

The effect of physician–hospital affiliations on hospital prices in California

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Abstract

During the 1990s, a record number of U.S. hospitals entered into some form of vertical combination with physicians. During the same period, many integrated hospital–physician arrangements broke up. Using data from California, we investigate whether such vertical activity affected hospital pricing. We find that neither integration nor disintegration was associated with significant changes in prices. Integration among rural hospitals is associated with large price decreases, but the sample of such hospitals is small.

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1. Introduction

During the 1990s, a record number of U.S. hospitals entered into some form of vertical combination with physicians. By 1996, the peak year for such combinations, over 40% of all hospitals had formed integrated entities.¹ These included loose affiliations (Independent Practice Associations), intermediate arrangements (physician hospital organizations) and fully integrated arrangements (integrated service models).² By the end of the decade, many of these arrangements were dissolved.

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¹ The percentage is from the AHA Annual Survey as interpreted in Ciliberto (2006).

² There is no contractual obligation for the Independent Practice Association (IPA) and hospital to negotiate with third party payers. Because they represent the loosest type of integration, we ignore IPAs. Including IPAs in the analysis does not change any of the results.

This paper investigates whether such vertical activity affected hospital prices for privately insured patients.

We study the effects of vertical integration on prices in California. California is a natural choice because it has been a leader in innovative health care organizational practices and because a long time series of reasonably reliable data is available to infer hospitals' prices. We isolate the effect of changing integration arrangements on price by estimating regressions with hospital fixed effects. The fixed effects capture unobservable heterogeneity, allowing us to focus on whether changes in integration are associated with changes in price.

We find that, on average, hospitals have lower prices when they are vertically integrated with their physicians.³ However, there is considerable variation in the price effect, so that the price reduction is imprecisely estimated and not statistically significant for some organization forms and in some specifications. We find some evidence that integration effects are asymmetric – price changes upon integration are not reversed on dis-integration – but again the estimates are imprecise. Finally, we find that rural hospitals on average charge higher prices when they are integrated. However, this result is driven by a handful of hospitals and may not generalize.

2. Vertical integration between hospitals and physicians

There is no consensus about why hospitals and physicians might vertically integrate.⁴ A popular view is that vertical integration was a response to cost containment pressures that began as far back as 1983, with the implementation of the Medicare Prospective Payment System, and intensified with the spread of managed care. Some proponents of vertical integration argued that it would facilitate alignment of provider goals and allow the organization to generate efficiencies.⁵ Lower costs could, in turn, translate into lower prices. More traditional economic theory suggests that vertical integration could eliminate double marginalization that might occur if the hospital and physicians had market power. We would expect the resulting price reductions to be greatest in smaller geographic markets where providers might possess considerable power.

Another line of thinking holds that vertical integration can enhance provider bargaining power with managed care organizations (MCOs). For example, Gal-Or (1999) presents a theoretical model in which, under certain demand conditions, vertical integration increases the providers' threat point in negotiations with managed care, enabling them to extract a larger share of the available rents.⁶ If the efficiencies and bargaining theories are both true, then vertical integration might have no net effect on prices. To date, there has been little empirical evidence either way on this matter. This paper helps to fill that void.

³ Cuellar and Gertler (2002) examine similar pricing issues, using data from Arizona, Wisconsin, and Florida. They find some evidence that vertically integrating hospitals increased their prices.

⁴ Gaynor and Haas-Wilson (1999) provide a survey of the ongoing debate. A standard microeconomic explanation not raised in this debate is that integration permits coordination (and reduction) of pricing of complementary goods.

⁵ For example, see Shortell et al. (1996). Shortell et al. caution that there are many organizational barriers to successful integration, so that cost containment is not inevitable.

⁶ There are several other theories that show that firms vertically integrate to increase prices. Ordober et al. (1990) and Hart and Tirole (1990) show that firms competing on prices can foreclose rivals from the market and increase their own profits by vertically integrating. Comanor and Freeh (1985), Mathewson and Winter (1987) and Schwarz (1987) show that the foreclosure benefits of vertical integration can also be achieved through contractual exclusive dealings. Rey and Tirole (in press) show that a monopolist can vertically integrate to commit to downstream firms that it will restrict output and will exercise market power. These theories, however, do not formally contemplate the presence of a third bargaining party, the managed care organization.

Our analysis does not treat all forms of vertical integration equally. The American Hospital Association identifies several types of integrated entities, including integrated service models (ISMs), and closed and open physician hospital organizations (CPHO and OPHO). ISMs represent one extreme on the integration spectrum—the hospital and physicians share common ownership. In particular, the hospital with an ISM buys the physician practices and the physicians become employees of the hospital. The hospital negotiates contracts with managed care organizations directly.

CPHOs and OPHOs are joint ventures that a hospital forms with physicians – mainly primary care doctors – on its medical staff. The physicians maintain ownership of their practices while the joint venture negotiates contracts with managed care organizations. The hospital and the physicians share the ownership of the list of patients covered by the managed care organization. If the contract between the joint venture and the managed care organization should be terminated, then the hospital and the physicians must renegotiate rates and coverage terms with the managed care organization. While any willing physician can be part of an OPHO, CPHOs are supposedly restricted to physicians who pass screening procedures, based, for example, on practice style. We are unaware of any practical differences in the operations of CPHOs and OPHOs and how these might affect pricing.

This discussion suggests that ISMs represent a “purer” form of vertical integration, in the sense that there is a common governance mechanism and it is essentially impossible for physicians to negotiate prices separately. To the extent that vertical integration matters, we would expect to see the biggest effects in ISMs.

3. Methods

3.1. Identification

We want to determine whether vertical integration with physicians is related to hospital pricing. It is unlikely that hospital integration strategies are independent of unobservable factors that might affect pricing. Hospitals likely choose to integrate with physicians strategically, taking into account factors that we cannot observe. For example, a hospital might integrate with its physicians in response to market conditions that also affect the hospital’s pricing decisions. Thus, simple ordinary least squares regression results could be biased.

To control for potential self-selection of organizational form, we include hospital fixed effects in our regressions. Fixed effects capture any time-invariant environmental factors that enter into the organizational form decision and affect prices. Since the time-invariant selection bias is fixed for each hospital, it is absorbed in the fixed effect (see [Veerbek and Nijman \(1992\)](#)). We identify the effect of organizational change on prices only from the within-hospital variation in prices, and not from variation in pricing decisions between hospitals.

However, if differences in relevant unmeasured factors vary over time, then fixed effects will not take care of the selection bias. In particular, the fixed effects approach assumes that the trends in price due to unmeasured factors are the same for the hospitals that adopt the organizational forms and for those that remain independent of their physicians. To address this concern, we re-estimate the model to allow for both organization form-specific trends and hospital-specific trends.⁷

⁷ Estimation with hospital-specific trends taxes our computer beyond its limit. To permit estimation, we examine a subset of the data. After confirming that our main results without hospital-specific trends are virtually identical with the subset, we add the trends.

3.2. Econometric specification

We use panel data on the price p_{iht} charged to patient i by hospital h in the year t . The vector \mathbf{x}_{iht} denotes the patient characteristics, such as patient's diagnosis related group (DRG) and gender. The vector α_h denotes hospital fixed effects and τ_t are year fixed effects. The vector \mathbf{z}_{ht} denotes the organizational form dummies. Because we include hospital fixed effects, we do not include hospital characteristics, such as teaching status, that tend to be invariant over time. Following Keeler et al. (1999), we estimate the following regression:

$$\ln(p_{iht}) = \beta_0 + \mathbf{x}_{iht}\beta + \mathbf{z}_{ht}\boldsymbol{\varphi} + \alpha_h + \tau_t + \varepsilon_{iht}$$

$\boldsymbol{\varphi}$ is the set of coefficients that measure the effects of adopting organizational forms on prices.⁸ We assume $E(\varepsilon_{iht} | \mathbf{x}_{iht}, \mathbf{z}_{ht}) = 0$.

An important concern is whether the patient-level observations are independent within each hospital and within each market. In fact, prices per patient are determined by negotiations between hospitals and MCOs, so that the independence assumption is surely violated. To compute the appropriate standard errors, we generally allow for the residuals to be correlated within hospitals. We also consider a specification where unobservables are allowed to be correlated within counties; this corresponds roughly to the market areas covered by MCOs.⁹

4. Data construction

We use financial and utilization data from the California Office of Statewide Planning and Development (OSHPD) for the period 1994–2001. OSHPD data has been used in many other research studies, and details can be found at the OSHPD web site: www.oshpd.cahwnet.gov California has often led the nation in trying new organizational forms in health care, and thus it provides an important context to test the effect of organization changes on prices.

We consider only short-term general hospitals and patients with some form of private insurance (such as HMO/PPO), since the prices for almost all the other patients are regulated. We drop patients who do not stay overnight at the hospital, as well as patients whose charges are less than US\$ 100.

Our research methods are computationally intensive so we took one additional steps to reduce the number of indicator variables in the analysis. We obtained the frequency distribution of all DRGs and dropped patients whose DRGs were in the lowest 40 percentile of the distribution.¹⁰ As a result, our data set counts 2,541,086 individuals and 320 hospitals over the span of 8 years.

⁸ Cuellar and Gertler (2002) address the independence issue using a two-step approach. In the first step, they estimate prices on patient characteristics and hospital-year fixed effects. In the second step, they regress the estimated coefficients of the hospital-year fixed effects on the organizational form dummies. We obtain very similar results using both our one-step and their two-step approaches.

⁹ Market definition is, of course, itself an issue worthy of separate research. The FTC has argued that MCOs serve markets consisting of metropolitan areas, which themselves consist of one or more counties. Clustering at the county level captures the idea that prices negotiated by MCOs are not independent, and also provides a plausible boundary for rural markets.

¹⁰ We reran regressions with all the DRGs and all hospitals but on a random 10% subsample of the observations. The coefficient estimates were nearly identical to those reported herein.

Table 1
Examples of integration coding

| Year | OPHO | CPHO | ISM | OPHO-A | CPHO-A | ISM-A | OPHO-L | CPHO-L | ISM-L |
|------|------|------|-----|--------|--------|-------|--------|--------|-------|
| 1994 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 |
| 1996 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 1 |

5. Variable definitions

5.1. Discounted charges

In order to compute discounted patient charges, we take the actual charge and multiply it by the yearly average discount rate that each hospital grants to private paying patients. We compute the average discount rate by dividing total inpatient deductions by the total gross inpatient revenue from privately insured patients' revenues.¹¹ From now on, when we refer to price, we mean the discounted charge.

5.2. Organizational forms

We identify vertical integration structures using data from the American Hospital Association. We consider three types of organizational forms: open hospital physician organization (OPHO), closed hospital physician organization (CPHO), and integrated salary model (ISM). The categorical variable OPHO is equal to 1 if the hospital is part of an OPHO in a particular year, otherwise OPHO is equal to zero. We construct CPHO and ISM in an analogous way.

In a traditional fixed effects analysis, the impact of integrating (going from "0" to "1" in the key predictor) is assumed to be equal in magnitude but opposite in sign to the impact of dis-integrating (going from "1" to "0"). In some analyses, we allow these effects to differ. We define the variable OPHO-Adopt as the effect that becoming part of a OPHO has on the hospital's prices. We define OPHO-Leave as the effect that leaving a OPHO has on the hospital's prices. We define CPHO-Adopt, CPHO-Leave, ISM-Adopt and ISM-Leave similarly. Table 1 provides examples of how we code integration and dis-integration and Table 2 presents the transition matrix for our sample.

There are 1370 hospital-year observations. The identification of the categorical variables OPHO, CPHO and ISM comes from the 95 instances in which a hospital changes organizational form. There are 39 hospital-year observations from dis-integration to integration, and 46 hospital-year observations from integration to dis-integration. On 10 occasions, hospitals switch

¹¹ The OSHPD dataset includes charity care in the category of private payers, which might result in underestimating the mean discount. To avoid this measurement error in the dependent variable, we constructed an alternative mean discount by subtracting the deductions from revenue for the provision of charity from the total gross inpatient revenue from privately insured patients' revenues. The mean discount that we use in the paper and this alternative mean discount have a correlation of 0.9783 before 1999. There is also another measurement issue. Since 1999, the OSHPD does not split up the inpatient and outpatient deductions for *managed care*. Therefore, we could overestimate the mean discount for inpatient services when we use the total deductions for managed care. To assess the importance of this measurement error, we compared the results in the paper with those that we would find if we assumed that the inpatient deductions are exactly half of the total deductions. The results are very similar.

Table 2
Transition matrix

| From | To | | | | Total |
|-------|------|------|------|-----|-------|
| | NONE | OPHO | CPHO | ISM | |
| NONE | 830 | 13 | 8 | 18 | 869 |
| OPHO | 19 | 23 | 3 | 2 | 47 |
| CPHO | 11 | 1 | 29 | 2 | 43 |
| ISM | 16 | 0 | 2 | 54 | 72 |
| Total | 876 | 37 | 42 | 76 | 1031 |

from one form of integration to another. Some hospital might have gone through several organizational changes during the period of analysis. The relevant point is that the identification of the effects of organizational changes on prices comes from both integration and de-integration. We also note that more hospitals abandoned integration models than newly integrated during the time period studied. This suggests either than hospitals were unable to sustain price increases, or failed to control costs.

5.3. Control variables

We use hospital fixed effects, so we do not include any hospital characteristics as predictors. We control for the patient's DRG and for the patient's gender. We also include a rural market interaction term, to determine whether the price effects differ in rural markets.

6. Results

Table 3 shows average prices by type of integrated model. CPHO and ISM hospitals charge higher prices than the hospitals that negotiate with managed care independently of their physicians.

We present our main regression results in Tables 4 and 5. In all of the regressions in Table 4, we assume that the effects of integration and dis-integration are symmetric. The first two regressions in Table 5 allow for asymmetric effects. The last regression in Table 5 estimates separate effects in urban and rural hospitals.

Column 1 in Table 4 reports the results when we exclude hospital fixed effects. Hospitals with OPHOs and CPHOs charge prices that are roughly 10 and 25% higher than those charged by independent hospitals, although the difference is not statistically significant. Hospitals with ISMs charge prices that are roughly 25% higher than hospitals that are independent and the difference is statistically significant.

Table 3
Prices by type of integration

| | All | OPHO | CPHO | ISM |
|---------------------------------------|-------------|-------------|-------------|-------------|
| Fraction of observations ^a | 1.00 | 0.040 | 0.050 | 0.087 |
| Average price (S.D.) | 3944 (3552) | 3279 (1498) | 4330 (3195) | 6212 (5988) |

Standard deviations in parentheses.

^a These data are patient-weighted.

Table 4
Regressions with symmetric integration effects

| | Ln(Price) | | | |
|----------------------------|------------------|-------------------|----------------------|----------------------------------|
| | 1 | 2 | 3 | 4 |
| OPHO | 0.205 (0.137) | −0.092*** (0.003) | −0.092*** (0.063) | −0.092 (0.078) |
| CPHO | 0.129 (0.079) | −0.059*** (0.003) | −0.059 (0.070) | −0.059 (0.062) |
| ISM | 0.244*** (0.081) | −0.009** (0.004) | −0.009 (0.067) | −0.009 (0.084) |
| Constant | 7.515*** (0.122) | 8.992*** (0.006) | 8.992*** (0.122) | 8.992*** (0.106) |
| Observations | 2541086 | 2541086 | 2541086 | 2541086 |
| R ² | 0.615 | 0.666 | 0.713 | 0.713 |
| Number of idd | 320 | 320 | 320 | 320 |
| Joint test Prob > F(3,320) | 0.003 | 0.000 | 0.408 | 0.374 |
| Hospital FE | No | Yes | Yes | Yes |
| Correlated unobservables | No | No | Yes, within hospital | Yes, within market area (County) |

All regressions include DRG fixed effects; and a patient-specific gender categorical variable. Robust standard errors in parentheses. The specifications in columns 1, 2 and 3 include year categorical variables. * Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

The difference between the fixed effects results in column 2 and the results in column 1 is striking. Now, integration is associated with price reductions of roughly 1–10%. We infer from the two sets of results that (a) hospitals that have high prices are disproportionately likely to also be integrated and (b) individual hospitals tend to have lower prices during periods when they are integrated.

Table 5
Alternative specifications

| | Ln(Price) | |
|----------------|------------------|-------------------|
| | 1 | 2 |
| OPHO-A | 0.074 (0.127) | |
| CPHO-A | −0.086 (0.080) | |
| ISM-A | 0.068 (0.087) | |
| OPHO-L | 0.263 (0.165) | |
| CPHO-L | 0.043 (0.091) | |
| ISM-L | 0.168 (0.211) | |
| OPHO | | −0.087 (0.064) |
| CPHO | | −0.057 (0.070) |
| ISM | | −0.005 (0.069) |
| RurOPHO | | −0.310*** (0.090) |
| RurCPHO | | −0.406*** (0.096) |
| RurISM | | −0.297*** (0.138) |
| Constant | 8.950*** (0.126) | 8.720 (3,716.318) |
| Observations | 2541086 | 2541086 |
| R ² | 0.713 | 0.713 |

All specifications include hospital fixed effect; DRG fixed effects; and a patient-specific gender dummy. Robust standard errors in parentheses. Patients unobservables are allowed to be correlated within each hospital. The specifications in columns 1 and 2 include year categorical variables. * Significant at 10%; ** significant at 5%.

*** Significant at 1%.

Table 6
Regressions with trend interactions

| | Ln(Price) | | |
|----------------|-------------------|------------------|------------------|
| | 1 | 2 | 3 |
| OPHO | -0.174* (0.103) | -0.115** (0.054) | -0.097 (0.063) |
| CPHO | 0.031 (0.131) | -0.011 (0.099) | -0.065 (0.070) |
| ISM | 0.026 (0.099) | -0.079 (0.103) | -0.000 (0.067) |
| Trend | -0.083*** (0.017) | | |
| Trend-OPHO | 0.024 (0.025) | | |
| Trend-CPHO | -0.028 (0.048) | | |
| Trend-ISM | -0.006 (0.027) | | |
| Constant | 9.502*** (0.088) | 7.726*** (0.030) | 9.023*** (0.123) |
| Observations | 2541086 | 674671 | 674474 |
| R ² | 0.707 | 0.753 | 0.712 |
| Number of idd | 320 | 317 | 317 |

All specifications include hospital fixed effect; DRG fixed effects; and a patient-specific gender dummy. Robust standard errors in parentheses. Patients unobservables are allowed to be correlated within each hospital. The specification in column 3 is run on a random subsample, and it includes interactions of the hospital fixed effects with the variable trend.

* Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

Column 3 of Table 4 presents the same fixed effects results but allows for correlated errors within hospitals. This is our “main model” and will serve as a basis for comparison with later specifications. As expected, the standard errors are much larger and the individual results are no longer statistically significant. Likewise, the joint test that the coefficients OPHO, CPHO and ISM are all equal to zero cannot be rejected at any standard level of statistical significance. There is too much variation in pricing practices (relative to trend) to draw firm conclusions about the effects of integration.¹² Column 4 of Table 4 presents the same fixed effects results but allows for correlated errors among observations in the same market area, here defined as a county. The standard errors are quite similar to those in column 3 of Table 4. The results are once again not statistically significant.

Table 5 presents two alternative specifications of the main model. The model in column 1 allows for asymmetric integration effects. Recall that a negative coefficient on OPHO-A would indicate a price decrease subsequent to integration, and a comparable positive coefficient on OPHO-L would indicate a symmetric price increase after dis-integration. Given the negative coefficient on OPHO reported in Table 4 columns 2 and 3, this is what we would expect to see in column 1 of Table 5 if integration effects were symmetric. The same applies to the other forms of integration. Although our coefficients are not precisely estimated, they suggest that integration effects may be asymmetric.

In column 3 of Table 5, we include rural/integration interaction terms. We find that integration of all forms at rural hospitals is associated with statistically significant price reductions exceeding 30%. This is consistent with the double marginalization story. There are admittedly very few rural hospitals in our sample that changed organizational form – the biggest group was the 6 that

¹² The coefficient estimates are robust to outlier analysis, which was done by rerunning this specification as many times as we observe hospital changes in organizational forms, and by dropping one change in organizational form at a time.

adopted a CPHO. We note that removing one hospital from the sample reduced the estimated CPHO pricing effect to 14%. Thus, the rural results may be driven by a few extreme outliers.

Table 6 presents results when we add organization form-specific or hospital-specific time trends to the main model. Column 1 includes organization-form specific time trends. There appears to be an 18% reduction in price at OPHOs, but adding trends has further increased standard errors, so that only the OPHO finding is borderline statistically significant. Once again, the hypothesis that the coefficients OPHO, CPHO and ISM are all zero cannot be rejected at traditional confidence levels. Column 2 adds hospital-specific time trends, which we do not report for sake of brevity. Our results are now much closer to those in our main model in column 3 of Table 4. Price reductions are modest and not statistically significant. For computational reasons we could only run this regression on a random subsample of the data. To show that this subsample is representative of the origin sample we present in column 3 of Table 6 the results of the main model run on the subsample. The results are virtually identical to those for the full sample in column 3 of Table 4.

7. Discussion

In a recent report, the U.S. Department of Justice and Federal Trade Commission expressed concern about health care provider market power (FTC/DOJ, 2004). They specifically pointed to hospital–physician integration as a potential source of market power and higher prices. Economic and organizational theory are ambiguous as to the effects of integration on prices. Integration could generate cost efficiencies or eliminate double marginalization, thereby reducing prices. Or it could increase provider bargaining leverage with MCOs, thereby increasing prices. The actual effects must be measured empirically.

In this paper, we investigate whether vertical integration activity affected prices at California hospitals during the 1990s. We find no evidence of higher prices. If anything, integration is associated with lower prices, though the estimated price reductions are neither precise nor statistically significant. Price reductions seem to be larger at rural hospitals, consistent with a double marginalization effect, but these findings may be due to a handful of outliers.

Our results do not support fears that vertical integration may have anticompetitive effects. Vertical integration may have been motivated by any number of other reasons besides bargaining power, as discussed by Burns and Pauly (2002), Ciliberto (2006), and elsewhere. It is even possible that hospitals adopted the new organizational forms to charge higher prices but they did not succeed. Indeed, one of the most pronounced trends of the past few years has been the slowdown, if not outright reversal, of vertical integration. The failure to realize tangible integration effects may be one reason for this trend.

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