments from the price calculation and their relatively low reimbursement rates will bring down the average price measure for the hospital. Controlling for the proportion of gross revenue that comes from outpatient care is also important as the negative coefficient estimates on outpatient revenue share suggest that outpatient prices are discounted more heavily than inpatient prices.

All of the cost controls indicate that higher costs result in higher prices consistent with eq. (3). The treatment effects are about two percentage points higher as is the fit of the model when the log of CMI is included. The estimates also suggest that hospitals that are near their capacity limit have higher prices. For example, hospitals that are above 75% of their capacity (measured in available inpatient bed days) will have a reimbursement price that is almost 5 percent higher than similar non-capacity constrained hospitals. Measuring utilization as a continuous measure also indicates that higher utilization hospitals have higher reimbursements, but that the price effect diminishes slightly as utilization increases. These higher prices could reflect some increase in bargaining power that comes from being able to play insurers off of one another since the hospital will not need to contract with all insurers

TABLE 3—THE IMPACT OF SYSTEM MEMBERSHIP ON THE PRICE/DISCHARGE CONTROLLING FOR PRIVATE PATIENT SHARE

ln(Price/Discharge)	(1)	(2)	(3)	(4)	(5)	(6)
T1× Private Share	0.141^b	0.140^c	0.144^c	0.140^c	0.147^c	0.152^c
	(0.061)	(0.048)	(0.053)	(0.048)	(0.049)	(0.054)
T2× Private Share	0.150^c	0.144^c	0.142^c	0.140^c	0.136^c	0.134^c
	(0.030)	(0.020)	(0.021)	(0.020)	(0.020)	(0.021)
Adj. R^2	0.049	0.478	0.506	0.479	0.481	0.511
N	21,868	21,868	17,332	21,868	21,868	17,332
ln(Price/Discharge)	(7)	(8)	(9)	(10)	(11)	(12)
T1× Private Share	0.088	0.145^b	0.170^b	0.144^b	0.149^b	0.175^b
	(0.076)	(0.064)	(0.070)	(0.064)	(0.064)	(0.071)
T2× Private Share	0.113^c	0.135^c	0.149^c	0.130^c	0.127^c	0.143^c
	(0.040)	(0.027)	(0.027)	(0.027)	(0.026)	(0.027)
Adj. R^2	0.049	0.478	0.506	0.479	0.481	0.511
N	21,868	21,868	17,332	21,868	21,868	17,332

Notes: Each specification includes the same control variables reported in the corresponding column in Table 2 as well as hospital and year fixed effects. Specifications in the bottom panel also includes treatment-specific time fixed effects. Standard errors in parentheses are clustered by hospital. Significance Levels: a =p $< .10$, b =p$< .05$, c =p $< .01$

to maximize utilization, or similarly, it could capture the fact that the opportunity cost of utilizing an inpatient bed becomes very high when the hospital is near its capacity limit.

Table 3 reports the treatment effects for the same specifications presented in Table 2 but based on eq. (5), in which treatment dummies are interacted with the proportion of a hospital's inpatients that are privately insured (full results are reported in Appendix Table C1). Privately insured patients represent about 73% of the non-Medicare patient population, but controlling for the fact that the treatment effect only impacts these patients increases the estimates by 15 to 40%, depending on the specification. The estimates indicate that an out-of-market acquisition generates about a 14 to 18 percent increase in the average reimbursement price while an in-market acquisition generates a 13 to 15 percent increase.

Since our identification and interpretation of the price effects of out-of-market mergers relies on considering only acquisitions of hospitals outside the relevant patient market of all other system partners, we also estimate the model using several alternative market definitions. Although we believe patients rarely consider hospitals more than 45 miles away to be relevant substitutes, we estimate specifications in which an acquired hospital is only considered out of market if it is more than 75 miles or more than 150 miles away from the nearest system partner. The results in Appendix Table D1 reveal that estimated acquisition price effects remain significant and relatively close to those from the baseline specification.

After controlling for cost changes and allowing for systematic differences in price trends between treatment and control hospitals, our estimates consistently suggest that private reimbursement rates tend to increase by about 14 to 18 percent when a hospital becomes affiliated with a system—even if the system has no other members in that local market. While this effect is quite substantial, several previous studies have also found evidence that system hospitals enjoy a price premium of similar magnitude over non-system hospitals, even after controlling for differences in local market concentration. For example, Melnick and Keeler (2007) find that hospitals belonging to a large system enjoy prices that are about 34 percent higher than non-system hospitals and Lewis and Pflum (2014) find that system hospitals in California have stronger bargaining power than non-system hospitals resulting in prices that are about 20 percent higher on average. Ho (2009) similarly finds that system hospitals have markups that are about $3,200 higher than non-system hospitals.[21] While these studies rely on cross-sectional data and cannot explicitly identify a causal effect of system membership, our findings suggest that much of their observed price differences are likely to have been a direct result of system membership, rather than simply arising due to some type of positive selection effect.

V. Cost of Care and Profit Margins

The price regressions in the previous section include measures of patient care costs (e.g., length of stay, cost per inpatient day, CMI) as control variables to assure that increases in observed reimbursement rates following a merger are not simply a result of an increase in the illness complexity of the patients they treat or a change in the cost effectiveness with which they treat those patients. As a result of including these cost controls, the treatment effects from our price regressions describe how the profit margins of these hospitals change when they are acquired by a system. If the cost efficiency of the hospital is relatively unaffected by the system acquisition, then an observed increase in profit margin largely translates to an increase in reimbursement rates. It is possible, however, that an increase in profit margin could be partially (or predominantly) driven by a reduction in costs, which would

[21] As Ho (2009) does not utilize hospital-level data it is not clear what the average price of a discharge was for the hospitals in her study, but in our national sample the average price of a discharge in 2002 (the year used in her study) was $14,200, suggesting that system hospitals had prices that were about 23% higher than non-system members having similar costs.

obviously have very different policy implications.[22,23]

We can investigate this possibility further by separately estimating how treatment costs themselves appear to respond following a system acquisition. We decompose these potential cost changes into two sources: changes in efficiency (the cost of treating a particular set of patients) and changes in the case-mix, patient population, or hospital utilization rates. Each source is investigated separately using the same difference-in-differences approach as in our price regressions.

To identify changes in cost efficiency we use the average cost of care (by inpatient day) as the dependent variable and include controls for the hospital's average length of stay and measures of the proportions of patients covered by Medicare and Medicaid since patient population mix may influence average costs in a variety of ways. For example, hospitals may choose to utilize fewer resources to treat Medicaid (or Medicare) patients if treatment for these groups is reimbursed at lower rates than privately insured patients. Alternatively, treatment complexity and cost of care may systematically differ for the (older) Medicare population or the (relatively younger) Medicaid population in ways that are not entirely reflected in their case-mix index or length of stay. In contrast to the price specifications, we do not interact the treatment dummies with the share of privately insured patients. These interactions are unnecessary in the cost specifications as changes to the cost of treatment resulting from a system acquisition are likely to affect all patients while changes in bargaining power only impact the reimbursements from the privately insured. Estimation results from these cost regressions are reported in Table 4.

The estimated treatment effects for out-of-market system acquisitions indicate that acquired hospitals may lower their average costs by about 3.5 to 4.5 percent while there is no treatment effect for in-market acquisitions. There is little evidence that the case-mix of the patients changes post acquisition where the case mix is measured by either the CMS assigned case-mix index or based on the average length of stay for inpatients. There is also little evidence that the utilization rate changes post acquisition. Specification (5) indicates that the

[22]Ho (2009) finds that, more generally, lower cost hospitals have a higher markup compared to high cost hospitals suggesting that the low cost hospitals have more bargaining power.

[23]It has been suggested to us that systems may acquire weak, unprofitable hospitals that are then reorganized by the system to be made profitable. If this transformation largely involves increasing the efficiency of the hospital, then such acquisitions would likely be favored by policy makers.

TABLE 4—THE IMPACT OF SYSTEM MEMBERSHIP ON HOSPITAL COST OF CARE

	ln(Cost/Day)		ln(CMI)		ln(Utilization)		ln(Avg. LOS)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
T1	-0.034^{a}	-0.046^{b}	0.003	-0.001	-0.060^{a}	-0.020	-0.024	-0.022
	(0.019)	(0.022)	(0.010)	(0.010)	(0.032)	(0.036)	(0.025)	(0.028)
T2	-0.007	-0.019	0.011^{b}	0.003	-0.010	0.000	-0.017	-0.015
	(0.011)	(0.013)	(0.004)	(0.005)	(0.017)	(0.019)	(0.015)	(0.016)
Time Fixed Effects								
Time Only	X		X		X		X	
Trmt×Time		X		X		X		X
Adj. R^2	0.401	0.401	0.037	0.037	0.040	0.041	0.011	0.010
N	21,868	21,868	17,332	17,332	21,868	21,868	21,868	21,868

Notes: All specifications include hospital fixed effects. Specifications (1) and (2) additionally include bed utilization, bed utilization squared, and the shares of Medicare and Medicaid patients as well as the out-patient share of revenues. Standard errors in parentheses are clustered by hospital. Significance Levels: a =p $< .10$, b =p$< .05$, c =p $< .01$

utilization rate may decrease by about 6 percent following an out-of-market acquisition, but the estimate is only weakly statistically significant and disappears when treatment-specific time fixed effects are used (specification 6). Although the estimates indicate that hospitals acquired by out-of-market systems exhibit some improvements in efficiency (reflected in a lower average cost per day), the size of these cost reductions suggest that over two-thirds of the increase in profit margins associated with system acquisitions in our main analysis result from increases in reimbursement prices.

VI. ROBUSTNESS AND ALTERNATIVE EXPLANATIONS

Our results reveal important cross-market price effects of system formation that existing studies of hospital competition do not incorporate. In this section we perform several empirical tests to explore the robustness of our findings.

A. Market-Wide Gains in Prices

In our main analysis we are careful to consider the possibility that estimated treatment effects could be biased if underlying price trends at hospitals targeted for acquisition differ systematically from other hospitals absent the merger taking place. To control for such differences we estimate specifications that include treatment-group-specific year fixed effects. One might, however, have a related concern that acquisitions may be more likely to occur in markets where the prices of all hospitals are increasing (or decreasing) more quickly than in other markets, or that changes occurring in a particular market may impact both the local

price trajectory and the likelihood of an acquisition occurring in the market. For example, a change in market structure on the insurer-side of the market (e.g., entry by additional insurers) could generate higher bargaining power for all hospitals in the area. The resulting reimbursement price increases could make independent hospitals in the market more attractive acquisition targets for a system wanting to expand and we want to be careful not to attribute these price increases to the acquisitions that they might induce. One way to control for this type of bias is to compare the post-acquisition prices of acquired hospitals with the prices of other hospitals located in markets where acquisitions occur, as these hospitals will experience the same unobserved market-wide shocks as our treatment hospitals. We estimate this using a triple-differences specification which compares our difference-in-differences treatment effect estimate for acquired hospitals with an analogous difference-in-differences "treatment" effect experienced by hospitals when another hospital in the city is acquired. Care should be taken in interpreting the results, however, as the prices of rival hospitals are likely to represent an imperfect counterfactual. As eq. (3) indicates, a hospital's reimbursement price is increasing in the reimbursement price of rival hospitals (i.e., the reaction function is upward sloping in prices)[24] so any price increase enjoyed by an acquired hospital is likely to also allow rivals in the same market to increase their prices somewhat. For this reason, the triple-differences specification might be viewed as a conservative estimate of the price increase generated by a hospital acquisition.

Our triple-differences specification is designed to account for cases in which multiple acquisitions occur in the same market over the sample period. Rather than include a simple dummy variable indicating whether an acquisition occurred in the market, we include a count of the number of hospitals that were acquired since the start of the sample. If only one hospital was acquired then this count variable is equivalent to an indicator. If more than one merger takes place, then the count variable is analogous to having a sum of acquisition indicator variables whose coefficients are assumed to be identical.

Columns (2) – (4) of Table 5 report the results of the triple-differences estimation.[25]

[24] Observe that a higher rival price improves the bargaining position of the index hospital while higher bargaining power increases the slope of the reaction function.

[25] Specifically, let $T1\_RivalT1_{ht}$ indicate whether hospital h hospital has been acquired by an out-of-market system or a nearby rival within 25 miles has been acquired by an out-of-market system before time t and let $T2\_RivalT2_{ht}$ indicate whether hospital h has been acquired by an in-market system or a nearby rival within 25 miles has been acquired by an

TABLE 5—MARKET-WIDE PRICE EFFECTS

	Diff-in-diff	Triple-differences			Effects of nearby rival mergers	
ln(Price/Discharge)	(1)	(2)	(3)	(4)	(5)	(6)
T1	0.147^{c}	0.154^{c}	0.154^{b}	0.152^{b}	0.147^{b}	0.143^{b}
	(0.049)	(0.052)	(0.066)	(0.068)	(0.064)	(0.064)
T2	0.136^{c}	0.086^{c}	0.082^{c}	0.113^{c}	0.134^{c}	0.133^{c}
	(0.020)	(0.021)	(0.028)	(0.028)	(0.027)	(0.026)
# Hospitals (including index hospital) acquired by an...						
out-of-market system		−0.006	−0.006	−0.009		
		(0.016)	(0.016)	(0.019)		
in-market system		0.051^{c}	0.051^{c}	0.019^{b}		
		(0.007)	(0.007)	(0.008)		
# Rivals acquired by an out-of-market system that are...						
less than 5 miles					0.112^{c}	0.106^{c}
					(0.031)	(0.032)
between 5 and 10 miles					0.057	0.061
					(0.036)	(0.039)
between 10 and 25 miles					-0.033^{a}	-0.036^{a}
					(0.019)	(0.022)
# Rivals acquired by an in-market system that are...						
less than 5 miles					0.098^{c}	0.061^{c}
					(0.025)	(0.023)
between 5 and 10 miles					0.083^{c}	0.055^{c}
					(0.018)	(0.018)
between 10 and 25 miles					0.041^{c}	0.008
					(0.008)	(0.010)
Time Fixed Effects						
Time Only	X	X			X	
Treatment×Time			X	X		X
Market-wide Treatment×Time				X		X
Adj. R^2	0.481	0.484	0.484	0.488	0.484	0.489
N	21,868	21,868	21,868	21,868	21,868	21,868

Notes: Market-wide treatment fixed effects are based on a hospital being within 25 miles of a hospital either acquired by an out-of-market or in-market system. All reported variables are interacted with the private share of non-Medicare in-patients and all specifications additionally include all of the covariates used in specification 5 in Tables 2 and 3. Standard errors in parentheses are clustered by hospital. Significance Levels: a =p $< .10$, b =p$< .05$, c =p $< .01$

Column (1) reports the previous difference-in-differences estimate from column (5) of Table 2 for comparison, and all of the specifications include the same controls present in columns (5) and (11) of Table 2. In order to capture citywide shocks, we construct acquisition counts for hospitals within a 25 mile radius of the observed hospital.[26] Each specification controls for changes in reimbursements over time in slightly different ways. Column (2) includes time fixed effects, column (3) includes treatment-specific time fixed effects, and column (4) additionally includes treatment-specific time fixed effects that are applied to all of the hospitals within the same markets as acquired hospitals.

Regardless of the type of time controls employed, all three specifications generate similar estimates indicting that the reimbursement prices of hospitals acquired by an out-of-market system are about 15 percent higher than the other hospitals in the same market while the reimbursement prices for hospitals acquired by an in-market system are about 5 to 8 percent higher. Hospitals acquired by in-market systems experience a smaller price increase relative to their competitors largely because the prices at non-acquired hospitals in these markets also tend to increase by 2.5 to 5 percent when an in-market acquisition takes place. In contrast, the average price of rival hospitals in markets where an out-of-market acquisition occurs do not exhibit any significant change.

The results reveal that prices at acquired hospitals do appear to increase even when controlling for the possibility of local market-wide shocks by adding an additional difference with respect to rival hospitals prices. This finding is particularly notable given that these triple-differences specifications are likely to be overly conservative as a result of rivals within the same market also having the ability to increase prices somewhat following an acquisition. The magnitude of this competitive reaction can be examined more carefully by noting that the impact of a hospital's price on its rivals will be dependent on the portion of that hospital's patients that would visit the rivals if they no longer can seek treatment at the hospital (i.e.,

in-market system before time t. The triple-differences specification then takes the form:

$$r_{ht} = \alpha + \beta_1 T1_{ht} + \beta_2 T2_{ht} + \beta_3 T1\_Rival T1_{ht} + \beta_4 T2\_Rival T2_{ht} + d_{ht}\delta + g_{ht}\gamma + \kappa_{ht} + \eta FP_{ht} + \mu_t + \xi_h + \epsilon_{ht},$$

where r_{ht}, d_{ht}, g_{ht}, γ, κ_{ht}, μ_t, ξ_h, ϵ_{ht} are all the same as in eq. (4).

[26]This *market* definition is not intended to describe the market in a competitive sense, but rather to characterize a geographic area in which hospitals might experience similar unobserved shocks such as changes in insurer market structure or local macroeconomic fluctuations.

how close of a substitute the hospitals are to one another). In consequence, if rival price effects follow from a competitive response to an increase in price at the acquired hospital we would expect rivals that are closer to an acquired hospital to exhibit a larger increase in price than rivals that are further away; whereas, if rival price effects are generated by some market-wide change, such as a decrease in the concentration of insurers, then hospital prices within a particular market should change more uniformly.

In columns (5) and (6) of Table 5 we alter our specification to examine how an acquisition's impact on rival prices varies with the distance to the acquired hospital. Here we allow the price of each hospital to be a function of whether it was acquired by a system itself and also the number of rival hospitals that have been acquired within different distance categories. Specification (5) includes time fixed effects while (6) includes treatment-specific time fixed effects and treatment-specific time fixed effects that are applied to all of the hospitals with the same markets as acquired hospitals. The results are again consistent between the two different sets of time controls, and clearly indicate that hospitals nearer to an acquired hospital experience larger increases in price. For example the reimbursement price for a hospital acquired by an out-of-market system increases by about 12 to 14 percent, while its rivals within 5 miles increase their prices by about 10 to 11 percent, those between 5 and 10 miles away increase price by about 5 to 7 percent, and those over 10 miles away exhibit a small decline in price. The price effects for rivals to hospitals acquired by in-market systems exhibit a similar trend though appear to diminish slightly more slowly with distance.[27]

The patterns of observed price effects at rival hospitals support the interpretation that price increases are a direct result of the acquisition and originate from the acquired hospital itself rather than reflecting some unobserved market-wide shock. In addition, the presence of a positive price effect for nearby rival hospitals provides additional evidence that the price increases identified in our main analysis are real and not a result of mismeasurement or a failure to effectively control for changes in cost and patient mix that might have occurred during the acquisition.

[27]One explanation for why the price effects do not diminish as rapidly with distance in the in-market group could be that the other system partners of the acquired hospital experience a price increase as a result of the acquisition, driving up the prices of their nearby rivals, while hospitals acquired by out-of-market systems have no such same-system partners.

B. Pre-Acquisition Price Effects

Treatment-group-specific fixed effects help to assure that treatment effects are not driven by unobserved factors that differentially impact the prices of acquired hospitals as a group relative to control hospitals, and our triple-differences specification mitigates concerns that market-wide unobserved shocks in cities experiencing acquisitions might give rise to endogeneity concerns. Neither of these methods, however, can control for unobserved idiosyncratic shocks that impact hospitals at different times and might cause an independent hospital's reimbursement prices to increase suddenly and raise the likelihood that it is acquired. In this section we address this possibility by examining the behavior of prices at treatment hospitals in the years immediately preceding acquisition. Using the same approach we also estimate the path of prices in the years following acquisition to determine how quickly the price effects of acquisition are realized.

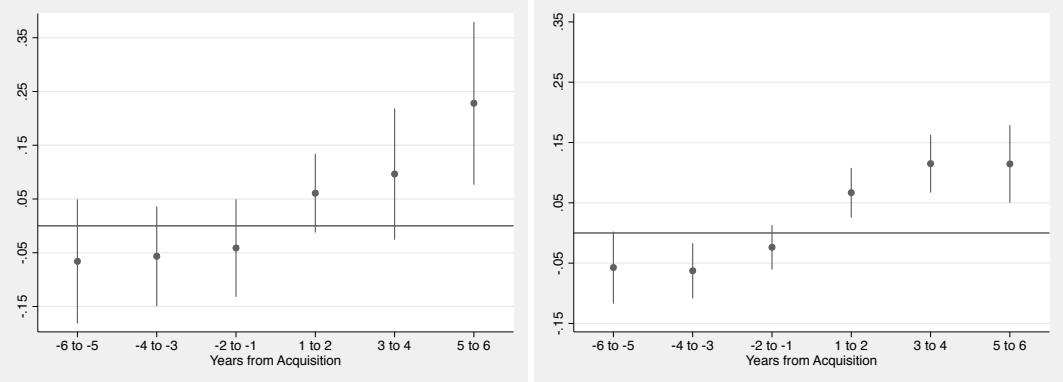
We identify price movements in more detail by including indicator variables based on the number of years between the observation year and the year the hospital is acquired. The pre-acquisition indicators will reveal whether prices are increasing in any meaningful way prior to acquisition while post-acquisition indicators will provide some insight into how rapidly a hospital's reimbursements increase after acquisition. Table 6 reports the results from several specifications. Specifications (1) – (3) include treatment-specific pre-acquisition dummies indicating if it is 1 to 2 years, 3 to 4 years, or 5 to 6 years before acquisition and a single post-acquisition treatment dummy. Observations more than six years before or after acquisition are not included in the sample as they are observed for a very small number of acquisitions. As a result, the pre- and post-acquisition dummies reflect the average difference in price from the acquisition year. The first three specifications differ only in how they control for changes in the reimbursement prices over time, using time fixed effects, treatment-specific time fixed-effects, and treatment-specific fixed effects that are applied to all of the hospitals within a market. The specifications in columns (4) – (6) include the same sets of time controls but instead of a single post-acquisition treatment indicator they include treatment-specific post-acquisition dummies indicating if it is 1 to 2 years, 3 to 4 years, or 5 to 6 years after acquisition with subsequent lags again truncated. All indicator variables are interacted with the private patient share of the non-Medicare patient population.

TABLE 6—LEAD AND LAG PRICE EFFECTS

	(1)	(2)	(3)	(4)	(5)	(6)
Years Relative to T1 Acquisition						
-6 to -5	−0.063	−0.010	−0.009	−0.074	−0.067	−0.067
	(0.059)	(0.093)	(0.092)	(0.051)	(0.052)	(0.051)
-4 to -3	−0.056	−0.014	−0.011	−0.065	−0.058	−0.057
	(0.047)	(0.067)	(0.067)	(0.050)	(0.048)	(0.048)
-2 to -1	−0.042	−0.040	−0.037	−0.054	−0.068	−0.066
	(0.046)	(0.054)	(0.054)	(0.048)	(0.045)	(0.046)
1 to 2				0.050	0.034	0.032
				(0.041)	(0.035)	(0.035)
3 to 4				0.072	0.049	0.045
				(0.056)	(0.055)	(0.054)
5 to 6				0.183^b	0.163^b	0.157^b
				(0.072)	(0.068)	(0.067)
Years Relative to T2 Acquisition						
-6 to -5	−0.054^a	−0.009	−0.022	−0.066^c	−0.059^c	−0.059^c
	(0.030)	(0.045)	(0.045)	(0.022)	(0.022)	(0.022)
-4 to -3	−0.062^c	−0.030	−0.037	−0.073^c	−0.073^c	−0.070^c
	(0.023)	(0.032)	(0.032)	(0.021)	(0.020)	(0.020)
-2 to -1	−0.023	−0.007	−0.009	−0.041^b	−0.048^c	−0.043^b
	(0.019)	(0.021)	(0.021)	(0.019)	(0.018)	(0.018)
1 to 2				0.043^b	0.025	0.028
				(0.019)	(0.019)	(0.019)
3 to 4				0.079^c	0.057^c	0.059^c
				(0.021)	(0.022)	(0.022)
5 to 6				0.068^b	0.040	0.039
				(0.028)	(0.029)	(0.029)
Post Acquisition						
T1	0.092^b	0.052	0.051			
	(0.043)	(0.048)	(0.048)			
T2	0.091^c	0.068^c	0.070^c			
	(0.022)	(0.024)	(0.024)			
Time Fixed Effects						
Time Only	X			X		
Treatment×Time		X	X		X	X
Market-wide Treatment×Time			X			X
Adj. R^2	0.479	0.479	0.482	0.484	0.484	0.488
N	21,835	21,835	21,835	21,835	21,835	21,835

Notes: All specifications include hospital fixed effects as well as the controls reported in column (5) of both Tables 2 and 3. Standard errors in parentheses are clustered by hospital. Significance Levels: a =p $< .10$, b =p$< .05$, c =p $< .01$

The estimates indicate that in the two years prior to an out-of-market acquisition the reimbursements are on average about 5 to 7 percent less than reimbursements in the acquisition year and 10 percent lower than in the years immediately following the acquisition. Furthermore, in almost all specifications, the reimbursements are nearly the same 1 to 2 years before acquisition as they are 5 to 6 years prior to acquisition indicating that systems do not appear to target hospitals for acquisition that are experiencing some sort of run-up in prices. In-market acquisitions exhibit a similar pattern.



(a) Out-of-market Acquisitions (b) In-market Acquisitions

FIGURE 2. LEAD AND LAG TREATMENT EFFECTS OF ACQUIRED HOSPITALS

To visualize how the average reimbursement rates evolve relative to the acquisition year figures 2(a) and 2(b) plot the point estimates and their respective 95 percent confidence intervals from specification (4) of Table 6. The graph paints a clear picture for out-of market acquisitions: Prices at hospitals acquired by out-of-market systems are not increasing more relative to other hospitals prior to acquisition. Then, starting in the acquisition year, they begin a strong, steady rise. When interpreting the graph it is important to keep in mind that we only observe the year in which a system changes its status from independent to belonging to a system. We do not observe, however, when the acquisition actually occurs (which could be in the prior year) nor do we observe when a hospital's reimbursement prices are renegotiated. If they renegotiate contracts with different MCOs at varying times over the years following acquisition, then the average post-acquisition reimbursement rate may increase gradually as displayed in figure 2(a) even if the hospital is able to secure a large increase in reimbursement rates in their first post-acquisition renegotiation with each MCO.

Given the lack of evidence for any significant pre-acquisition price effects and the large jump in prices that occurs surrounding the acquisition year, endogeneity in the selection of hospitals would require that systems anticipate idiosyncratic price increases that are about to occur at particular independent hospitals and manage to acquire these hospitals precisely when these price increases are to occur. We believe such a sequence of events to be reasonably unlikely.

C. *Hospital Quality*

Another possible explanation for observing higher prices following a system acquisition might be that acquired hospitals tend to improve their quality of care or the quality of their facilities allowing them to command higher reimbursement rates. Unfortunately, it is difficult to observe measures of perceived hospital quality so we cannot directly control for these potential changes like we can for changes in cost of treatment or severity of the patient case-mix. Nevertheless, if acquired hospitals exhibit an increase in admissions despite the fact that prices have increased, this would be a fairly clear sign that the hospital has improved its quality or become more attractive to patients. In light of this we adopt our standard difference-in-differences specification to examine the effects of system acquisitions on the quantity of care provided. We consider two different measures of hospital output—the total number of discharges and the number of privately insured patient discharges—as well as several measures of the hospital's market share.[28] Market shares are calculated as the hospital's share of all discharges observed at hospitals within a 45-mile or 15-mile radius. Since we are using output measures instead of price as the dependent variable in these specifications we no longer need to include additional controls for patient care costs or patient mix, but we still consider the same variety of time controls as in earlier specifications to control for other factors affecting hospital usage.

Table 7 reports the estimated treatment effects for each of the different measures of hospital output and market share. For both in-market and out-of-market acquisitions the impact on the quantity of care appears to be very small. Most of the coefficient estimates are statistically indistinguishable from zero and there is a lack of consistency between estimates. Together the results provide no systematic evidence that improvements in quality (if they exist) increase the overall demand for acquired hospitals.

Despite the absence of an increase in quantity demanded, we can still not rule out the possibility of quality improvements because any associated demand increase could have been counteracted by increases in patient out-of-pocket costs or attempts by MCOs to steer patients away from these now higher priced hospitals, causing the net effect on the acquired

[28]Note that in analyzing the effects of acquisition on costs we already examined whether an acquired hospital's utilization rate increases and, if anything, find that utilization decreases following acquisition.

TABLE 7—THE IMPACT OF SYSTEM MEMBERSHIP ON DEMAND

	45 mile Market Share (1)	15 mile Market Share (2)	# Discharges (3)	# Private Discharges (4)	% Medicare (5)	Cost/Discharge (6)
T1	−0.053	−0.006	−0.061	−0.046	−0.013	
	(0.045)	(0.052)	(0.044)	(0.053)	(0.029)	
T2	0.026	0.010	0.031	0.027	−0.016	
	(0.021)	(0.021)	(0.019)	(0.026)	(0.017)	
# Rivals within 10 mi. acquired by an...						
out-of-market system						−0.052[a]
						(0.028)
in-market system						−0.032[c]
						(0.012)
Adj. R^2	0.009	0.010	0.033	0.023	0.062	0.470
N	21,868	21,868	21,868	21,850	21,868	17,108
	(7)	(8)	(9)	(10)	(11)	(12)
T1	−0.039	0.032	−0.035	−0.011	−0.033	
	(0.046)	(0.053)	(0.046)	(0.057)	(0.034)	
T2	−0.001	0.011	0.020	0.061[b]	−0.025	
	(0.022)	(0.021)	(0.021)	(0.028)	(0.017)	
# Rivals within 10 mi. acquired by an...						
out-of-market system						−0.011
						(0.027)
in-market system						−0.009
						(0.012)
Adj. R^2	0.009	0.010	0.033	0.023	0.062	0.474
N	21,868	21,868	21,868	21,850	21,868	17,108

Notes: All dependent variables are in natural logs. All specifications include hospital fixed effects. The top panel includes time fixed effects while the bottom panel includes treatment-specific time fixed effects. Specifications (6) and (12) do not include treatment hospitals and additionally include bed utilization, bed utilization squared, and the shares of Medicare and Medicaid patients as well as the out-patient share of revenues. Standard errors in parentheses are clustered by hospital. Significance Levels: a =p $< .10$, b =p$< .05$, c =p $< .01$

hospital's admissions to be unchanged. It is important to note, however, that any such increase in quality did not result from an increase in patient care spending, as the acquisition-related price increases we observe are estimated conditional on patient care costs and the results of Table 4 reveal that the cost of care at acquired hospitals remained largely unchanged (or decreased slightly) following acquisition. It is possible that becoming a member of a system helps hospitals to more efficiently provide a higher quality of care, but based on the results of our rivals analysis such quality improvements do not appear to be the main factor responsible for increases in profit margins observed following acquisition.

Nearby rival hospitals could respond to possible quality improvements at acquired hospitals by increasing spending on patient care to maintain competitive quality levels, but there is little reason to expect that these rival hospitals become more efficient at producing higher quality after a nearby hospital is acquired by a system. If the main impact of system acquisition were to allow the acquired hospital to provide higher quality care more efficiently, we

would expect the profit margins of nearby rivals to decrease (due to the presence of a more efficient competitor) rather than increase as the results of Table 5 show. Moreover, we might expect nearby rival hospitals to respond by spending more on patient care in response to a nearby acquisition. Specifications (6) and (12) of Table 7 further examine how patient care costs at rival hospitals respond to a nearby acquisition. The sample for these specifications include only the control hospitals, some of which represent rivals to acquired hospitals. The effects of having an acquired rival are precisely estimated and suggest that the rivals to acquired hospitals do not exhibit an increase in their cost of care that would suggest an effort to compete with increased quality. This together with the lack of a change in quantity or market share for acquired hospitals suggests that the price increases are likely not driven by quality improvements.

D. Uncompensated Care

Our measure of average reimbursement price has the potential to be biased because hospitals provide some amount of care for which they never receive payment (i.e., uncompensated care), which distorts downward the calculated reimbursement per discharge. More importantly, if hospitals tend to provide less uncompensated care after being acquired by a system this will cause us to overestimate the treatment effects.

Hospitals report the total value of uncompensated care they provide each year to the CMS. However, collection of this data began in 2003, so there are only 23 in-market acquisitions and 54 out-of-market acquisitions for which we observe levels of uncompensated care both before and after merger. Using our standard difference-in-differences approach we test whether system acquisitions are accompanied by significant changes in the amount of uncompensated care provided by acquired hospitals. The results from this estimation are reported in Appendix Table B2.

While the estimates are relatively imprecise (due to the shorter sample period), some specifications suggest that acquired hospitals may reduce their provision of uncompensated care by 10 to 30%. However, given that uncompensated care represents a relatively small share of total discharges for the average hospital, these effects would at most translate into an overestimate of the average post-acquisition reimbursement rate on the order of 1.25

percentage points—a fraction of the estimated treatment effects from our main analysis.

E. For-Profit Status Changes

Another potential source of bias could arise if price effects resulting from a change in the ownership type (i.e., for-profit status) of the hospital become confounded with acquisition effects. Many acquired hospitals change status from non-profit to for-profit, and failing to account for any corresponding change in objective could distort our estimates of the price increase directly attributable to system acquisition. We can control for changes in ownership status by including indicators identifying the current for-profit status of the hospital in our standard difference-in-differences specification. The estimates (reported in Appendix Table B3) provide some evidence that prices at hospitals in the out-of-market treatment group are somewhat higher when they operate as for-profit hospitals. However, even when controlling for profit-status changes, the estimated price increase associated with an out-of-market acquisition remains nearly identical to our previous specifications suggesting that changes in for-profit status are not driving the price increases associated with acquisition.

We also investigate whether the magnitudes of price increases following system acquisition tend to differ for for-profit and nonprofit hospitals. Our estimates indicate that prices increase about 5 percentage points more at for-profit hospitals than nonprofits following an out-of-market acquisition and about 11 to 12 percentage points more following an in-market acquisition. The finding is suggestive that for-profits are more able or more willing to exploit the market power that comes with system membership, but given the relatively small number of acquisitions observed for each profit type, some caution in interpreting the results might be warranted.

F. Medicare Reimbursement Rates and System Acquisition

All of our empirical findings support the assertion that there is a market power effect associated with out-of-market acquisitions. In light of this we implement one final falsification test by examining the effect of these acquisitions on a hospital's average reimbursement rate from Medicare patients. Rather than being negotiated, the Medicare reimbursement prices are administratively set and based on the average costs of providing care nationally

and adjusted for case severity and geographic factors. As a result, a change in a hospital's bargaining power should not impact revenues from Medicare patients the way it does for privately insured patients.[29]

For each hospital we observe both the total revenues for inpatient-care from Medicare patients and the total number of Medicare patient discharges and inpatient days, so we can construct accurate measures of average reimbursement rates for these patients. We estimate our standard difference-in-differences regression using Medicare prices as the dependent variable. The estimates are reported in Appendix Table B4.

The out-of-market treatment effects are all near zero, as expected. Some of the estimated treatment effects for Medicare prices are statistically different from zero for in-market acquisitions, however, they are all of opposite sign and much smaller in magnitude than those estimated in the price regressions for privately insured patients. The absence of an increase in average reimbursement rates for Medicare patients suggests that the treatment effects we observe for privately insured patients are not simply the result of unobserved increases in the cost of treatment or the severity of the case mix of a hospital's overall patient population further reinforcing the robustness of the treatment effects identified for privately insured patients.

VII. Conclusions

While previous studies have shown that merging hospitals can increase their reimbursement prices by reducing competition over patients, our results suggest that mergers increase hospital market power even when they do not reduce hospital competition within a patient market. We find that hospitals that join out-of-market systems experience an increase of around 14 to 18 percent in their reimbursement price. We show that the identified increases in reimbursement rates are not driven by changes in patient case-mix, quality of care, or the cost of providing care more generally. Furthermore, by examining the acquisition price effects on nearby rivals and the price trends of acquired hospitals we are able to rule out several potential sources of endogeneity that would bias the estimates. Taken together, these findings indicate that there are important cross-market dependencies present in the market

[29] Average Medicare revenues can change from system acquisition if the hospital makes changes that attract a different Medicare case-mix.

allowing hospitals to gain market power vis-à-vis MCOs in the price negotiation game by joining an out-of-market system.

The fact that hospitals secure higher reimbursement prices as a consequence of joining out-of-market systems raises some 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.[30] This methodology focuses entirely on how local system acquisitions reduce the ability of remaining hospitals to provide patients with adequate alternatives. Although the ability of hospitals to raise prices by reducing competition within a local patient market continues to have the potential to increase market power, our study suggests that systems can have a substantial impact on the market power of member hospitals in other ways as well. Acquisitions of hospitals by large national chains such as Hospital Corporation of America, Ascension Health, or Tenet Healthcare may not increase hospital concentration in the affected local markets, but could nevertheless generate higher prices.

Merger simulations based on the option demand approach will severely underestimate the effect on prices in cases where there is little to no change in the local patient market but the merger increases the bargaining power of the acquired hospital. In fact, the majority of the 479 acquisitions that take place between 2000 and 2010 had either minimal impact (in the case of in-market acquisitions) or no impact on local market concentration yet the acquired hospitals typically secured large price increases after their acquisition. Although increasing hospital concentration in local patient markets may have been an important source of market power in the merger wave of the 1990s, these findings suggest that the changes to the relative bargaining power of acquired hospitals has been one of the more important sources of increased market power in recent acquisitions. In light of this, future theoretical and empirical work examining the underlying mechanisms that contribute to hospital bargaining power could be particularly valuable.

[30] Dranove and Sfekas (2009) provide an overview of how these methods have been used in antitrust cases and Farrell et al. (2011) describes how the method is used in hospital cases specifically.

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ONLINE APPENDICES – NOT FOR PUBLICATION

APPENDIX A: HOSPITAL PRICE CALCULATION

The average price per discharge for a given year is calculated as follows. As HCRIS reports gross revenues for both inpatient and outpatient services, but reports only total contractual deductions, the net inpatient revenues are found by discounting the gross inpatient revenues by the amount implied by the contractual adjustments. That is, gross inpatient revenues are multiplied by $1 - (\text{total contractual adjustments})/(\text{gross inpatient revenues} + \text{gross outpatient revenues})$. This generates an estimate for total net inpatient revenue, from which we subtract the total payments received from Medicare. Lastly, this non-Medicare net-revenue is divided by the number of non-Medicare discharges to generate an average price per discharge. The following equation reports the calculation used to estimate a hospital average price per discharge.

$$\text{Discharge Price} = \frac{\left[\text{Gross Inpatient Revenue} \times (1 - \text{discount})\right] - \text{Medicare Payments}\big]}{\text{Non-Medicare Discharges}},$$

where

$$\text{discount} = \frac{\text{Total contractual adjustments}}{\text{Gross Inpatient Revenue} + \text{Gross Outpatient Revenue}}.$$

Gross inpatient and outpatient revenues come from the values reported on Line 25, columns 1 and 2, respectively, of Worksheet G-2, Form CMS-2552-96. In the case of inpatient revenues this value represents the revenues represented by the list prices for the general routine care, intensive care, and ancillary services provided during the reporting period.

The Medicare payments represent all payments received from inpatient care provided to Medicare patients including patients' out-of-pocket costs, adjustments given for graduate medical education, cost of teaching physicians, special add-on payments for new technologies, and other pass-through costs. The Medicare payments come from line 16 of Worksheet E, Part A, line 17 of Worksheet E, Part B, line 4 of Worksheet E-3 Part I, and line 19 of Worksheet E-3 Part II all from Form CMS-2552-96.

Total contractual adjustments come from line 2 Worksheet G-3 and the non-Medicare discharges is the difference between line 12, columns 6 and 4 of Worksheet S-3, Form CMS-2552-96.

APPENDIX B: ADDITIONAL SPECIFICATIONS

TABLE B1—SYSTEM DESCRIPTIVE STATISTICS

	Acquiring System Size					# States Acquiring System Has Members				
	Mean	(S.D.)	Median	Min.	Max.	Mean	S.D.	Median	Min.	Max.
T1	24.3	(36.6)	5	1	131	9.2	(12.1)	3.5	1	39
T2	13.3	(22.8)	4	1	131	4.7	(8.4)	1	1	39

Notes: The data include the distance between hospitals that are within 250 miles.

TABLE B2—THE IMPACT OF SYSTEM MEMBERSHIP ON UNCOMPENSATED CARE

$\ln\left(\frac{\text{Uncompensated Gross Charges}}{\text{Total Gross Charges}}\right)$	(1)	(2)	(3)	(4)	(5)	(6)
T1	-0.102	-0.309	-0.316	-0.091	-0.254	-0.263
	(0.225)	(0.395)	(0.395)	(0.231)	(0.396)	(0.396)
T2	-0.010	-0.150	-0.165	-0.010	-0.138	-0.153
	(0.087)	(0.137)	(0.138)	(0.087)	(0.139)	(0.141)
Additional patient shares	No	No	No	Yes	Yes	Yes
Time Fixed Effects						
Time Only	X			X		
Treatment×Time		X	X		X	X
Market-wide Treatment×Time			X			X
Adj. R^2	0.042	0.046	0.047	0.046	0.049	0.051
N	5658	5658	5658	5658	5658	5658

Notes: Hospitals report to the CMS an annual measure of uncompensated care (gross charges for which they are not reimbursed), but the data is only available from 2003 to 2009. Due to this shorter sample period there are only 23 in-market acquisitions and 36 out-of-market acquisitions for which we observe levels of uncompensated care both before and after merger, however, we can still employ our standard difference-in-differences specification to gain some insight into how hospitals alter their level of uncompensated care following an acquisition. On average, non-Medicare patients represent around 50% of a hospital's discharges and for both treatment and control hospitals uncompensated care charges represent about 4% of the total charges. A 31% decrease in the share of uncompensated care represents about a 1.25 percentage point decrease in uncompensated care which would bias the estimated price for non-Medicare patients by $1.25/.5 = 2.5$ percentage points. Additional patient shares include the share of in-patients that are insured by Medicare and Medicaid, as well as the share of all revenue coming from out-patient services. All specifications also include hospital fixed effects. Standard errors in parentheses are clustered by hospital.
Significance Levels: a =p $< .10$, b =p$< .05$, c =p $< .01$

TABLE B3—THE IMPACT OF HOSPITAL OWNERSHIP STATUS ON PRICES

ln(Price/Discharge)	(1)	(2)	(3)	(4)	(5)	(6)	(7)
T1	0.153^{c}	0.132^{b}	0.133^{b}				
	(0.048)	(0.064)	(0.064)				
T2	0.136^{c}	0.122^{c}	0.122^{c}				
	(0.020)	(0.026)	(0.026)				
FP× Treatment Hospital		0.101^{a}	0.167				
		(0.055)	(0.120)				
FP× Control Hospital		-0.116^{a}	-0.062				
		(0.062)	(0.122)				
Nonprofit× T1				0.145^{b}	0.132^{b}	0.140^{a}	0.130^{b}
				(0.071)	(0.061)	(0.072)	(0.061)
Nonprofit× T2				0.120^{c}	0.054^{b}	0.117^{c}	0.051^{b}
				(0.027)	(0.022)	(0.027)	(0.022)
For-Profit× T1				0.153^{b}	0.125^{a}	0.202^{b}	0.182^{b}
				(0.077)	(0.065)	(0.083)	(0.075)
For-Profit× T2				0.191^{c}	0.119^{a}	0.244^{c}	0.177^{b}
				(0.066)	(0.066)	(0.075)	(0.074)
Time Fixed Effects							
Treatment×Time	X	X	X	X	X	X	X
Market-wide Trtmt×Time					X		X
For-Profit Status×Time			X			X	X
Adj. R^2	0.481	0.482	0.482	0.481	0.487	0.481	0.487
N	21,868	21,868	21,868	21,868	21,868	21,868	21,868

Notes: Of the hospitals in our sample, 18 acquired by an out-of-market system and 31 acquired by an in-market system change to for-profit status after acquisition. An additional 7 acquired by an out-of-market system and 8 acquired by an in-market system change status at least two years before acquisition and 65 of the control hospitals change to for-profit status. These specifications provide more insight into how non-profit and for-profit hospitals differ. All reported variables are interacted with the private share of non-Medicare patients. Standard errors in parentheses are clustered by hospital.
Significance Levels: a =p $< .10$, b =p$< .05$, c =p $< .01$

TABLE B4—THE IMPACT OF SYSTEM MEMBERSHIP ON THE MEDICARE PRICE/DISCHARGE

	(1)	(2)	(3)	(4)	(5)	(6)
T1	0.004	-0.002	-0.000	0.003	0.006	0.007
	(0.035)	(0.025)	(0.025)	(0.034)	(0.027)	(0.027)
T2	-0.032^{c}	-0.022^{a}	-0.023^{b}	-0.030^{c}	-0.022^{b}	-0.023^{b}
	(0.010)	(0.012)	(0.011)	(0.010)	(0.011)	(0.011)
ln(Cost/Day)				0.190^{c}	0.189^{c}	0.187^{c}
				(0.022)	(0.022)	(0.022)
ln(Avg. Length of Stay)				0.258^{c}	0.257^{c}	0.247^{c}
(Medicare Only)				(0.058)	(0.058)	(0.060)
Time Fixed Effects						
Time Only	X			X		
Treatment×Time		X			X	
Market-wide Trmt×Time			X			X
Adj. R^2	0.422	0.422	0.431	0.472	0.472	0.478
N	21,853	21,853	21,853	21,853	21,853	21,853

Notes: All specifications include hospital fixed effects. Standard errors in parentheses are clustered by hospital.
Significance Levels: a =p $< .10$, b =p$< .05$, c =p $< .01$

TABLE B5—THE IMPACT OF SYSTEM MEMBERSHIP AND HHI ON THE PRICE/DISCHARGE

	(1)	(2)	(3)
T1× Private Share	0.149^b	0.148^b	0.148^b
	(0.064)	(0.064)	(0.064)
T2× Private Share	0.127^c	0.124^c	0.123^c
	(0.026)	(0.026)	(0.026)
Δ HHI × Private Share		0.876^a	
		(0.464)	
(Δ HHI> 0.01)× Private Share			0.068
			(0.045)
For-Profit×Private Share	−0.014	−0.014	−0.014
	(0.044)	(0.044)	(0.044)
% Medicare	1.358^c	1.359^c	1.358^c
	(0.075)	(0.075)	(0.075)
% Medicaid	-0.114^a	-0.115^a	-0.117^a
	(0.069)	(0.069)	(0.069)
% OP Revenue	-1.578^c	-1.578^c	-1.578^c
	(0.075)	(0.075)	(0.075)
ln(Cost/Day)	0.933^c	0.933^c	0.933^c
	(0.033)	(0.033)	(0.033)
ln(Avg. Length of Stay)	0.842^c	0.842^c	0.842^c
	(0.017)	(0.017)	(0.017)
ln(# Beds)	0.127^c	0.127^c	0.127^c
	(0.033)	(0.033)	(0.033)
Bed Utilization	0.397^c	0.397^c	0.398^c
	(0.080)	(0.080)	(0.080)
Bed Utilization Sqrd.	−0.062	−0.062	−0.062
	(0.047)	(0.047)	(0.047)
Adj. R^2	0.481	0.481	0.481
N	21,868	21,868	21,868

Notes: All specifications include hospital fixed effects and treatment-specific time fixed effects. Standard errors in parentheses are clustered by hospital. Significance Levels: a =p $< .10$, b =p$< .05$, c =p $< .01$

TABLE B6—THE IMPACT OF SYSTEM MEMBERSHIP ON THE PRICE/DISCHARGE CONTROLLING FOR PRIVATE PATIENT SHARE USING THE NON-MEDICARE PRIVATE SHARE FROM TWO YEARS PRIOR TO ACQUISITION

ln(Price/Discharge)	(1)	(2)	(3)	(4)	(5)	(6)
T1× Private Share$_{2\text{ yrs before acq.}}$	0.132^{b}	0.136^{c}	0.146^{c}	0.137^{c}	0.147^{c}	0.159^{c}
	(0.059)	(0.046)	(0.049)	(0.046)	(0.047)	(0.050)
T2× Private Share$_{2\text{ yrs before acq.}}$	0.143^{c}	0.144^{c}	0.144^{c}	0.141^{c}	0.140^{c}	0.138^{c}
	(0.031)	(0.021)	(0.021)	(0.021)	(0.021)	(0.022)
Adj. R^2	0.049	0.478	0.506	0.479	0.482	0.511
N	21,868	21,868	17,332	21,868	21,868	17,332
ln(Price/Discharge)	(7)	(8)	(9)	(10)	(11)	(12)
T1× Private Share$_{2\text{ yrs before acq.}}$	0.078	0.143^{b}	0.176^{c}	0.144^{b}	0.153^{b}	0.188^{c}
	(0.075)	(0.062)	(0.066)	(0.063)	(0.063)	(0.067)
T2× Private Share$_{2\text{ yrs before acq.}}$	0.097^{b}	0.136^{c}	0.152^{c}	0.132^{c}	0.133^{c}	0.148^{c}
	(0.041)	(0.027)	(0.028)	(0.027)	(0.027)	(0.028)
Adj. R^2	0.049	0.478	0.506	0.479	0.481	0.511
N	21,868	21,868	17,332	21,868	21,868	17,332

Notes: Each specification includes the same control variables reported in the corresponding column in Table 3 as well as hospital and year fixed effects. The treatment effect is interacted with the hospitals non-Medicare private patient share two years prior to the acquisition. Specifications in the bottom panel also includes treatment-specific time fixed effects. Standard errors in parentheses are clustered by hospital. Significance Levels: a =p $< .10$, b =p$< .05$, c =p $< .01$

APPENDIX C: ROBUSTNESS OF RESULTS TO DATA TRIMMING

TABLE C1—THE IMPACT OF SYSTEM MEMBERSHIP ON THE PRICE/DISCHARGE

ln(Price/Discharge)	(1)	(2)	(3)	(4)	(5)	(6)
T1× Private Share	0.141^{b}	0.140^{c}	0.144^{c}	0.140^{c}	0.147^{c}	0.152^{c}
	(0.061)	(0.048)	(0.053)	(0.048)	(0.049)	(0.054)
T2× Private Share	0.150^{c}	0.144^{c}	0.142^{c}	0.140^{c}	0.136^{c}	0.134^{c}
	(0.030)	(0.020)	(0.021)	(0.020)	(0.020)	(0.021)
For-Profit× Private Share	−0.019	−0.024	−0.005	−0.023	−0.014	0.008
	(0.049)	(0.044)	(0.045)	(0.044)	(0.044)	(0.046)
% Medicare		1.372^{c}	0.776^{c}	1.367^{c}	1.358^{c}	0.769^{c}
		(0.075)	(0.079)	(0.075)	(0.075)	(0.079)
% Medicaid		−0.109	−0.112	−0.109	−0.113	-0.117^{a}
		(0.069)	(0.070)	(0.069)	(0.069)	(0.069)
% OP Revenue		-1.739^{c}	-1.677^{c}	-1.713^{c}	-1.579^{c}	-1.494^{c}
		(0.072)	(0.080)	(0.072)	(0.075)	(0.082)
ln(Cost/Day)		0.877^{c}	1.018^{c}	0.879^{c}	0.933^{c}	1.088^{c}
		(0.031)	(0.030)	(0.031)	(0.033)	(0.033)
ln(Avg. Length of Stay)		0.849^{c}	0.918^{c}	0.848^{c}	0.842^{c}	0.906^{c}
		(0.017)	(0.019)	(0.017)	(0.017)	(0.019)
ln(CMI)			0.060			0.012
			(0.059)			(0.059)
High Bed Utilization (> 75%)				0.044^{c}		
				(0.013)		
Bed Utilization					0.397^{c}	0.379^{c}
					(0.080)	(0.073)
Bed Utilization Sqrd.					−0.061	−0.005
					(0.047)	(0.025)
Adj. R^2	0.049	0.478	0.506	0.479	0.481	0.511
N	21,868	21,868	17,332	21,868	21,868	17,332
ln(Price/Discharge)	(7)	(8)	(9)	(10)	(11)	(12)
T1× Private Share	0.180^{b}	0.224^{c}	0.245^{c}	0.244^{c}	0.229^{c}	0.251^{c}
	(0.077)	(0.072)	(0.078)	(0.079)	(0.072)	(0.079)
T2× Private Share	0.162^{c}	0.190^{c}	0.195^{c}	0.188^{c}	0.181^{c}	0.188^{c}
	(0.038)	(0.033)	(0.033)	(0.033)	(0.032)	(0.033)
For-Profit× Private Share	−0.038	−0.034	−0.009	−0.005	−0.022	0.008
	(0.045)	(0.047)	(0.049)	(0.049)	(0.048)	(0.050)
% Medicare	1.770^{c}	1.292^{c}	0.662^{c}	0.661^{c}	1.282^{c}	0.663^{c}
	(0.108)	(0.080)	(0.091)	(0.091)	(0.080)	(0.091)
% Medicaid	−0.073	−0.051	−0.051	−0.051	−0.057	−0.059
	(0.090)	(0.071)	(0.077)	(0.076)	(0.071)	(0.077)
% OP Revenue	-2.745^{c}	-2.008^{c}	-1.929^{c}	-1.874^{c}	-1.800^{c}	-1.702^{c}
	(0.092)	(0.089)	(0.099)	(0.098)	(0.092)	(0.101)
ln(Cost/Day)		0.863^{c}	1.053^{c}	1.058^{c}	0.927^{c}	1.130^{c}
		(0.035)	(0.034)	(0.034)	(0.038)	(0.039)
ln(Avg. Length of Stay)		-0.062^{c}	−0.014	−0.016	-0.068^{c}	−0.023
		(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
ln(CMI)			0.072	0.054		0.021
			(0.068)	(0.067)		(0.068)
High Bed Utilization (> 75%)				0.058^{c}		
				(0.013)		
Bed Utilization					0.450^{c}	0.411^{c}
					(0.094)	(0.083)
Bed Utilization Sqrd.					−0.086	−0.010
					(0.061)	(0.030)
Adj. R^2	0.259	0.373	0.379	0.382	0.377	0.385
N	21,868	21,868	17,332	21,868	21,868	17,332

Notes: This table reports the full results from the specifications reported in Table 3. All specifications include hospital and year fixed effects while the bottom panel also includes treatment-specific time fixed effects. Standard errors in parentheses are clustered by hospital. Significance Levels: a =p < .10, b =p< .05, c =p < .01

TABLE C2—THE IMPACT OF SYSTEM MEMBERSHIP ON THE PRICE/DISCHARGE, NO DATA TRIMMING

ln(Price/Discharge)	(1)	(2)	(3)	(4)	(5)	(6)
T1	0.160^{b}	0.111^{b}	0.095^{a}	0.111^{b}	0.119^{b}	0.105^{a}
	(0.067)	(0.050)	(0.055)	(0.050)	(0.050)	(0.055)
T2	0.147^{c}	0.144^{c}	0.141^{c}	0.140^{c}	0.137^{c}	0.134^{c}
	(0.031)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
For-Profit	−0.010	−0.006	0.002	−0.005	0.006	0.015
	(0.053)	(0.041)	(0.041)	(0.041)	(0.042)	(0.042)
% Medicare		1.544^{c}	0.815^{c}	1.539^{c}	1.533^{c}	0.817^{c}
		(0.110)	(0.114)	(0.110)	(0.110)	(0.115)
% Medicaid		−0.049	−0.020	−0.048	−0.056	−0.027
		(0.091)	(0.097)	(0.091)	(0.092)	(0.096)
% OP Revenue		-2.107^{c}	-1.999^{c}	-2.073^{c}	-1.887^{c}	-1.755^{c}
		(0.109)	(0.113)	(0.108)	(0.108)	(0.115)
ln(Cost/Day)		0.971^{c}	1.142^{c}	0.973^{c}	1.041^{c}	1.225^{c}
		(0.038)	(0.043)	(0.039)	(0.041)	(0.050)
ln(Avg. Length of Stay)		0.938^{c}	0.988^{c}	0.937^{c}	0.929^{c}	0.976^{c}
		(0.017)	(0.018)	(0.017)	(0.017)	(0.018)
ln(CMI)			0.195^{b}			0.138
			(0.096)			(0.096)
High Bed Utilization (> 75%)				0.051^{c}		
				(0.017)		
Bed Utilization					0.586^{c}	0.547^{c}
					(0.119)	(0.111)
Bed Utilization Sqrd.					−0.112	−0.025
					(0.079)	(0.044)
Adj. R^2	0.044	0.409	0.413	0.409	0.412	0.417
N	22,604	22,604	17,918	22,604	22,604	17,918

ln(Price/Discharge)	(1)	(2)	(3)	(4)	(5)	(6)
T1	0.123	0.123^{a}	0.127^{a}	0.124^{a}	0.129^{b}	0.136^{a}
	(0.080)	(0.065)	(0.072)	(0.065)	(0.065)	(0.072)
T2	0.101^{b}	0.136^{c}	0.141^{c}	0.131^{c}	0.130^{c}	0.137^{c}
	(0.046)	(0.033)	(0.034)	(0.033)	(0.033)	(0.034)
For-Profit	−0.012	−0.006	0.003	−0.005	0.007	0.016
	(0.053)	(0.041)	(0.041)	(0.041)	(0.042)	(0.042)
% Medicare		1.542^{c}	0.811^{c}	1.537^{c}	1.531^{c}	0.813^{c}
		(0.109)	(0.114)	(0.110)	(0.109)	(0.115)
% Medicaid		−0.050	−0.020	−0.049	−0.057	−0.027
		(0.091)	(0.097)	(0.091)	(0.092)	(0.096)
% OP Revenue		-2.108^{c}	-2.003^{c}	-2.074^{c}	-1.890^{c}	-1.762^{c}
		(0.109)	(0.113)	(0.107)	(0.107)	(0.116)
ln(Cost/Day)		0.972^{c}	1.143^{c}	0.974^{c}	1.040^{c}	1.224^{c}
		(0.038)	(0.043)	(0.039)	(0.041)	(0.051)
ln(Avg. Length of Stay)		0.938^{c}	0.987^{c}	0.937^{c}	0.929^{c}	0.976^{c}
		(0.017)	(0.018)	(0.017)	(0.017)	(0.018)
ln(CMI)			0.200^{b}			0.144
			(0.096)			(0.096)
High Bed Utilization (> 75%)				0.051^{c}		
				(0.017)		
Bed Utilization					0.580^{c}	0.536^{c}
					(0.119)	(0.110)
Bed Utilization Sqrd.					−0.111	−0.022
					(0.079)	(0.043)
Adj. R^2	0.044	0.409	0.413	0.409	0.412	0.417
N	22,604	22,604	17,918	22,604	22,604	17,918

Notes: All specifications include hospital and year fixed effects while the bottom panel also includes treatment-specific time fixed effects. Standard errors in parentheses are clustered by hospital.
Significance Levels: a =p < .10, b =p< .05, c =p < .01

TABLE C3—THE IMPACT OF SYSTEM MEMBERSHIP ON THE PRICE/DISCHARGE, NO DATA TRIMMING

ln(Price/Discharge)	(1)	(2)	(3)	(4)	(5)	(6)
T1× Private Share	0.264^{c}	0.189^{c}	0.169^{b}	0.189^{c}	0.196^{c}	0.178^{b}
	(0.088)	(0.064)	(0.070)	(0.064)	(0.064)	(0.071)
T2× Private Share	0.204^{c}	0.194^{c}	0.192^{c}	0.189^{c}	0.184^{c}	0.180^{c}
	(0.038)	(0.030)	(0.029)	(0.030)	(0.030)	(0.029)
For-Profit× Private Share	−0.035	−0.018	−0.016	−0.017	−0.003	0.004
	(0.075)	(0.058)	(0.056)	(0.058)	(0.059)	(0.057)
% Medicare		1.548^{c}	0.820^{c}	1.544^{c}	1.538^{c}	0.823^{c}
		(0.110)	(0.114)	(0.110)	(0.110)	(0.114)
% Medicaid		−0.031	0.002	−0.030	−0.036	−0.003
		(0.092)	(0.097)	(0.092)	(0.093)	(0.096)
% OP Revenue		-2.104^{c}	-1.997^{c}	-2.071^{c}	-1.886^{c}	-1.755^{c}
		(0.109)	(0.113)	(0.107)	(0.107)	(0.115)
ln(Cost/Day)		0.972^{c}	1.142^{c}	0.973^{c}	1.040^{c}	1.224^{c}
		(0.038)	(0.043)	(0.039)	(0.041)	(0.050)
ln(Avg. Length of Stay)		0.938^{c}	0.988^{c}	0.937^{c}	0.929^{c}	0.976^{c}
		(0.017)	(0.018)	(0.017)	(0.017)	(0.018)
ln(CMI)			0.193^{b}			0.136
			(0.096)			(0.096)
High Bed Utilization (> 75%)				0.049^{c}		
				(0.017)		
Bed Utilization					0.582^{c}	0.542^{c}
					(0.119)	(0.111)
Bed Utilization Sqrd.					−0.113	−0.025
					(0.079)	(0.044)
Adj. R^2	0.045	0.409	0.414	0.410	0.413	0.417
N	22,604	22,604	17,918	22,604	22,604	17,918

ln(Price/Discharge)	(1)	(2)	(3)	(4)	(5)	(6)
T1× Private Share	0.244^{b}	0.225^{c}	0.231^{b}	0.225^{c}	0.228^{c}	0.236^{c}
	(0.104)	(0.082)	(0.090)	(0.082)	(0.082)	(0.091)
T2× Private Share	0.163^{c}	0.192^{c}	0.197^{c}	0.186^{c}	0.182^{c}	0.188^{c}
	(0.055)	(0.042)	(0.041)	(0.042)	(0.042)	(0.041)
For-Profit× Private Share	−0.038	−0.017	−0.013	−0.016	−0.002	0.006
	(0.075)	(0.058)	(0.056)	(0.058)	(0.059)	(0.057)
% Medicare		1.547^{c}	0.818^{c}	1.542^{c}	1.536^{c}	0.820^{c}
		(0.110)	(0.114)	(0.110)	(0.110)	(0.114)
% Medicaid		−0.030	0.006	−0.029	−0.035	0.002
		(0.092)	(0.097)	(0.092)	(0.092)	(0.097)
% OP Revenue		-2.106^{c}	-2.002^{c}	-2.073^{c}	-1.890^{c}	-1.764^{c}
		(0.109)	(0.113)	(0.107)	(0.107)	(0.115)
ln(Cost/Day)		0.972^{c}	1.143^{c}	0.974^{c}	1.040^{c}	1.223^{c}
		(0.038)	(0.043)	(0.038)	(0.040)	(0.051)
ln(Avg. Length of Stay)		0.937^{c}	0.987^{c}	0.937^{c}	0.929^{c}	0.976^{c}
		(0.017)	(0.018)	(0.017)	(0.017)	(0.018)
ln(CMI)			0.198^{b}			0.142
			(0.096)			(0.096)
High Bed Utilization (> 75%)				0.049^{c}		
				(0.017)		
Bed Utilization					0.576^{c}	0.530^{c}
					(0.119)	(0.110)
Bed Utilization Sqrd.					−0.111	−0.022
					(0.079)	(0.044)
Adj. R^2	0.044	0.409	0.414	0.410	0.412	0.418
N	22,604	22,604	17,918	22,604	22,604	17,918

Notes: All specifications include hospital and year fixed effects while the bottom panel also includes treatment-specific time fixed effects. Standard errors in parentheses are clustered by hospital.
Significance Levels: a =p $< .10$, b =p$< .05$, c =p $< .01$

TABLE C4—THE IMPACT OF SYSTEM MEMBERSHIP ON THE PRICE/DISCHARGE, 5% TAILS TRIMMED

ln(Price/Discharge)	(1)	(2)	(3)	(4)	(5)	(6)
T1	0.085^{b}	0.087^{c}	0.087^{b}	0.088^{c}	0.093^{c}	0.094^{b}
	(0.043)	(0.034)	(0.037)	(0.034)	(0.034)	(0.037)
T2	0.086^{c}	0.094^{c}	0.094^{c}	0.091^{c}	0.090^{c}	0.090^{c}
	(0.023)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
For-Profit	0.005	−0.012	0.001	−0.011	−0.006	0.007
	(0.034)	(0.029)	(0.030)	(0.029)	(0.029)	(0.031)
% Medicare		1.344^{c}	0.783^{c}	1.338^{c}	1.332^{c}	0.779^{c}
		(0.071)	(0.072)	(0.072)	(0.072)	(0.072)
% Medicaid		-0.134^{b}	-0.135^{b}	-0.133^{b}	-0.139^{b}	-0.140^{b}
		(0.065)	(0.066)	(0.064)	(0.065)	(0.066)
% OP Revenue		-1.595^{c}	-1.536^{c}	-1.567^{c}	-1.462^{c}	-1.395^{c}
		(0.070)	(0.076)	(0.068)	(0.071)	(0.079)
ln(Cost/Day)		0.838^{c}	0.973^{c}	0.839^{c}	0.881^{c}	1.026^{c}
		(0.030)	(0.029)	(0.030)	(0.031)	(0.032)
ln(Avg. Length of Stay)		0.809^{c}	0.895^{c}	0.808^{c}	0.804^{c}	0.885^{c}
		(0.017)	(0.018)	(0.017)	(0.017)	(0.018)
ln(CMI)			0.044			0.009
			(0.054)			(0.054)
High Bed Utilization ($> 75\%$)				0.044^{c}		
				(0.013)		
Bed Utilization					0.304^{c}	0.270^{c}
					(0.068)	(0.065)
Bed Utilization Sqrd.					−0.038	0.014
					(0.036)	(0.019)
N	21,130	21,130	16,758	21,130	21,130	16,758
ln(Price/Discharge)	(1)	(2)	(3)	(4)	(5)	(6)
T1	0.007	0.065	0.078^{a}	0.066	0.071^{a}	0.085^{a}
	(0.051)	(0.042)	(0.045)	(0.043)	(0.043)	(0.046)
T2	0.046	0.078^{c}	0.092^{c}	0.075^{c}	0.074^{c}	0.089^{c}
	(0.031)	(0.021)	(0.021)	(0.021)	(0.020)	(0.021)
For-Profit	0.001	−0.013	0.000	−0.012	−0.007	0.007
	(0.034)	(0.029)	(0.031)	(0.029)	(0.030)	(0.031)
% Medicare		1.344^{c}	0.782^{c}	1.339^{c}	1.333^{c}	0.779^{c}
		(0.071)	(0.072)	(0.072)	(0.072)	(0.072)
% Medicaid		-0.134^{b}	-0.134^{b}	-0.134^{b}	-0.140^{b}	-0.139^{b}
		(0.065)	(0.066)	(0.065)	(0.065)	(0.066)
% OP Revenue		-1.593^{c}	-1.536^{c}	-1.564^{c}	-1.459^{c}	-1.395^{c}
		(0.070)	(0.076)	(0.068)	(0.071)	(0.079)
ln(Cost/Day)		0.837^{c}	0.973^{c}	0.838^{c}	0.881^{c}	1.026^{c}
		(0.030)	(0.029)	(0.030)	(0.031)	(0.032)
ln(Avg. Length of Stay)		0.809^{c}	0.894^{c}	0.808^{c}	0.804^{c}	0.884^{c}
		(0.017)	(0.018)	(0.017)	(0.017)	(0.018)
ln(CMI)			0.045			0.010
			(0.054)			(0.054)
High Bed Utilization ($> 75\%$)				0.044^{c}		
				(0.013)		
Bed Utilization					0.307^{c}	0.270^{c}
					(0.068)	(0.065)
Bed Utilization Sqrd.					−0.040	0.014
					(0.037)	(0.019)
Adj. R^2	0.047	0.472	0.509	0.473	0.475	0.513
N	21,130	21,130	16,758	21,130	21,130	16,758

Notes: All specifications include hospital and year fixed effects while the bottom panel also includes treatment-specific time fixed effects. Standard errors in parentheses are clustered by hospital.
Significance Levels: a =p $< .10$, b =p$< .05$, c =p $< .01$

TABLE C5—THE IMPACT OF SYSTEM MEMBERSHIP ON THE PRICE/DISCHARGE, 5% TAILS TRIMMED

ln(Price/Discharge)	(1)	(2)	(3)	(4)	(5)	(6)
T1× Private Share	0.133^{b}	0.130^{c}	0.131^{b}	0.130^{c}	0.136^{c}	0.138^{c}
	(0.059)	(0.048)	(0.052)	(0.048)	(0.048)	(0.053)
T2× Private Share	0.127^{c}	0.129^{c}	0.129^{c}	0.125^{c}	0.123^{c}	0.123^{c}
	(0.028)	(0.019)	(0.020)	(0.019)	(0.019)	(0.020)
For-Profit× Private Share	0.009	−0.016	−0.001	−0.014	−0.008	0.009
	(0.045)	(0.039)	(0.039)	(0.039)	(0.039)	(0.040)
% Medicare		1.347^{c}	0.787^{c}	1.342^{c}	1.336^{c}	0.784^{c}
		(0.071)	(0.072)	(0.072)	(0.072)	(0.072)
% Medicaid		-0.121^{a}	-0.118^{a}	-0.121^{a}	-0.125^{a}	-0.121^{a}
		(0.065)	(0.066)	(0.064)	(0.065)	(0.065)
% OP Revenue		-1.594^{c}	-1.534^{c}	-1.566^{c}	-1.462^{c}	-1.395^{c}
		(0.070)	(0.076)	(0.068)	(0.071)	(0.079)
ln(Cost/Day)		0.838^{c}	0.973^{c}	0.839^{c}	0.881^{c}	1.025^{c}
		(0.030)	(0.029)	(0.030)	(0.031)	(0.032)
ln(Avg. Length of Stay)		0.809^{c}	0.894^{c}	0.808^{c}	0.803^{c}	0.884^{c}
		(0.017)	(0.018)	(0.017)	(0.017)	(0.018)
ln(CMI)			0.043			0.007
			(0.054)			(0.054)
High Bed Utilization (> 75%)				0.043^{c}		
				(0.013)		
Bed Utilization					0.302^{c}	0.267^{c}
					(0.068)	(0.065)
Bed Utilization Sqrd.					−0.039	0.014
					(0.037)	(0.019)
Adj. R^2	0.047	0.473	0.510	0.474	0.476	0.513
N	21,130	21,130	16,758	21,130	21,130	16,758

ln(Price/Discharge)	(1)	(2)	(3)	(4)	(5)	(6)
T1× Private Share	0.114^{a}	0.140^{b}	0.165^{c}	0.162^{c}	0.143^{b}	0.167^{c}
	(0.067)	(0.057)	(0.060)	(0.059)	(0.056)	(0.059)
T2× Private Share	0.109^{c}	0.138^{c}	0.151^{c}	0.145^{c}	0.130^{c}	0.144^{c}
	(0.032)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
For-Profit× Private Share	−0.029	−0.030	−0.003	0.001	−0.020	0.011
	(0.040)	(0.042)	(0.043)	(0.044)	(0.043)	(0.044)
% Medicare	1.463^{c}	1.137^{c}	0.633^{c}	0.634^{c}	1.131^{c}	0.636^{c}
	(0.091)	(0.072)	(0.081)	(0.081)	(0.073)	(0.081)
% Medicaid	−0.050	−0.046	−0.060	−0.060	−0.051	−0.067
	(0.086)	(0.065)	(0.068)	(0.067)	(0.065)	(0.068)
% OP Revenue	-2.474^{c}	-1.903^{c}	-1.876^{c}	-1.827^{c}	-1.726^{c}	-1.675^{c}
	(0.089)	(0.082)	(0.089)	(0.088)	(0.086)	(0.092)
ln(Cost/Day)		0.823^{c}	1.000^{c}	1.003^{c}	0.876^{c}	1.064^{c}
		(0.035)	(0.031)	(0.031)	(0.038)	(0.036)
ln(Avg. Length of Stay)		-0.056^{c}	−0.021	-0.023^{a}	-0.062^{c}	-0.029^{b}
		(0.014)	(0.013)	(0.013)	(0.014)	(0.013)
ln(CMI)			0.036	0.024		−0.004
			(0.060)	(0.060)		(0.061)
High Bed Utilization (> 75%)				0.048^{c}		
				(0.012)		
Bed Utilization					0.376^{c}	0.347^{c}
					(0.084)	(0.072)
Bed Utilization Sqrd.					−0.075	−0.011
					(0.052)	(0.025)
Adj. R^2	0.253	0.380	0.411	0.413	0.384	0.416
N	21,130	21,130	16,758	21,130	21,130	16,758

Notes: All specifications include hospital and year fixed effects while the bottom panel also includes treatment-specific time fixed effects. Standard errors in parentheses are clustered by hospital.
Significance Levels: a =p < .10, b =p< .05, c =p < .01

APPENDIX D: ROBUSTNESS OF RESULTS TO SAME-MARKET DISTANCE (2.5% TRIMMING)

TABLE D1—THE IMPACT OF SYSTEM MEMBERSHIP ON THE PRICE/DISCHARGE USING DIFFERENT DISTANCE CUT-OFFS TO DEFINE OUT-OF-MARKET ACQUISITIONS

ln(Price/Discharge)	45 Mi.	75 mi.	150 mi.	45 Mi.	75 mi.	150 mi.
T1× Private Share	0.152^{c}	0.161^{c}	0.212^{c}	0.175^{b}	0.200^{b}	0.254^{c}
	(0.054)	(0.062)	(0.071)	(0.071)	(0.080)	(0.090)
T2× Private Share	0.134^{c}	0.133^{c}	0.120^{c}	0.143^{c}	0.140^{c}	0.136^{c}
	(0.021)	(0.021)	(0.021)	(0.027)	(0.027)	(0.027)
Time Fixed Effects						
Time Only	X	X	X			
Trmt×Time				X	X	X
# Hospitals in T1						
Total	143	117	87	143	117	87
Acquired in 2000-2008	98	78	56	98	78	56

Notes: Each specification includes the same control variables reported in specification 6 of Table 2 as well as hospital and year fixed effects. Standard errors in parentheses are clustered by hospital. Significance Levels: a =p $< .10$, b =p$< .05$, c =p $< .01$