Hospital Alignment with Physicians as a Bargaining Response to Commercial Insurance Markets*

Sean Huang
Georgetown University

Ian M. McCarthy†
Emory University

November 2015

Abstract

The relationship between physicians and hospitals has dramatically changed over the last decade, with the employer-employee model supplanting the traditional model of private physicians with hospital admitting privileges. We examine the motivations for this increase in physician-hospital alignment, focusing on alignment as a tool to increase bargaining power with private insurers. We find a positive and significant effect of private insurance concentration on hospital-physician alignment. We also find differential effects of private insurance markets and physician-hospital alignment across hospital ownership type and competition in the local hospital market. Sensitivity analysis suggests that our results are robust to mismeasured alignment and endogenous private insurance market concentration.

*We thank Bob Town, Jim Burgess, Gautam Gowrisankaran, Guy David, Avi Dor, and Jim Marton for insightful comments and suggestions, as well as the participants at the 2015 American Health Economics Conference.
†Correspondence to: Ian McCarthy, Emory University, Department of Economics, 1602 Fishburne Dr., Atlanta, GA 30322, U.S.A. E-mail: ian.mccarthy@emory.edu

1 Introduction

Hospital employment of physicians increased by 55% from 2003 to 2011, and over 50% of physicians now identify themselves as employees rather than private practice (MedPAC, 2013; The Physician's Foundation, 2012). This does not include physician practices that are exclusively aligned with a single hospital (or hospital system) but not directly employed, the relationship between which would intuitively mirror that of an employer-employee more than a private practice physician. These numbers reflect the quickly changing relationship between physicians and hospitals over the last decade, with the employer-employee model supplanting the traditional medical staff model of private physicians with hospital admitting privileges. The goal of the current paper is to examine the potential motivating factors for this increase in physician-hospital alignment, focusing in particular on alignment as a tool to increase bargaining power with private insurers.

To date, much of the current academic literature concerning competitiveness in the health care provider market has focused on the effects of hospital mergers or system-joiners (i.e., horizontal integration) rather than the effects of physician-hospital alignment (i.e., vertical integration).[1] The literature generally finds an increase in hospital prices following mergers and system-joiners, with ambiguous effects on quality (Alexander *et al.*, 1996; Kessler & McClellan, 2000; Dranove & Lindrooth, 2003; Dafny, 2009; Spang *et al.*, 2009; Harrison, 2011).[2] In studies focusing specifically on physician-hospital alignment, Cuellar & Gertler (2006) found that alignment led to higher prices and no efficiency gains, while Ciliberto & Dranove (2006) found no effect of vertical integration on hospital prices. In related studies, Afendulis & Kessler (2007) found that overall Medicare expenditures increased when patients with coronary artery disease were treated with a physician as part of an integrated network relative to a nonintegrated physician. Baker *et al.* (2014) similarly found that an increase in market

[1]We consider vertical alignment as the consolidation of physicians and hospitals, although other forms of vertical alignment may also exist in healthcare provider markets. For example, Huckman (2006) examined hospital acquisitions of specialty cardiac services in New York state, therefore defining vertical alignment as the consolidation of complementary hospital services rather than between physicians and hospitals. Vertical alignment is sometimes also defined as alignment between insurers and hospitals or insurers and physicians.

[2]See Vogt & Town (2006) and Gaynor & Town (2012b) for excellent surveys of the current literature in this area.

share for more vertically integrated systems was associated with higher prices and increased spending. Existing studies therefore indicate that physician-hospital alignment increases spending with potential increases in prices as well.[3]

Gone largely unexamined thus far is the underlying motivation for increased physician-hospital alignment. Some exceptions include Burns *et al.* (2000), Cuellar & Gertler (2006), and Brunt & Bowblis (2014). Burns *et al.* (2000) examined the relationship between the managed care market and the number of hospitals with some form of physician alliance, finding that hospital alliances with physicians were significantly more common in areas with more managed care payers. Cuellar & Gertler (2006) study this relationship looking at hospital transitions from one form of alignment to another. Based on data for Arizona, Florida, and Wisconsin from 1994 through 1998, they find a statistically significant relationship between physician-hospital alignment and managed care penetration. Citing survey evidence from health care providers, Gaynor & Town (2012b) further discuss how physician-hospital alignment appears to be driven in-part by incentives to increase bargaining power with insurers and perhaps less driven by efficiency gains or cost savings. And more recently, Brunt & Bowblis (2014) examined the relationship between concentration in the insurance market and consolidation among primary care physicians, finding that physicians were more likely to work in larger practices or be owned by a hospital when insurance markets were more concentrated.

Extending this literature, we examine the motivation for physician-hospital alignment by investigating the relationship between concentration in private insurance markets and the degree of alignment between a hospital and its physicians. Our analysis makes three primary contributions relative to the existing literature. First, we consider the hospital-level decision to integrate with physicians rather than the physician-level decision as in Brunt & Bowblis (2014). Second, our methodology allows for a broader assessment of physician-hospital alignment by considering different levels of integration, as

[3] In related literature on physician-hospital markets, Lammers (2013) investigated the effect of hospital-physician alignment on technology adoption. Using state variation in corporate practice of medicine laws as an instrument for hospital-physician alignment, the authors found that vertical integration has a significant positive effect on hospital adoption of electronic medical records and computerized provider order entry. Baker *et al.* (2013) examined the effect of concentration in physician markets on physician prices, finding that larger physician practices lead to higher prices for physician services.

opposed to the binary treatment of integration in Burns *et al.* (2000). Specifically, we consider the following "levels" of integration: 1) the typical medical staff model (least aligned); 2) hospital administrative support with relatively few restrictions of physician practice patterns; 3) hospital support along with influence on physician practice patterns; 4) hospital employment of physicians; and 5) an equity model in which physicians share in the financial outcomes of the hospital (most aligned).[4] Related to this second contribution, our analysis is broader in scope relative to existing studies, and we examine all hospitals across the U.S. rather than a specific geographic subset of hospitals (Cuellar & Gertler, 2006; Ciliberto & Dranove, 2006). Third, we extend our analysis allowing for misreported physician-hospital alignment using the monotone rank estimator proposed in Cavanagh & Sherman (1998), Abrevaya & Hausman (1999), and Hausman (2001).

Our analysis is based on data from the 2009-2011 American Hospital Association (AHA) Annual Surveys and commercial insurance data from the American Medical Association (AMA) annual reports on competition in the private health insurance market. Our initial results suggest that increased concentration in the private insurance market significantly impacts hospital-physician consolidation, with hospital employment of physicians increasing by 0.18% on average following a 1% increase in private health insurance concentration. Similarly, the number of equity relationships increases by 0.41% following a 1% increase in private health insurance market concentration. In other words, a one standard deviation increase in the private insurance Herfindahl-Hirschman Index (HHI) would increase the expected number of hospitals with an employee or equity model by as much as 118 and 33, respectively. Interestingly, we find a differential response to private insurance pressures across ownership type, with larger effects among for-profit hospitals but no significant effects among not-for-profit hospitals. We also find differential effects depending on the number of hospitals operating in the local market. Here, it is when hospitals face some level of competition where vertical integration becomes a more important strategy in the presence of more concentrated private insurance markets.

[4] The AHA defines an equity model as, "allow[ing] established practitioners to become shareholders in a professional corporation in exchange for tangible and intangible assets of their existing practices." In our analysis, we consider physician ownership as a form of an equity model.

The remainder of the paper is organized as follows. In Section 2, we discuss the theoretical support for a relationship between private insurance markets and hospital bargaining effort. Section 3 describes our data in more detail and presents summary statistics. Section 4 presents our analysis of the relationship between commercial insurance markets and hospital-physician alignment, with sensitivity analysis presented in Section 6. Section 7 concludes.

2 Theoretical Motivation

The current wave of physician-hospital alignment is not new. For example, a single year from 1994 to 1995 saw a 60% increase in the number of physician practices owned or managed by a hospital or hospital system (Gal-Or, 1999). By 1996, approximately 55% of hospitals were aligned with physicians in the form of physician-hospital organizations (PHO) or management services organizations (MSO; Burns & Pauly (2002)). This trend subsequently reversed from its peak in 1996, and by 2000, less than 40% of hospitals had a PHO or MSO (Burns & Pauly, 2002). The recent increase in hospital-physician alignment therefore reflects yet another reversal of trends in the healthcare provider market. In this section, we discuss the existing theory related to physician-hospital alignment and propose an extension of a recent bargaining model to better examine the role of insurance markets.

2.1 Justification for Alignment

In the existing literature, two primary theoretical justifications have been posited for the observed increases in physician-hospital alignment (Gal-Or, 1999; Cuellar & Gertler, 2006; Gaynor, 2006). The first is a transactions cost motive in which hospitals and physicians integrate for efficiency gains. Alignment to achieve efficiency gains will have theoretically ambiguous effects on observed hospital prices in a managed care environment, although the more likely outcome would tend to be a reduction in prices following integration. Following the wave of vertical integration in hospital and physician markets in the 1990s, there was little evidence that such integration was driven by the search for efficiency gains or economies of scale (Burns & Pauly, 2002). Additional studies have since found little evidence in support of efficiency gains following increased physician-hospital alignment (Cuellar & Gertler, 2006; Ciliberto & Dranove, 2006; Gaynor & Town, 2012a; Baker *et al.*, 2014).

A second motive cited for vertical integration in health care markets is to increase bargaining power. Here, we would expect to observe an increase in prices following integration; however, Gal-Or (1999) discusses how the motive for increasing bargaining power would only exist if competitiveness in the physician and hospital markets are similar. Intuitively, this requires that the newly integrated entity must not be moving from a position of large market power to one of significantly lower market power. For example, a powerful physician group would not align with a hospital with very low market power (all else equal) as such a move would reduce their bargaining power in a managed care environment. We do not examine this issue in the current paper, as our focus is on integration from the hospital's perspective; however, alignment is clearly a joint decision between both hospitals and physician practices. We consider the interaction between these parties and its effects on alignment as important areas for future research.

2.2 Formal Bargaining Model

Importantly, the transactions cost motive and bargaining power motive need not be mutually exclusive. For example, consider the recent hospital-insurer negotiation model of Gowrisankaran *et al.* (2015) (GNT).[5] The authors describe a two-stage bargaining process, where in stage one, hospitals and insurers negotiate the terms of their agreement, and in stage two, individuals receive health draws which dictate their health care needs. Working backward, and with functional-form assumptions for consumer utility and payoffs for insurers and hospitals, the authors derive the Nash bargaining solution as the choice of prices maximizing the net value from agreement. For a single-hospital system, the

[5] See Dor *et al.* (2004) and Lewis & Pflum (2015) for additional studies of hospital behavior employing a Nash-bargaining framework. Lewis & Pflum (2015) specifically examines the effect of hospital characteristics and other observables on estimated hospital bargaining power. The authors parameterize a hospital's bargaining power, finding that increased physician-hospital alignment has a strong positive effect on bargaining power, with the magnitude of this effect comparable to the effects of system membership.

authors derive the net value from agreement between insurer m and hospital j as:

$$NB^m\left(p_{mj}|\mathbf{p}_{m,\setminus j}\right)=\left[q_{mj}\left(N_m,\mathbf{p}_m\right)\left(p_{mj}-mc_{mj}\right)\right]^{b_{mj}}\times\left[V_m\left(N_m,\mathbf{p}_m\right)-V_m\left(N_m\setminus j,\mathbf{p}_m\right)\right]^{1-b_{mj}}, \quad (1)$$

where p_{mj} denotes the price to be negotiated, $\mathbf{p}_{m,\setminus j}$ denotes the vector of prices negotiated between insurer m and other hospitals, q_{mj} denotes the "intensity-weighted" expected number of insurer m's patients going to hospital j, N_m denotes the set of hospitals in insurer m's network, mc_{mj} denotes marginal cost, V_m denotes the payoff to the insurer and its participating employers, $V_m\left(N_m\setminus j,\mathbf{p}_m\right)$ denotes this payoff without hospital j in the network, and b_{mj} denotes the bargaining power of hospital j when negotiating with insurer m, expressed as the weight to which the hospital's payoffs are given in the overall net value. The bargaining model proposed by GNT, and other similar bargaining models in this literature, are primarily used to examine the bargaining solution for prices. To this end, bargaining power is largely treated as exogenous.

GNT also provides a clear structure by which to study strategic bargaining effort. Specifically, assume that the hospital's bargaining power, b_{mj}, derives from the product of the hospital's costly bargaining effort, γ, and some exogenous level of maximum bargaining power, $\bar{b}_{mj}$, such that $b_{mj}=\gamma\times\bar{b}_{mj}$, with $\gamma\in[0,1]$ and $\bar{b}_{mj}\in[0,1]$. The hospital can then adjust its bargaining power (up to $\bar{b}_{mj}$) via its choice of bargaining effort. In our context, we consider physician-hospital alignment as one potential proxy for bargaining effort, γ.[6]

To examine the hospital's choice of γ, we expand the two-stage GNT model to a three-stage framework. In stage one, hospitals choose to invest in some costly bargaining effort. In stage two, given γ, hospitals and insurers negotiate prices and network inclusion. And in the final stage, individuals receive their health draws as in the original GNT framework.

Starting in stage two, we derive an expression for negotiated prices for a single-hospital system.

[6] One could alternatively consider bargaining power as an adjustment in an agent's threat point. However, incorporating bargaining power in this way would also directly change the payoffs for one or both of the negotiating parties. Incorporating bargaining effort through γ instead allows the negotiating parties to influence bargaining power directly, with indirect effects on payoffs. We consider this a more realistic process in a hospital-insurer setting.

Analogous to equation 16 in GNT, the expression for negotiated prices is

$$p_{mj} - mc_{mj} = -q_{mj} \left(\frac{\partial q_{mj}}{\partial p_{mj}} + q_{mj} \times \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \times \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m} \right)^{-1}. \tag{2}$$

Allowing for prices and costs as a function of bargaining effort, the hospital profit function is

$$\pi_j = \sum_{m \in M_j} q_{mj} \left(p_{mj}(\gamma) - mc_{mj}(\gamma) \right),$$

where $mc_{mj}(\gamma)$ allows for some efficiency gains to be achieved through the hospital's bargaining efforts. Specifically, $\frac{\partial mc_{mj}}{\partial \gamma} > 0$ implies a reduction in hospital efficiency through bargaining effort (e.g., a transfer of resources away from patient care and thus an increase in the marginal cost of patient care). Conversely, $\frac{\partial mc_{mj}}{\partial \gamma} < 0$ suggests an increase in hospital efficiency through bargaining efforts, as could be the case with improved care coordination from hospital-physician alignment.

Taking equation 2 as given, the hospital chooses γ to maximize profits in the first stage, which yields the first order condition

$$\frac{\partial \pi_j}{\partial \gamma} = \sum_{m \in M_j} \left[\frac{\partial q_{mj}}{\partial p_{mj}} \frac{\partial p_{mj}}{\partial \gamma} \left(p_{mj}(\gamma) - mc_{mj}(\gamma) \right) + q_{mj} \left(\frac{\partial p_{mj}}{\partial \gamma} - \frac{\partial mc_{mj}}{\partial \gamma} \right) \right].$$

Rearranging terms, we can rewrite this first order condition as

$$\sum_{m \in M_j} \frac{\partial p_{mj}}{\partial \gamma} \left[\frac{\partial q_{mj}}{\partial p_{mj}} \left(p_{mj}(\gamma) - mc_{mj}(\gamma) \right) + q_{mj} \right] = \sum_{m \in M_j} q_{mj} \frac{\partial mc_{mj}}{\partial \gamma}. \tag{3}$$

Even in this simplified single-hospital framework, the incentives for bargaining effort are complicated and depend on a number of factors. First, note that $\frac{\partial p_{mj}}{\partial \gamma}$ is generally positive. We derive this expression explicitly in Appendix A. If bargaining effort is purely costly with no efficiency gains, then $\frac{\partial mc_{mj}}{\partial \gamma} > 0$. The hospital's optimal bargaining effort is therefore determined primarily by the subsequent influence on prices, $\frac{\partial p_{mj}}{\partial \gamma} > 0$, and by patient responsiveness to price changes, $\frac{\partial q_{mj}}{\partial p_{mj}} < 0$. If patients are highly responsive, then the hospital will be limited in its ability to extract a high margin through its choice of γ relative to a market in which patients are unresponsive to price changes.

More importantly for the purposes of our analysis, equation 3 provides a framework with which to examine the relationship between competition (both in the insurance and provider markets) and bargaining effort. Competition among hospitals is incorporated into the GNT framework through the model of patient hospital choice. Competition among insurers does not explicitly enter into their base model; however, there are several avenues by which we might expect insurance market concentration to influence an insurer's behavior and subsequently influence a hospital's bargaining effort.[7] We discuss these avenues and their potential effects in detail below:

1. **Direct changes to $\triangle V_m$:** With increasing concentration, insurance companies will intuitively derive less net value from inclusion of a given hospital in their network. If $\frac{\partial V_m}{\partial p_{mj}}$ is sufficiently large in absolute value, then a reduction in $\triangle V_m$ will tend to increase γ. Details of this calculation are provided in Appendix A. Similar intuition would follow when allowing explicitly for insurer competition in premiums (e.g., in the premium posting model in Gowrisankaran *et al.* (2015) and Ho & Lee (2013)).

2. **Changes to maximum bargaining weight, $\bar{b}_{mj}$:** The maximum bargaining power for a given hospital may be limited in markets dominated by few large insurers. Under similar conditions in point (1) above, hospitals will again respond by increasing γ as the marginal benefit to bargaining effort increases as $\bar{b}_{mj}$ decreases.

3. **Changes in the relative weight on employee welfare:** The GNT model defines τ as the relative weight placed by the insurer on its customers' welfare relative to its own costs. Higher insurance market concentration may therefore allow the insurer to reduce τ, effectively increasing the weight of its own costs in the price negotiation. This will effect bargaining effort through its

[7] Gowrisankaran *et al.* (2015), in a model similar to Ho & Lee (2013), consider an extension of their base model in which insurers post premiums and customers can choose among different insurance plans. This extension explicitly allows for competition among insurers in premiums; however, competition along other dimensions (e.g., coinsurance rates) is not considered. More importantly, competition in this model influences $\triangle V_m$ and therefore can be intuitively incorporated into the existing framework.

effect on $\frac{\partial V_m}{\partial p_{mj}}$ as well as $\triangle V_m$. Specifically, $\frac{\partial V_m}{\partial p_{mj}}$ is decreasing in τ, while $\triangle V_m$ is increasing in τ. The resulting effect on bargaining effort is ambiguous and depends on the size of the effect on $\frac{\partial V_m}{\partial p_{mj}}$ relative to $\triangle V_m$.

4. **Changes in coinsurance rates:** With fewer competitors in the insurance market, insurers can intuitively increase the coinsurance rate, shifting the cost burden to the patient and thus reducing the costs of care for the insurer. From GNT, coinsurance rates would effect equation 3 directly via a decrease in q_{mj} and a decrease (more negative) in $\frac{\partial q_{mj}}{\partial p_{mj}}$. Coinsurance rates will also influence $\frac{\partial p_{mj}}{\partial \gamma}$ via the influence on $\triangle V_m$ and $\frac{\partial V_m}{\partial p_{mj}}$. Ultimately, the effect on γ is again ambiguous.

These results illustrate the complicated interaction between bargaining effort and other variables that can be manipulated by insurers. In some cases, we can definitively sign the resulting effect on γ, but in others, the relationship between insurance market behaviors and bargaining effort is an empirical question. Empirically, we suspect that changes in insurance market concentration most directly influence $\triangle V_m$ and $\bar{b}_{mj}$, rather than affecting the insurer's weight on employee welfare or coinsurance rates. As such, we hypothesize that insurance market concentration increases hospital bargaining effort.

Equation 3 also illustrates the role of hospital market competitiveness in determining the relationship between insurance markets and bargaining effort. For example, increasing concentration in the hospital market will tend to increase $\frac{\partial q_{mj}}{\partial p_{mj}}$ so that patients are less responsive to price changes. A reduction in hospital competition will also tend to increase $\triangle V_m$, leading to an increase in $\frac{\partial p_{mj}}{\partial \gamma}$. The resulting effect on γ depends on the relative size of these terms. For example, if $\frac{\partial q_{mj}}{\partial p_{mj}}$ is already relatively small, then the influence of hospital competition on γ is largely determined by $\frac{\partial p_{mj}}{\partial \gamma}$, and increasing competition will tend to increase the incentive for bargaining effort.

Finally, if we interpret mc_{mj} as a perceived marginal cost, then equation 3 easily extends to the case of not-for-profit (NFP) versus for-profit (FP) hospitals. In the NFP case, hospitals have some perceived marginal cost equal to their true marginal cost less some additional utility derived from quantity of care provided. As such, if γ offers no efficiency gains, then the incentive to invest in bargaining effort is lower relative to FP hospitals. If, however, γ increases the utility derived from the non-profit motives (e.g., through improved care coordination and management of chronic conditions) then the incentives for bargaining effort may actually be higher for some NFP hospitals.

Although our analysis does not estimate these relationships directly, equation 3 yields several testable hypotheses: 1) hospital bargaining effort will increase with increases in insurance market concentration; 2) the effects of insurance market concentration will be larger for hospitals with more profit motives (all else equal); and 3) the effects of insurance market concentration will be larger in areas with more hospital competition. We test these relationships with several reduced-form specifications discussed in Section 5.

3 Data

Our analysis is based on 18,985 total observations from the 2009-2011 AHA Annual Surveys. We focus on community hospitals as defined in *AHA Hospital Statistics*, leaving 14,965 total observations. We drop an additional 1,458 observations for hospitals that identify themselves as a psychiatric hospital, a dependency center, a children's hospital, or an institutional (prison or college) hospital. Our final AHA data therefore consist of 13,507 hospital-year observations covering 4,602 unique AHA hospital IDs.

We incorporate commercial insurance data from the American Medical Association's (AMA) annual reports on competition in the private health insurance market for each year from 2005 through 2011. The AMA reports provide the annual Herfindahl-Hirchman index (HHI) for 351 Metropolitan Statistical Areas (MSAs) in the U.S., as well as the market shares of the largest two private insurers in each MSA.[8] Due to county overlap with MSAs, the 351 MSAs in the AMA data cover 1,064 counties.[9]

[8] HHI values are calculated as of January 1st of each year. Private insurance markets are defined as the combination of HMO, PPO, and POS product markets.

[9] The AMA reports adopt a different geographic coding system for some New England areas. These areas are excluded from our analysis as we cannot match geographic areas across datasets.

We then merge the AMA data to the AHA data by county FIPS codes. Since a large number of counties do not fall within an MSA, our merged AHA-AMA data consist of 7,120 total observations from 2009-2011.

The AHA data reflect the most recently completed fiscal year for each hospital. For example, consider a hospital with its fiscal year from July 1 through June 30. The hospital's reported physician arrangement in the 2011 AHA data are then reflective of the hospital's relationships as of the end of June 2011. Meanwhile, the AMA data reflect the insurance market concentration over the prior calendar year. The 2011 AMA data are therefore reflective of the insurance market concentration at the end of 2010 and into the beginning of 2011. As such, when we merge the 2011 AMA and AHA data, we are incorporating to some extent a lag between our measure of insurance market concentration and our measure of physician-hospital alignment. This lag will be largest for hospitals whose fiscal years align with the calendar year (fiscal year ending in December with HHI as of January of the same year), and smallest for hospitals whose fiscal years end early in the calendar year. Because of the timing of our data sources, our analysis generally considers the effect of concurrent HHI as well as lagged HHI on physician-hospital alignment. These results are discussed in more detail in Section 5.

Our primary variable of interest is the level of vertical integration among hospitals. Following Cuellar & Gertler (2006), Ciliberto & Dranove (2006), and Baker *et al.* (2014), we measure vertical integration using self-reported physician arrangements from the AHA surveys. Specifically, hospitals are asked whether they participate in any of the following arrangements: 1) independent practice association; 2) group practice without walls; 3) open physician-hospital organization; 4) closed physician-hospital organization; 5) management service organization; 6) integrated salary model; 7) equity model; 8) foundation; and 9) other. Due to overlap across different arrangements, as well as small sample size problems for some classifications, we group these responses into the following categories:

1. "Traditional:" As defined by the AHA, all physician arrangements listed above are intended to reflect a form of "integrated healthcare delivery...implementing physician compensation and

incentive systems for managed care services." Hospitals with no response to these questions are therefore assumed to follow a traditional medical staff model in which physicians may be granted admitting privileges but with otherwise no formal arrangement or incentives. This interpretation is consistent with statistics reported in the literature.

2. "Support:" Here, hospitals offer some administrative or managerial support, but physicians are otherwise relatively unrestricted in their practice and referral patterns. We include in this category all independent practice associations, group practice without walls, and management service organizations.

3. "Referral:" In this case, hospitals can more directly impact physician practices via managed care contracting or cost-effectiveness requirements. We include in this category open physician-hospital organizations, closed physician-hospital organizations, and foundation arrangements.

4. "Employee:" Physicians are directly employed by the hospital (or larger system) and paid a salary for medical services (including primary and specialty care). We include in this category the integrated salary model.

5. "Equity:" Physicians have some ownership stake in the hospital or related entity. We include in this category the equity model indicator directly from the AHA Annual Survey as well as any hospital reported as being owned (in whole or in part) by physicians or a physician group.[10] Note that, under the Stark laws, physicians cannot also be co-owners of tax-exempt hospitals. Not-for-profit hospitals are therefore prohibited from adopting a fully physician-owned model; however, not-for-profit hospitals can still pursue "joint ventures in which the hospital accepts as a diluted interest in a hospital service and the physicians agree to a strong non-competition or liquidated damages provision" (Auten & Goldman, 2006). In these cases, not-for-profit hospitals must demonstrate sufficient control of the joint ventures but not necessarily maintain majority

[10]The AHA defines the equity model as one that "allows established practitioners to become shareholders in a professional corporation in exchange for tangible and intangible assets of their existing practices."

ownership (Berenson *et al.*, 2007). Therefore, although the restrictions for an equity arrangement may be larger among not-for-profit hospitals, the equity model remains an option for both for-profit and not-for-profit hospitals, which is consistent with the observed arrangements in the AHA data.

Table 1 presents summary statistics on the level of physician-hospital alignment across different percentiles of insurance market concentration. Consistent with trends in the private insurance market, the 1st, 2nd, and 3rd quartiles of the insurance market HHI are 0.22, 0.27, and 0.35, respectively, and nearly 75% of markets are considered to be highly concentrated based on the Department of Justice's standard HHI threshold of 0.25. Across all columns, the traditional medical staff model and the employee model are the most common physician-hospital arrangements. The table also reveals a large increase in the relative frequency of "Employee" arrangements as private insurance markets become more concentrated, with 28% of hospitals adopting an employee model in the least concentrated markets, and 34% of hospitals adopting such a model in the most concentrated markets. The "Equity" model is similarly more common among the more concentrated insurance markets, with 5.1% of hospitals reporting an equity model in the most concentrated markets compared to 3.1% of hospitals in the least concentrated markets.

Table 1

Tables 2 and 3 present hospital-level and county-level summary statistics, respectively, with standard deviations in parenthesis. Overall, 67% of hospitals belong to a larger hospital system, 38% of hospitals are teaching hospitals,[11] and there are approximately 250 staffed beds per facility. Regarding ownership type, 66% of hospitals are private not-for-profit compared to 20% for-profit. We also see large differences in hospital characteristics across different physician-hospital arrangements. For example, not-for-profit hospitals are much more likely to adopt a "Referral" or "Employee" model, whereas

[11] We define "teaching hospital" as any hospital with full-time medical residents or interns. Our empirical results are unchanged when instead considering some minimum ratio (e.g., 10%) of residents or interns to hospital beds.

for-profit hospitals are much more likely to adopt an "Equity" model. Hospitals with a "Referral" or "Employee" arrangement with its physicians are also much larger in terms of the number of staffed beds, particularly relative to hospitals adopting an "Equity" model.

Tables 2 and 3

As part of the market summary statistics, the bottom panel of Table 3 summarizes several private insurance market variables. These data show an initial decrease in private insurance concentration from 2009 to 2010, with a slight increase from 2010 to 2011. Similarly, we observe a decrease in the first and second largest insurer's market share from 2009 to 2010, with a small increase from 2010 to 2011. Across all years, the average HHI is 0.346, with the largest insurer's market share averaging 0.490 and the second largest averaging 0.213.

4 Methods

We denote by $y_{j(m)t}$ the physician arrangement reported by hospital j operating in market m in time t, with $y_{j(m)t} \in \{1,2,3,4,5\}$ as enumerated in Section 3. $y_{j(m)t} = 1$ therefore reflects the least amount of alignment (i.e., the traditional medical staff model), with $y_{j(m)t} = 2$ reflecting a larger degree of alignment, and so forth up to $y_{j(m)t} = 5$ reflecting the the most aligned arrangement available (in our case, physicians having an equity-stake in the hospital itself). Denote the latent physician-hospital alignment measure by

$$y^*_{j(m)t} = \beta_{hhi}\text{hhi}_{mt} + \delta X_{mt} + \theta X_{jt} + \mu_t + \eta_s + \varepsilon_{jt},$$

where X_{mt} denotes county-level demographic variables, μ_t denotes year fixed effects, X_{jt} denotes hospital characteristics including for-profit or not-for-profit status, teaching hospital status, specialty services offered, number of staffed beds, and an indicator for whether the hospital is part of a larger hospital system, and η_s denotes state fixed effects. The latent $y^*_{j(m)t}$ therefore proxies the bargaining effort, γ. The observed level of alignment, $y_{j(m)t}$, then derives from the latent bargaining effort as follows:

$$y_{j(m)t} = k \text{ if } \alpha_{k-1} < y^*_{j(m)t} \leq \alpha_k, \tag{4}$$

where α_k denote threshold values to be estimated. We estimate the coefficients of interest (β_{hhi}, δ, θ, μ_t, and α_k) with an ordered probit model and with standard errors clustered at the MSA level.

5 Results

Results from the ordered probit regressions are summarized in Table 4. The columns reflect increasing lagged values of HHI, with column (1) based on concurrent HHI and columns (2)-(5) based on lagged HHI ($t-1$ through $t-4$, respectively). In all cases, insurance market concentration has a positive and significant effect on physician-hospital alignment, consistent with the findings in Cuellar & Gertler (2006). As expected, the effects decrease in magnitude as we increase the lag between alignment and our measure of HHI.[12]

Table 4

Marginal effects for HHI at time t and $t-1$ are summarized in bottom panel of Table 4, presented as elasticities averaged across all observations. Each column in this panel presents the marginal effects across different levels of the ordered outcome. For example, looking at the column for "Equity" and the row corresponding to "HHI$_t$", the marginal effect of 0.406 indicates that a 1% increase in insurance market concentration leads to a 0.406% increase in the probability of hospitals adopting an equity model. Focusing on HHI$_t$ and HHI$_{t-1}$, the findings suggest that a 1% increase in insurance market

[12] As a falsification test, we also estimate the effect of one-period ahead HHI on current physician-hospital alignment. As summarized in Appendix B, our estimated coefficient on future HHI is < 0.0001. This offers some confidence that our analysis of alignment and HHI is identifying a true response among hospitals to insurance market pressures rather than some other spurious relationship.

HHI leads to between a 0.15% and 0.18% increase in the probability of hospitals adopting an employee model, and between a 0.34% and 0.41% increase in the probability of hospitals adopting an equity model. Put another way, a one standard deviation increase in insurance market HHI would increase the expected number of hospitals with an employee model by between 98 and 118, and similarly increase the expected number of hospitals with an equity model by between 27 and 33.[13]

5.1 Effects by Competition, Ownership, and Insurer Affiliation

The overall results in Table 4 suggest that hospitals respond to insurance market pressures in-part by tightening their physician-hospital relationships; however, hospitals may differ in their ability to adjust these relationships (e.g., due to the ownership type of the hospital or due to state restrictions on certain physician-hospital arrangements). In this subsection, we therefore consider several extensions of our initial analysis focusing on specific subsamples of hospitals and counties as suggested by our theoretical framework in Section 2.

First, we consider differential effects of private insurance market HHI based on the level of hospital competition in the area, looking specifically at counties with more than one hospital. The results, summarized in Table 5, show that the magnitude of the effect of insurance market HHI on physician-hospital alignment is stronger in areas with at least some local hospital competition. For example, based on the results using HHI_t, we estimate that hospitals increase their adoption of equity arrangements by 0.52% and their employee arrangements by 0.23% following a 1% increase in private insurance market HHI. These effects are around 25% larger than those estimated among the full sample, suggesting that hospitals with substantial horizontal market power may have less need for vertical integration with physicians in order to bargain with insurers. It is instead when hospitals face some level of competition where vertical integration becomes a more important strategy in the presence of more concentrated private insurance markets.

[13] Interpretations based on the observed 1,691 total hospitals with an employee model and 206 hospitals with an equity model, out of 4,602 unique hospital IDs.

Table 5

Second, we may expect a different response to insurance markets among for-profit hospitals relative to not-for-profit hospitals. For-profit hospitals, emphasizing profit-maximizing motives, may react to private insurance pressures more quickly and more substantially.[14] Legal or administrative restrictions may also impose differential transaction costs across hospitals with regard to physician alignment. For example, although we observe not-for-profit hospitals with "Equity" relationships in the AHA data, the equity model is a relatively more costly option for not-for-profit hospitals. In addition, many state regulations regarding physician-hospital alignment treat for-profit and not-for-profit hospitals separately (Lammers, 2013). The results of a separate analysis among for-profit and not-for-profit hospitals are summarized in Tables 6 and 7, respectively. As suggested in the bargaining model in Section 2, for-profit hospitals are more responsive to insurance market pressures in terms of physician-hospital alignment relative to not-for-profit hospitals, with marginal effects estimated to be 2.5 to 3 times larger among for-profit hospitals relative to the overall average.

Tables 6 and 7

To our knowledge, this is the first evidence showing a significantly different alignment response to private insurance pressures across ownership types. Overall, our findings of heterogeneous responses across ownership types adds to the literature that for-profit and not-for-profit hospitals have heterogeneous production preferences and therefore differential responses to financial, regulatory, and market changes.[15]

[14]For example, Dafny (2005) finds that for-profit hospitals are more likely to upcode patient diagnoses to offset revenue shortfalls following changes in Medicare reimbursement formulas.

[15]For example, Marsh-Dalton & Warren (2014) study California hospitals' outsourcing decisions and find that for-profit hospitals are more likely to outsource their services than not-for-profit counterparts. Chang & Jacobson (2012) examine production responses to the unexpected California Seismic Retrofit mandate, again finding heterogeneous responses among for-profit and not-for-profit hospitals. And Duggan (2000) finds that the public hospital response to financial incentives is more distinct from that of private (for-profit and not-for-profit) hospitals due to the soft budget constraint unique to public hospitals.

Finally, some hospitals are affiliated with a private health insurance plan, which would tend to diminish the effect of insurance market concentration on their behaviors. We replicated the previous analysis excluding hospitals who report having some ownership interest in an HMO or PPO. As summarized in Table 8, the results are as expected with a slightly larger estimated effect of private insurance HHI on physician-hospital alignment when excluding hospitals affiliated with a managed care plan. Specifically, a 1% increase in private insurance HHI leads to a 0.49% increase in hospitals adopting an equity arrangement and a 0.22% increase in employee arrangements. Hospitals without an ownership stake in an insurance company are therefore approximately 20% more responsive to insurance market pressures relative to the overall average hospital.

TABLE 8

6 Sensitivity Analysis

Our initial results are subject to several sources if bias and inconsistency, including mismeasured alignment and endogenous insurance market concentration. In this section, we directly examine the sensitivity of our results to these two important issues.

6.1 Misreported Alignment

The AHA survey collection process as well as observed data on hospital-physician alignment suggests that hospital-physician alignment may not be accurately reported in all cases. To examine the influence of potentially misreported alignment, we consider two empirical approaches.

First, we explicitly allow for misreported alignment with a semiparametric monotone rank estimator (MRE), which is robust to misreported ordered outcomes (Cavanagh & Sherman, 1998; Abrevaya & Hausman, 1999; Hausman, 2001). The MRE is the $K \times 1$ coefficient vector, $\hat{\beta}$, that maximizes the objective function

$$S(b) = \sum_{i=1}^{N} M(y_i)\text{Rank}(x_i b), \quad (5)$$

where $M(y_i)$ is some increasing function and where Rank$(x_i b)$ is such that $x_1 b < x_2 b < ... < x_N b$ implies Rank$(x_m b) = m$. As discussed in Cavanagh & Sherman (1998) and Abrevaya & Hausman (1999), β is only identified up to a scale and requires the normalization, $|\beta_k| = 1$. Consistency then requires that $x_i\beta$ are associated with higher y_i on average. Individual misreporting is therefore allowed provided that, on average, higher $x_i\beta$ yields higher alignment.[16] We estimate β using the Nelder-Mead algorithm, with $M(y_i) = \text{Rank}(y_i)$ and standard errors estimated from 200 bootstrap replications. For identification, we also set $|\beta_1| = 1$ and normalize our estimates to a vector length of one.

The estimates themselves are difficult to interpret; however, we can still examine the sensitivity of potentially mismeasured alignment by comparing estimates across models. We therefore re-estimate our initial ordered probit model, again setting $|\beta_1| = 1$ and with unit vector length. The results are summarized in Table 9, which is divided between two panels, each consisting of three columns. Panel 1 is based on concurrent HHI, and panel two is based on the one-year lagged HHI. In both panels, column (1) presents the estimates from our ordered probit model (with appropriate normalizations), column (2) presents estimates from the MRE, and column (3) presents the percentage difference between the ordered probit and MRE estimates.

Table 9

The results are broadly consistent across the two measures of HHI, and in both cases, our MRE estimates reveal a positive and significant effect of HHI and physician-hospital alignment. Based on current-year HHI, the results suggest that our ordered probit estimates in Table 4 are underestimated by up to 22%. This underestimate reduces to 13% using the one-year lagged HHI.

[16] This is a common requirement in misreporting-robust point estimates, with similar conditions imposed in the binary misreporting case (Hausman, 2001).

Second, we consider broader delineations of alignment that may be less subject to measurement error. We consider first a binary variable for a traditional model versus any form of alignment (support, referral, employee, or equity). The results from this analysis as summarized in Table 10 and are consistent with the qualitative findings from our initial analysis. In this case, hospitals increase their adoption of integrated physician models by 0.15% in response a 1% increase in HHI in the private insurance market.

Table 10

Table 11 considers an alternative delineation of alignment, lumping the "Support" and "Referral" measures together. The main results are again consistent with our initial analysis, with a 0.42% increase in hospitals adopting an equity arrangement and a 0.18% increase in hospitals adopting an employee arrangement following a 1% increase in private insurance market HHI.

Table 11

6.2 Endogeneity and Measurement Error of Insurance Market Concentration

Our initial results considered the effects of insurance market HHI on physician-hospital alignment; however, there may be unobserved factors influencing HHI and hospital-physician alignment. This is particularly relevant in our analysis, where our time series is not sufficient to fully exploit the panel structure of our data with hospital fixed effects. HHI values in the AMA reports may also be subject to some measurement error. As such, insurance market concentration may be endogenous in our analysis.

To address this concern, we follow Terza *et al.* (2008) and re-estimate our ordered probit regressions with two-stage residual inclusion (2SRI). We take as instruments the number of counties in a given

MSA, and the minimum and maximum of insurance market HHI in other MSAs in the same state. Our first stage regression in this case is a linear regression of HHI on X_{jt}, X_{mt}, μ_t, η_s, and our instruments. The residuals from this first stage regression then enter as an additional covariate in our second-stage ordered probit regression.

Intuitively, the number of counties in a given MSA is an appealing instrument. This is because healthcare providers attempt to draw patients from a broad geographic area that will not generally align specifically with the boundaries of a given MSA, but the counties included in an MSA will directly influence the AMA HHI calculations by construction. Our instrument therefore intuitively satisfies the exogeneity assumption. Similarly, the concentration in *other* MSAs (in the same sate) may be reflective of broader market trends that will not generally be of concern to a given hospital.

Our 2SRI results are summarized in Table 12. The first two columns are based on current year HHI, with first stage results in column (1) and second stage results in column (2). Similarly, columns (3) and (4) are based on HHI at time $t-1$, with first stage results in column (3) and second stage results in column (4). In both cases, our instruments are significant in the first stage with a joint F-statistic of 21 and 17, respectively. A test of overidentifying restrictions also yields a low and insignificant Hansen J-statistics. In the second stage results, the estimates of insurance market HHI are larger than our initial results; however, the estimated effect of lagged HHI is imprecisely estimated and insignificant. Moreover, the residuals from our first-stage regressions are insignificant in the second-stage ordered probit regressions, suggesting that any concerns about the endogeneity of HHI may be unfounded (Stuart *et al.*, 2009).

Table 12

7 Conclusion

This paper examines the relationship between physician-hospital alignment and concentration in the private health insurance market. We find that increased concentration in the private insurance market significantly impacts hospital-physician alignment, with overall hospital employment of physicians increasing by as much 0.18% and equity arrangements increasing by as much as 0.41% following a 1% increase in health insurance concentration. These effects imply that a one standard deviation increase in the private insurance HHI would increase the expected number of hospitals with an employee or equity model by as much as 118 and 33, respectively. These effects are larger among for-profit hospitals and in areas with at least two competing hospitals. Similarly, estimates are larger among hospitals not affiliated with a health insurance plan. Finally, when accounting for potential misreporting of our physician-hospital alignment variable, we find that our initial results are likely underestimated by approximately 20%.

Our results therefore provide empirical support for the claim that hospital-physician alignment is driven in-part by private insurance market pressures. Based on the trends in physician-hospital alignment observed in our data, these effects are relatively large in magnitude. For example, over the 2009-2011 period, the number of hospitals reporting an employee arrangement with its physicians increased from 1,337 to 1,438. Based on our estimates, this increase would be fully explained by a one-standard deviation increase in private insurance market HHI.

References

Abrevaya, Jason, & Hausman, Jerry A. 1999. Semiparametric estimation with mismeasured dependent variables: an application to duration models for unemployment spells. *Annales d'Economie et de Statistique*, 243–275.

Afendulis, Christopher C, & Kessler, Daniel P. 2007. Tradeoffs from Integrating Diagnosis and Treatment in Markets for Health Care. *The American Economic Review*, 1013–1020.

Alexander, Jeffrey A, Halpern, Michael T, & Lee, SY. 1996. The short-term effects of merger on hospital operations. *Health Services Research*, **30**(6), 827.

Auten, Donald, & Goldman, C. Mitchell. 2006. Can nonprofit hospitals coesixt with physician ownership? *Modern Healthcare Magazine*, **October 2006**.

Baker, Laurence, Bundorf, Kate, & Royalty, Anne. 2013. *Physician Consolidation and Prices for Physician Services*. Working Paper. University of Pennsylvania.

Baker, Laurence C, Bundorf, M Kate, & Kessler, Daniel P. 2014. Vertical integration: hospital ownership of physician practices is associated with higher prices and spending. *Health Affairs*, **33**(5), 756–763.

Berenson, Robert A., Ginsburg, Paul B., & May, Jessica H. 2007. Hospital-Physician Relations: Cooperation, Competition, or Separation. *Health Affairs*, 31–43.

Brunt, Christopher S, & Bowblis, John R. 2014. Health insurer market power and primary care consolidation. *Economics Letters*, **125**(1), 61–65.

Burns, Lawton R, & Pauly, Mark V. 2002. Integrated delivery networks: a detour on the road to integrated health care? *Health affairs*, **21**(4), 128–143.

Burns, Lawton R, Bazzoli, Gloria J, Dynan, Linda, & Wholey, Douglas R. 2000. Impact of HMO market structure on physician-hospital strategic alliances. *Health Services Research*, **35**(1 Pt 1), 101.

Cavanagh, Christopher, & Sherman, Robert P. 1998. Rank estimators for monotonic index models. *Journal of Econometrics*, **84**(2), 351–381.

Chang, Tom, & Jacobson, Mireille. 2012. What do Nonprofit Hospitals Maximize? Evidence from California's Seismic Retrofit Mandate. *Working Paper*.

Ciliberto, Federico, & Dranove, David. 2006. The effect of physician–hospital affiliations on hospital prices in California. *Journal of Health Economics*, **25**(1), 29–38.

Cuellar, Alison Evans, & Gertler, Paul J. 2006. Strategic integration of hospitals and physicians. *Journal of health economics*, **25**(1), 1–28.

Dafny, Leemore. 2009. Estimation and Identification of Merger Effects: An Application to Hospital Mergers. *Journal of Law and Economics*, **52**(3), 523–550.

Dafny, Leemore S. 2005. How Do Hospitals Respond to Price Changes? *The American Economic Review*, **95**(5), 1525–1547.

Dor, Avi, Grossman, Michael, & Koroukian, Siran M. 2004. Hospital transaction prices and managed-care discounting for selected medical technologies. *American Economic Review*, 352–356.

Dranove, David, & Lindrooth, Richard. 2003. Hospital consolidation and costs: another look at the evidence. *Journal of health economics*, **22**(6), 983–997.

Duggan, Mark. 2000. Hospital Ownership and Public Medical Spending. *The Quarterly Journal of Economics*, **115**(4), 1343–1373.

Gal-Or, Esther. 1999. The profitability of vertical mergers between hospitals and physician practices. *Journal of Health Economics*, **18**(5), 623–654.

Gaynor, M, & Town, R. 2012a. Competition in Health Care Markets. *In:* Pauly, M., McGuire, T., & Pita Barros, P. (eds), *Handbook of Health Economics*, vol. 2. Amsterdam: Elsevier.

Gaynor, M, & Town, R. 2012b. *The impact of hospital consolidation - Update.* Policy Brief. Robert Wood Johnson Foundation.

Gaynor, Martin. 2006. Is vertical integration anticompetitive?: Definitely maybe (but that's not final). *Journal of Health Economics*, **25**(1), 175–180.

Gowrisankaran, Gautam, Nevo, Aviv, & Town, Robert. 2015. Mergers When Prices Are Negotiated: Evidence from the Hospital Industry. *American Economic Review*, **105**(1), 172–203.

Harrison, Teresa D. 2011. Do mergers really reduce costs? Evidence from hospitals. *Economic Inquiry*, **49**(4), 1054–1069.

Hausman, Jerry. 2001. Mismeasured variables in econometric analysis: problems from the right and problems from the left. *Journal of Economic Perspectives*, 57–67.

Ho, Kate, & Lee, Robin S. 2013. *Insurer competition and negotiated hospital prices.* Tech. rept. National Bureau of Economic Research.

Huckman, Robert S. 2006. Hospital integration and vertical consolidation: An analysis of acquisitions in New York State. *Journal of Health Economics*, **25**(1), 58–80.

Kessler, Daniel, & McClellan, Mark. 2000. Is hospital competition socially wasteful? *Quarterly Journal of Economics*, **2**(115), 577–615.

Lammers, Eric. 2013. The Effect Of Hospital–Physician Integration On Health Information Technology Adoption. *Health economics*, **22**(10), 1215–1229.

Lewis, Matthew, & Pflum, Kevin. 2015. Diagnosing Hospital System Bargaining Power in Managed Care Networks. *American Economic Journal: Economic Policy*, **7**(1), 243–274.

Marsh-Dalton, Christina, & Warren, Patrick L. 2014. Outsourcing and Ownership: Theory and Evidence from California General Care Hospitals. *Working Paper*.

MedPAC. 2013. *Report to Congress: Medicare and the Health Care Delivery System*. Policy Brief.

Spang, Heather Radach, Arnould, Richard J, & Bazzoli, Gloria J. 2009. The effect of non-rural hospital mergers and acquisitions: An examination of cost and price outcomes. *The Quarterly Review of Economics and Finance*, **49**(2), 323–342.

Stuart, Bruce C, Doshi, Jalpa A, & Terza, Joseph V. 2009. Assessing the impact of drug use on hospital costs. *Health services research*, **44**(1), 128–144.

Terza, Joseph V, Basu, Anirban, & Rathouz, Paul J. 2008. Two-stage residual inclusion estimation: addressing endogeneity in health econometric modeling. *Journal of health economics*, **27**(3), 531.

The Physician's Foundation. 2012. *A Survey of America's Physicians: Practice Patterns and Perspectives*. Report.

Vogt, William B, & Town, Robert. 2006. *How has hospital consolidation affected the price and quality of hospital care?* Policy Brief. Robert Wood Johnson Foundation.

A Appendix A: Bargaining Effort Derivatives

Recall the negotiated price from the Nash bargaining stage,

$$p_{mj} - mc_{mj} = -q_{mj} \left(\frac{\partial q_{mj}}{\partial p_{mj}} + q_{mj} \times \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \times \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m} \right)^{-1}.$$

Differentiating with respect to γ yields

$$\frac{\partial p_{mj}}{\partial \gamma} = \frac{-q_{mj}^2 \times \frac{1}{\gamma^2 \bar{b}_{mj}} \times \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m}}{\left(\frac{\partial q_{mj}}{\partial p_{mj}} + q_{mj} \times \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \times \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m} \right)^2}. \tag{6}$$

The sign of equation 6 depends on $\frac{\partial V_m}{\partial p_{mj}}$. Gowrisankaran *et al.* (2015) derive this term explicitly and discuss its primary components. In particular, the authors show that $\frac{\partial V_m}{\partial p_{mj}} < 0$ except possibly in extreme cases in which p_{mj} is very high relative to the weighted average price of the other hospitals in network m. With $\frac{\partial V_m}{\partial p_{mj}} < 0$, it follows that $\frac{\partial p_{mj}}{\partial \gamma} > 0$, and we reach the intuitive result in which a hospital's bargaining effort allows for a higher negotiated price.

The hospital's optimal choice of γ in the first stage is such that

$$\sum_{m \in M_j} \frac{\partial p_{mj}}{\partial \gamma} \left[\frac{\partial q_{mj}}{\partial p_{mj}} \left(p_{mj}(\gamma) - mc_{mj}(\gamma) \right) + q_{mj} \right] = \sum_{m \in M_j} q_{mj} \frac{\partial mc_{mj}}{\partial \gamma}.$$

For a given $\frac{\partial q_{mj}}{\partial p_{mj}}$ and $\frac{\partial mc_{mj}}{\partial \gamma}$, the hospital's responsiveness to insurance pressures depends largely on $\frac{\partial p_{mj}}{\partial \gamma}$, as this term incorporates the second-stage effects on insurance payoffs into the hospital's first-stage choice of γ. The effects of insurer payoffs on $\frac{\partial p_{mj}}{\partial \gamma}$ can therefore inform us as to the hospital's anticipated response with regard to γ following changes in the insurance markets. In particular, if the right hand side in equation 3 is a positive constant, then γ is decreasing in $\frac{\partial p_{mj}}{\partial \gamma}$ (all else equal). In the remainder of this Section, we examine the effects of these variables on $\frac{\partial p_{mj}}{\partial \gamma}$ and discuss the resulting influence on a hospital's choice of γ. We are interested in the effects of three variables in particular, all of which are intuitively influenced by insurance market concentration: 1) $\frac{\partial V_m}{\partial p_{mj}}$; 2) $\triangle V_m$; and 3) $\bar{b}_{mj}$.

1. Effect of insurance changes through $\frac{\partial V_m}{\partial p_{mj}}$: Denoting $\frac{\partial V_m}{\partial p_{mj}}$ by A, we are interested in the cross-partial, $\frac{\partial^2 p_{mj}}{\partial \gamma \partial A}$. The sign of this derivative is determined by the sign of the numerator, which we

derive explicitly as follows:

$$
\begin{aligned}
=& - q_{mj}^2 \frac{1}{\gamma^2 \bar{b}_{mj}} \frac{1}{\triangle V_m} \left(\frac{\partial q_{mj}}{\partial p_{mj}} + q_{mj} \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m} \right)^2 \\
&+ 2 q_{mj}^3 \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \frac{1}{\triangle V_m} \frac{1}{\gamma^2 \bar{b}_{mj}} \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m} \left(\frac{\partial q_{mj}}{\partial p_{mj}} + q_{mj} \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m} \right) \\
=& q_{mj}^2 \frac{1}{\gamma^2 \bar{b}_{mj}} \frac{1}{\triangle V_m} \left(\frac{\partial q_{mj}}{\partial p_{mj}} + q_{mj} \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m} \right) \\
&\times \left(- \frac{\partial q_{mj}}{\partial p_{mj}} + q_{mj} \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m} \right).
\end{aligned}
$$

Since

$$
q_{mj} \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m} < 0
$$

in most circumstances, the sign of the cross-partial is determined by $q_{mj} \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m}$ relative to $\frac{\partial q_{mj}}{\partial p_{mj}}$. If the first term dominates, then the cross-partial is positive and γ is decreasing in $\frac{\partial V_m}{\partial p_{mj}}$.

2. Effect of changes in $\triangle V_m$: Again, we are interested in the cross-partial, $\frac{\partial^2 p_{mj}}{\partial \gamma \partial \triangle V_m}$, the sign of which is determined by the numerator:

$$
\begin{aligned}
=& q_{mj}^2 \frac{1}{\gamma^2 \bar{b}_{mj}} \frac{\partial V_m}{\partial p_{mj}} (\triangle V_m)^{-2} \left(\frac{\partial q_{mj}}{\partial p_{mj}} + q_{mj} \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m} \right)^{-2} \\
&- 2 q_{mj}^3 \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \frac{1}{\gamma^2 \bar{b}_{mj}} \left(\frac{\partial V_m}{\partial p_{mj}} \right)^2 (\triangle V_m)^{-3} \left(\frac{\partial q_{mj}}{\partial p_{mj}} + q_{mj} \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m} \right) \\
=& q_{mj}^2 \frac{1}{\gamma^2 \bar{b}_{mj}} \frac{\partial V_m}{\partial p_{mj}} (\triangle V_m)^{-2} \left(\frac{\partial q_{mj}}{\partial p_{mj}} + q_{mj} \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m} \right) \\
&\times \left(\frac{\partial q_{mj}}{\partial p_{mj}} - q_{mj} \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m} \right).
\end{aligned}
$$

As was the case in part (1) above, the sign of the cross-partial depends on $q_{mj} \frac{1-\gamma \bar{b}_{mj}}{\gamma \bar{b}_{mj}} \frac{\frac{\partial V_m}{\partial p_{mj}}}{\triangle V_m}$ relative to $\frac{\partial q_{mj}}{\partial p_{mj}}$. If the first term dominates, then this cross-partial is positive and γ is decreasing in $\triangle V_m$.

3. Effect of changes in $\bar{b}_{mj}$: This cross-partial follows the same as with $\triangle V_m$. For sufficiently negative $\frac{\partial V_m}{\partial p_{mj}}$ or sufficiently small $\frac{\partial q_{mj}}{\partial p_{mj}}$, then the cross-partial is again positive and γ is decreasing in $\bar{b}_{mj}$.

Intuitively, we expect increases in concentration to decrease $\triangle V_m$ and $\bar{b}_{mj}$. In this case, concentration will increase in γ. The relationship between concentration and $\frac{\partial V_m}{\partial p_{mj}}$ is less clear and depends on the current coinsurance rates.

B Appendix B: Falsification Test

Table 13 presents results from a falsification test in which we re-estimate our initial ordered probit regressions with future HHI as a covariate rather than current HHI. For comparison, the regression using current HHI based on the same sample is included in column (1) of the table, with column (2) presenting the results based on HHI at $t+1$. Although the estimate for HHI at $t+1$ is precisely estimated, the point estimate is very small in magnitude ($\hat{\beta} = 0.00006$). As such, the falsification test provides some confidence that our analysis of alignment and HHI is identifying a true response among hospitals to insurance market pressures rather than some other spurious relationship.

Table 13

C Tables and Figures

Table 1: **Physician-Hospital Alignment and Private Insurance HHI**[a]

Physician	Percentile Range			
Arrangement	0-25%	25-50%	50-75%	75-100%
Traditional	908	927	875	709
	(52.12)	(51.93)	(48.83)	(39.37)
Support	115	98	122	120
	(6.60)	(5.49)	(6.81)	(6.66)
Referral	177	214	196	271
	(10.16)	(11.99)	(10.94)	(15.05)
Employee	487	479	529	610
	(27.96)	(26.83)	(29.52)	(33.87)
Equity	55	67	70	91
	(3.16)	(3.75)	(3.91)	(5.05)

[a]Count of physician arrangement types reported by hospitals in the 2009-2011 AHA Annual Surveys, with percentages in parenthesis.

Table 2: **Summary Statistics for Hospital-level Variables**

	All	Traditional	Support	Referral	Employee	Equity
Staffed Beds (100s)	2.465	2.040	2.420	2.757	3.164	1.595
	(2.193)	(1.804)	(2.128)	(1.996)	(2.670)	(1.587)
Part of System (%)	0.674	0.705	0.602	0.655	0.648	0.661
Teaching Hospital (%)	0.384	0.424	0.264	0.372	0.385	0.124
Not-for-profit (%)	0.656	0.591	0.640	0.763	0.789	0.163
For-profit (%)	0.197	0.264	0.180	0.094	0.056	0.795
N	7,120	3,419	455	858	2,105	283

Table 3: **Summary Statistics for County-level Variables**

	2009	2010	2011
County Demographics			
Population (100k)	2.769	2.755	2.778
	(5.551)	(5.450)	(5.485)
Age 18 to 34 (%)	0.228	0.225	0.225
Age 35 to 64 (%)	0.398	0.401	0.401
White (%)	0.806	0.805	0.805
Black (%)	0.113	0.112	0.112
Income \$50k to \$75k (%)	0.194	0.193	0.191
Income \$75k to \$100k (%)	0.126	0.127	0.127
Income \$100k to \$150k (%)	0.113	0.117	0.122
Income > \$150k (%)	0.065	0.068	0.073
High School Only (%)	0.323	0.319	0.316
Some College (%)	0.211	0.214	0.218
Bachelor's Degree (%)	0.154	0.158	0.160
Counties	814	843	845
County Demographics[a]			
HHI	0.369	0.334	0.336
	(0.143)	(0.138)	(0.134)
Largest Share	0.511	0.478	0.482
	(0.155)	(0.156)	(0.153)
Second Largest Share	0.218	0.209	0.210
	(0.078)	(0.075)	(0.072)
MSAs	330	347	348

[a]Statistics calculated at the MSA level.

Table 4: **Insurance Market Concentration and Physician-Hospital Alignment**[a]

	(1)	(2)	(3)	(4)	(5)
Insurance Market HHI					
HHI_t	0.58**				
	(0.28)				
HHI_{t-1}		0.47**			
		(0.22)			
HHI_{t-2}			0.47**		
			(0.20)		
HHI_{t-3}				0.44**	
				(0.19)	
HHI_{t-4}					0.38**
					(0.19)
Hospital Characteristics					
Staffed Beds (100s)	0.12***	0.12***	0.12***	0.12***	0.12***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Part of System	-0.16***	-0.16***	-0.16***	-0.16***	-0.16***
	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)
Teaching Hospital	-0.31***	-0.31***	-0.32***	-0.32***	-0.34***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)
Not-for-profit	0.06	0.07	0.07	0.06	0.05
	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)
For-profit	0.09	0.09	0.09	0.06	0.07
	(0.10)	(0.11)	(0.11)	(0.11)	(0.11)
N	7,120	6,776	6,392	6,134	5,956

Marginal Effects of HHI[b]

	Traditional	Support	Referral	Employee	Equity
HHI_t	-0.156*	0.001	0.048**	0.177**	0.406**
	(0.076)	(0.005)	(0.024)	(0.086)	(0.197)
HHI_{t-1}	-0.130**	-0.001	0.038**	0.146**	0.338**
	(0.061)	(0.004)	(0.019)	(0.069)	(0.160)

[a]Results based on ordered probit regressions with standard errors in parenthesis and clustered at the MSA level. Hospital specialty, time, and state fixed effects were included in the regression but excluded from the table. Similarly, the following county demographic variables were included in the analysis but excluded from the table: total population, percent ages 18 to 34, percent ages 35 to 64, percent white, percent black, percent earning between \$50k and \$75k, percent earning between \$75k and \$100k, percent earning between \$100k and \$150k, percent earning >\$150k, percent graduating high school, percent with some college or associates degree, percent graduating college. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

[b]Marginal effects calculated as elasticities.

Table 5: **Insurance Market Concentration and Physician-Hospital Alignment**[a]
(counties with two or more hospitals)

	(1)	(2)	(3)	(4)	(5)
Insurance Market HHI					
HHI_t	0.76**				
	(0.33)				
HHI_{t-1}		0.59**			
		(0.25)			
HHI_{t-2}			0.65***		
			(0.23)		
HHI_{t-3}				0.51**	
				(0.23)	
HHI_{t-4}					0.47**
					(0.23)
Hospital Characteristics					
Staffed Beds (100s)	0.11***	0.11***	0.11***	0.11***	0.11***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Part of System	-0.12**	-0.12**	-0.11*	-0.10*	-0.11*
	(0.05)	(0.06)	(0.06)	(0.06)	(0.06)
Teaching Hospital	-0.30***	-0.30***	-0.31***	-0.31***	-0.33***
	(0.08)	(0.08)	(0.07)	(0.07)	(0.09)
Not-for-profit	-0.02	-0.02	-0.01	-0.03	-0.03
	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)
For-profit	-0.00	-0.00	-0.00	-0.03	-0.02
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
N	5,947	5,640	5,322	5,113	4,976

Marginal Effects of HHI[b]

	Traditional	Support	Referral	Employee	Equity
HHI_t	-0.202**	-0.001	0.062**	0.227**	0.519**
	(0.089)	(0.007)	(0.027)	(0.098)	(0.226)
HHI_{t-1}	-0.164**	-0.003	0.048**	0.182**	0.419**
	(0.070)	(0.006)	(0.021)	(0.077)	(0.179)

[a]Results based on ordered probit regressions with standard errors in parenthesis and clustered at the MSA level. Hospital specialty, time, and state fixed effects were included in the regression but excluded from the table. Similarly, the following county demographic variables were included in the analysis but excluded from the table: total population, percent ages 18 to 34, percent ages 35 to 64, percent white, percent black, percent earning between $50k and $75k, percent earning between $75k and $100k, percent earning between $100k and $150k, percent earning >$150k, percent graduating high school, percent with some college or associates degree, percent graduating college. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

[b]Marginal effects calculated as elasticities.

Table 6: **Insurance Market Concentration and Physician-Hospital Alignment**[a]
(for-profit hospitals only)

	(1)	(2)	(3)	(4)	(5)
Insurance Market HHI					
HHI_t	2.00***				
	(0.65)				
HHI_{t-1}		1.29**			
		(0.53)			
HHI_{t-2}			1.65***		
			(0.44)		
HHI_{t-3}				1.55***	
				(0.46)	
HHI_{t-4}					0.79*
					(0.48)
Hospital Characteristics					
Staffed Beds (100s)	-0.01	-0.01	-0.01	-0.01	-0.01
	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
Part of System	-0.34	-0.36	-0.35	-0.37	-0.40*
	(0.23)	(0.24)	(0.24)	(0.24)	(0.24)
Teaching Hospital	-0.82***	-0.85***	-0.76***	-0.76***	-0.80***
	(0.15)	(0.16)	(0.14)	(0.14)	(0.17)
N	1,406	1,336	1,308	1,270	1,232

Marginal Effects of HHI[b]

	Traditional	Support	Referral	Employee	Equity
HHI_t	-0.395***	0.336***	0.467***	0.646***	1.09***
	(0.134)	(0.108)	(0.151)	(0.210)	(0.355)
HHI_{t-1}	-0.260**	0.235**	0.324**	0.446**	0.740**
	(0.111)	(0.096)	(0.132)	(0.182)	(0.305)

[a]Results based on ordered probit regressions with standard errors in parenthesis and clustered at the MSA Level. Hospital specialty, time, and state fixed effects were included in the regression but excluded from the table. Similarly, the following county demographic variables were included in the analysis but excluded from the table: total population, percent ages 18 to 34, percent ages 35 to 64, percent white, percent black, percent earning between $50k and $75k, percent earning between $75k and $100k, percent earning between $100k and $150k, percent earning >$150k, percent graduating high school, percent with some college or associates degree, percent graduating college. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

[b]Marginal effects calculated as elasticities.

Table 7: **Insurance Market Concentration and Physician-Hospital Alignment**[a]
(not-for-profit hospitals only)

	(1)	(2)	(3)	(4)	(5)
Insurance Market HHI					
HHI_t	0.08				
	(0.35)				
HHI_{t-1}		0.19			
		(0.28)			
HHI_{t-2}			0.02		
			(0.26)		
HHI_{t-3}				0.01	
				(0.25)	
HHI_{t-4}					0.22
					(0.25)
Hospital Characteristics					
Staffed Beds (100s)	0.15***	0.15***	0.16***	0.15***	0.15***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Part of System	-0.15**	-0.14**	-0.15**	-0.16**	-0.15**
	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)
Teaching Hospital	-0.23***	-0.23***	-0.25***	-0.26***	-0.27***
	(0.08)	(0.09)	(0.09)	(0.09)	(0.09)
N	4,671	4,444	4,111	3,921	3,803

Marginal Effects of HHI[b]

	Traditional	Support	Referral	Employee	Equity
HHI_t	-0.024	-0.003	0.004	0.026	0.072
	(0.104)	(0.015)	(0.017)	(0.110)	(0.309)
HHI_{t-1}	-0.060	-0.009	0.008	0.062	0.180
	(0.088)	(0.014)	(0.012)	(0.091)	(0.264)

[a]Results based on ordered probit regressions with standard errors in parenthesis and clustered at the MSA level. Hospital specialty, time, and state fixed effects were included in the regression but excluded from the table. Similarly, the following county demographic variables were included in the analysis but excluded from the table: total population, percent ages 18 to 34, percent ages 35 to 64, percent white, percent black, percent earning between $50k and $75k, percent earning between $75k and $100k, percent earning between $100k and $150k, percent earning >$150k, percent graduating high school, percent with some college or associates degree, percent graduating college. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

[b]Marginal effects calculated as elasticities.

Table 8: **Insurance Market Concentration and Physician-Hospital Alignment**[a]
(excluding hospitals with HMO or PPO plans)

	(1)	(2)	(3)	(4)	(5)
Insurance Market HHI					
HHI_t	0.70**				
	(0.31)				
HHI_{t-1}		0.58**			
		(0.24)			
HHI_{t-2}			0.55**		
			(0.22)		
HHI_{t-3}				0.46**	
				(0.20)	
HHI_{t-4}					0.45**
					(0.20)
Hospital Characteristics					
Staffed Beds (100s)	0.13***	0.13***	0.13***	0.12***	0.12***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Part of System	-0.17***	-0.17***	-0.17***	-0.17***	-0.17***
	(0.06)	(0.06)	(0.06)	(0.06)	(0.06)
Teaching Hospital	-0.35***	-0.35***	-0.35***	-0.35***	-0.37***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)
Not-for-profit	0.10	0.10	0.10	0.09	0.08
	(0.07)	(0.07)	(0.07)	(0.07)	(0.07)
For-profit	0.12	0.11	0.10	0.08	0.08
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
N	6,556	6,241	5,886	5,652	5,491

Marginal Effects of HHI[b]

	Traditional	Support	Referral	Employee	Equity
HHI_t	-0.180**	0.014	0.069**	0.219**	0.491**
	(0.080)	(0.009)	(0.031)	(0.097)	(0.217)
HHI_{t-1}	-0.153**	0.010	0.057**	0.185**	0.419**
	(0.065)	(0.007)	(0.024)	(0.077)	(0.176)

[a]Results based on ordered probit regressions with standard errors in parenthesis and clustered at the MSA level. Hospital specialty, time, and state fixed effects were included in the regression but excluded from the table. Similarly, the following county demographic variables were included in the analysis but excluded from the table: total population, percent ages 18 to 34, percent ages 35 to 64, percent white, percent black, percent earning between $50k and $75k, percent earning between $75k and $100k, percent earning between $100k and $150k, percent earning >$150k, percent graduating high school, percent with some college or associates degree, percent graduating college. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

[b]Marginal effects calculated as elasticities.

Table 9: **Monotone Rank Estimator Results for Insurance HHI and Alignment**[a]

	HHI at time t			HHI at time $t-1$		
	Ordered Probit	MRE	% Difference	Ordered Probit	MRE	% Difference
HHI	0.0203	0.0248***	22%	0.0196	0.0221***	13%
		(0.005)			(0.0048)	
Staffed Beds (100s)	0.0040	0.0057***	43%	0.0041	0.0059***	43%
		(0.0007)			(0.0007)	
Part of System	-0.0058	-0.0063***	8%	-0.0061	-0.0061***	0.6%
		(0.0014)			(0.0012)	
Teaching Hospital	-0.0124	-0.0125***	0.7%	-0.0127	-0.0120***	-5%
		(0.0017)			(0.0018)	
Not-for-profit	0.0033	0.0050***	52%	0.0037	0.0052***	42%
		(0.0012)			(0.0012)	
For-profit	-0.0000	0.0000	-126%	-0.0000	-0.0000	-51%
		(0.0000)			(0.0004)	
N		7,120			6,776	

[a]Results based on the Monotone Rank Estimator. Standard errors in parenthesis based on 200 bootstrap replications. For comparison, all estimates are normalized to vector length one with $\beta_{\text{Beds}} = 1$. Time dummies and hospital specialty indicators were included in the regression but excluded from the table. Similarly, the following county demographic variables were included in the analysis but excluded from the table: total population, percent ages 18 to 34, percent ages 35 to 64, percent white, percent black, percent earning between $50k and $75k, percent earning between $75k and $100k, percent earning between $100k and $150k, percent earning >$150k, percent graduating high school, percent with some college or associates degree, percent graduating college. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 10: **Insurance Market Concentration and Physician-Hospital Alignment**[a]
(Any Type of Integration)

	(1)	(2)	(3)	(4)	(5)
Insurance Market HHI					
HHI_t	0.62*				
	(0.35)				
HHI_{t-1}		0.63**			
		(0.27)			
HHI_{t-2}			0.58**		
			(0.24)		
HHI_{t-3}				0.45**	
				(0.22)	
HHI_{t-4}					0.32
					(0.23)
Hospital Characteristics					
Staffed Beds (100s)	0.16***	0.16***	0.16***	0.16***	0.16***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Part of System	-0.15**	-0.15**	-0.15**	-0.15**	-0.17**
	(0.06)	(0.07)	(0.07)	(0.07)	(0.07)
Teaching Hospital	-0.35***	-0.35***	-0.35***	-0.36***	-0.36***
	(0.09)	(0.09)	(0.09)	(0.09)	(0.10)
Not-for-profit	0.08	0.08	0.08	0.07	0.06
	(0.07)	(0.07)	(0.08)	(0.08)	(0.08)
For-profit	-0.27***	-0.27**	-0.28***	-0.30***	-0.27**
	(0.10)	(0.10)	(0.11)	(0.11)	(0.11)
N	7,115	6,768	6,391	6,133	5,949

[a]Results based on ordered probit regressions with standard errors in parenthesis and clustered at the MSA level. State, time, and hospital specialty indicators were included in the regression but excluded from the table. Similarly, the following county demographic variables were included in the analysis but excluded from the table: total population, percent ages 18 to 34, percent ages 35 to 64, percent white, percent black, percent earning between \$50k and \$75k, percent earning between \$75k and \$100k, percent earning between \$100k and \$150k, percent earning >\$150k, percent graduating high school, percent with some college or associates degree, percent graduating college. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 11: **Insurance Market Concentration and Physician-Hospital Alignment**[a]
(Alternative Definition: Traditional, Support+Referral, Employee, Equity)

	(1)	(2)	(3)	(4)	(5)
Insurance Market HHI					
HHI_t	0.61**				
	(0.29)				
HHI_{t-1}		0.49**			
		(0.22)			
HHI_{t-2}			0.48**		
			(0.20)		
HHI_{t-3}				0.46**	
				(0.19)	
HHI_{t-4}					0.39**
					(0.19)
Hospital Characteristics					
Staffed Beds (100s)	0.12***	0.12***	0.12***	0.12***	0.12***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Part of System	-0.16***	-0.16***	-0.16***	-0.16***	-0.16***
	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)
Teaching Hospital	-0.32***	-0.32***	-0.33***	-0.33***	-0.35***
	(0.07)	(0.07)	(0.07)	(0.07)	(0.08)
Not-for-profit	0.06	0.06	0.06	0.06	0.05
	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)
For-profit	0.10	0.09	0.09	0.06	0.08
	(0.10)	(0.11)	(0.11)	(0.11)	(0.11)
N	7,120	6,776	6,392	6,134	5,956

[a]Results based on ordered probit regressions with standard errors in parenthesis and clustered at the MSA level. State, time, and hospital specialty indicators were included in the regression but excluded from the table. Similarly, the following county demographic variables were included in the analysis but excluded from the table: total population, percent ages 18 to 34, percent ages 35 to 64, percent white, percent black, percent earning between \$50k and \$75k, percent earning between \$75k and \$100k, percent earning between \$100k and \$150k, percent earning >\$150k, percent graduating high school, percent with some college or associates degree, percent graduating college. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 12: **Two-stage Residual Inclusion Results for Insurance HHI and Alignment**[a]

	HHI at time t		HHI at time $t-1$	
	1st Stage	2nd Stage	1st Stage	2nd Stage
Insurance Market HHI				
HHI_t		1.60*		
		(0.95)		
HHI_{t-1}				0.531
				(0.528)
Instruments				
Counties in MSA	-0.00***		-0.00***	
	(0.00)		(0.00)	
Max HHI	0.14***		0.26***	
	(0.04)		(0.05)	
Min HHI	0.46***		0.48***	
	(0.09)		(0.14)	
Joint F-statistic	20.81		16.83	
p-value	0.000		0.000	
Hansen's J-statistic	1.502		2.714	
p-value	0.472		0.257	
First-stage Residual		-1.07		-0.07
		(0.98)		(0.58)
Hospital Characteristics				
main				
Staffed Beds (100s)	-0.00**	0.12***	-0.00***	0.12***
	(0.00)	(0.01)	(0.00)	(0.01)
Part of System	-0.01**	-0.15***	-0.01**	-0.16***
	(0.00)	(0.05)	(0.00)	(0.05)
Teaching Hospital	-0.00	-0.31***	-0.00	-0.31***
	(0.00)	(0.07)	(0.00)	(0.07)
Not-for-profit	-0.00	0.07	-0.01	0.07
	(0.00)	(0.06)	(0.00)	(0.06)
For-profit	-0.00	0.10	-0.00	0.09
	(0.00)	(0.10)	(0.01)	(0.11)
N	7,119	7,119	6,774	6,774

[a]Results based on 2SRI estimator. Standard errors in parenthesis clustered at the MSA level. State, time, and hospital specialty indicators were included in the regression but excluded from the table. Similarly, the following county demographic variables were included in the analysis but excluded from the table: total population, percent ages 18 to 34, percent ages 35 to 64, percent white, percent black, percent earning between \$50k and \$75k, percent earning between \$75k and \$100k, percent earning between \$100k and \$150k, percent earning >\$150k, percent graduating high school, percent with some college or associates degree, percent graduating college. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 13: **Falsification Test for Insurance Market Concentration and Physician-Hospital Alignment**[a]

	(1)	(2)
Insurance Market HHI		
HHI_t	0.51*	
	(0.28)	
HHI_{t+1}		0.00**
		(0.00)
Hospital Characteristics		
Staffed Beds (100s)	0.12***	0.12***
	(0.01)	(0.01)
Part of System	-0.17***	-0.17***
	(0.05)	(0.05)
Teaching Hospital	-0.30***	-0.30***
	(0.07)	(0.07)
Not-for-profit	0.05	0.05
	(0.07)	(0.07)
For-profit	0.08	0.08
	(0.11)	(0.11)
N	4,727	

[a]Results based on ordered probit regressions with standard errors in parenthesis and clustered at the MSA level. Hospital specialty, time, and state fixed effects were included in the regression but excluded from the table. Similarly, the following county demographic variables were included in the analysis but excluded from the table: total population, percent ages 18 to 34, percent ages 35 to 64, percent white, percent black, percent earning between $50k and $75k, percent earning between $75k and $100k, percent earning between $100k and $150k, percent earning >$150k, percent graduating high school, percent with some college or associates degree, percent graduating college. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$