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Kirkman-Liff, Robbert Huijsman, Tom van der Grinten, Greg Brink  **Abstract**  A number of countries have adopted contracting reforms in which hospitals are placed at financial risk. This risk has stimulated a number of adaptive strategies to achieve organizational success. This paper presents a model of six forms of contracting relationships and reviews the adaptation strategies observed in three health systems: the USA, England and the Netherlands. These strategies include service diversification, improved management information systems, the employment of marketing and contract managers, the use of clinical pathways, case management and concurrent/retrospective review of hospital stays, quality management and quality assurance programs, pre-admission authorization, discharge planning, and physician profiling and participation in management. These adaptive strategies have three implications for managers: increased ‘partnering’ with purchasers, collaboration with medical staff, and assumption of managed care roles. Two groups of institutions are at risk from the changes in hospital contracting: university teaching hospitals and inner-city hospitals serving socially deprived populations. The paper ends with implications for the education of hospital managers and research on hospital management and adaption to contracting.  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Strategic integration of hospitals and physicians

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**Abstract**

A striking development in the healthcare market place has been the formation of strategic relationships between hospitals and physicians. Hospital–physician integration appears to be a response to rapidly expanding managed care health insurance. We examine whether integration lead to efficiency gains from transaction cost economies thereby allowing providers to offer managed care insurance plans lower prices or whether integration is really a strategy to improve bargaining power and thereby increase prices. We find that integration has little effect on efficiency, but is associated with an increase in prices, especially when the integrated organization is exclusive and occurs in less competitive markets.

**Keywords:** Vertical integration; Market power; Transaction cost economics; Hospitals; Physicians

**JEL classification:** L22; L44; I11; I18

**Article Outline**

1. [Motives](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX1)

1.1. [Transaction cost economies and economies of scope](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX2)

1.2. [Market-bargaining power](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX3)

1.3. [Comparison](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX4)

2. [Organizational forms](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX5)

3. [Efficiency](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX6)

3.1. [Methods](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX7)

3.2. [Results](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX8)

4. [Prices and volumes](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX9)

4.1. [Methods](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX10)

4.2. [Results](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX11)

5. [Quality](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX12)

5.1. [Methods](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX13)

5.2. [Results](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX14)

6. [Integration](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX15)

6.1. [Methods](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX16)

6.2. [Results](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX17)

7. [Conclusions](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#SECX18)

[Acknowledgements](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#ack001)

Appendix A. [Appendix](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#app1)

[References](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#bibl001)

A striking development in the healthcare market place has been the formation of strategic relationships between hospitals and physicians. By 1998, 66% of hospitals had either acquired or formed a long-term contract with one or more physician organizations. These relationships vary from loosely networked, open confederations to exclusive, Fully Integrated Organizations.

Hospital–physician integration likely reflects providers’ organizational responses to competitive pressures from rapidly expanding managed care health insurance. A number of authors have hypothesized that hospital–physician integration likely leads to efficiency gains by facilitating the exploitation of transaction cost economies such as being better able to deal with incomplete contracting challenges and economies of scope ([Robinson and Casalino, 1995](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib31), [Robinson and Casalino, 1996](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib32), [Robinson, 1997](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib29) and [Robinson, 1999](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib30)). In this case, the more efficient integrated organization is able to offer lower prices to managed care plans. Others suggest that integration may really be an attempt to improve bargaining (market) power with managed care plans and thereby increase prices ([Gal-Or, 1999](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib14) and [Gaynor and Haas-Wilson, 2000](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib17)).

In this paper, we investigate the impact of hospital–physician integration on hospital efficiency, prices, quantities, and quality, and examine whether the results are consistent with the transaction cost economies hypothesis or the bargaining-market power theory. The answer to this question is important for antitrust and Medicare–Medicaid contracting policies.

The general literature on vertical integration provides few clear predictions. Theoretical models posit both efficiency gains that result in lower prices and higher quality, and to market foreclosures that lead to higher prices and lower consumer welfare ([Klein et al., 1978](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib21), [Salinger, 1988](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib33), [Williamson, 1988](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bbib37) O.E. Williamson, Transaction cost economics. In: R. Schmalensee and R. Willig, Editors, *Handbook of Industrial Organization*, Elsevier Science Publishing Co. Inc. (1988).[Williamson, 1988](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#bib37) and [Ordover et al., 1990](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib25); [Bernheim and Whinston, 1998](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib7)). The limited empirical literature is also mixed.[2](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "fn2)

We use panel data from Arizona, Florida, and Wisconsin for 1994–1998 to estimate the impact of integration on hospital performance. We exploit differences in the performance predictions of the two competing theories across organization types to identify the model. Specifically, the transactions cost models predict lower costs and lower prices, while the market power models predict no change in costs and increases in prices, especially in relationships that are exclusive and in less competitive provider markets. We also exploit the panel to control for possible bias from unobserved heterogeneity as a result of the fact that integration is a choice.

We find strong support for the market power explanations and little support for the transaction costs economies explanations of hospital–physician integration. Specifically, integrated organizations have higher prices than stand-alone hospitals and the differences are larger for exclusive arrangements and in less competitive markets. However, integrated organizations are no more efficient than stand-alone hospitals.

Our paper proceeds as follows. First, we lay out the competing theories and predictions. Then we describe the types of integrated organizations and present evidence on the effect of integration on hospital performance. We then empirically investigate why these organizations formed in order to test our identification strategy. Finally, we draw conclusions.

**1. Motives**

The strategic response of hospitals to form relationships with physicians has been fast-paced. By 1998, 66% of hospitals had formed strategic contracting relationships with physicians, twice the proportion in 1993 ([Burns et al., 2000](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib8)). This fast-paced growth in hospital-physician integration likely reflects providers’ response to expanding managed care. In fact, as demonstrated in [Fig. 1](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#fig1), hospitals in high-managed care areas, i.e., areas with high managed care penetration rates, are more likely to have vertical relationships with physicians than hospitals in low-managed care areas; only 29% of hospitals in low-managed care areas had vertical relationships in 1998, compared to 70% of hospitals in high-managed care areas.

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Fig. 1. Percentage of hospitals in integrated organizations with physician groups in Flordia, Wisconson, and Arizona. *Source and notes:* the data on hospital–physician integration are from the American Hospital Association's Annual Surveys of Hospitals 1994 and 1998. Managed care penetration is calculated from State hospital patient discharge data provided by the state agencies from Arizona, Florida, and Wisconsin. A low managed care county has up to 10% of patients enrolled in managed care (25th percentile), while a high managed care county has more than 30% of hospital patients enrolled in managed care (75th percentile or more). Medium managed care is defined as counties with 10–30% of hospital patients enrolled in managed care.

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Before managed care, indemnity insurance paid any hospital or physician chosen by a patient on a cost-plus or fee-for-service basis. Managed care brought about a change in contracting and reimbursement for hospital services. Unlike indemnity insurers, managed care plans selectively contract with hospitals in order to negotiate lower hospital prices, shift payment risk to hospitals, and form provider networks that appeal to their enrollees. Managed care plans extract price discounts by threatening to exclude providers from their selected networks. Hospitals and physicians wanting to improve their competitive position for managed care contracts try to lower costs or develop strategies to counter managed care bargaining power.[3](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "fn3)

One response to the rise of managed care is for hospitals and physicians to integrate. The literature provides two explanations for why hospitals and physicians have formed vertical relationships in response to managed care. The first is a transactions costs and economies of scope argument that such relationships increase efficiency and quality. With greater efficiency, providers are able to offer managed care plans lower prices without sacrificing quality. The second is that hospitals and physicians ally in order to improve their bargaining position with managed care plans and other insurers and thereby raise prices. The next three subsections summarize the theoretical arguments and their predictions for hospital performance.

**1.1. Transaction cost economies and economies of scope**

Before managed care, under fee-for-service payment to physicians and cost-plus payment to hospitals, there was little financial incentive for hospitals and physicians to work together to achieve economies of scope and otherwise become more efficient. While these theories assume efficient production in hospital care, in a managed care environment where providers are paid via capitation[4](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "fn4) and other forms of prospective payment,[5](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "fn5) physicians and hospitals can accrue the financial benefits of increased efficiency, if they can overcome internal agency problems and take advantage of economies of scope. Vertical integration may more easily permit the use of financial incentives to lower cost and improve quality, such as bonuses or withhold pools ([Klein et al., 1978](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#bib21) and [Williamson, 1988](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#bib37)). The care of any one patient typically spans both hospital and physician office settings. By changing the process of patient care and coordinating care across sites, joint hospital–physician organizations may improve the ability of hospitals and physicians to exploit economies of scope.[6](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "fn6) Shared information systems can be put into place to gather data on costs, quantity, quality, and monitor performance relative to benchmarks. Integrated management can facilitate the sharing and use of information and identify areas of complementarity and substitutability. Since the hospital and the physician are both inputs into the care of a patient, by achieving economies of scope the organization might improve care coordination and therefore health outcomes and efficiency. Further, by integrating and restructuring financial incentives, the interests of hospitals and physicians may become more closely aligned and thereby reduce transaction costs of contracting and cooperation. ([Klein et al., 1978](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib21) and [Williamson, 1988](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib37)). However, there are substantial administrative costs to such coordination, which may offset any savings.

There are theoretical reasons for hypothesizing that not all types of organizations will be equally successful in reducing transaction costs or controlling clinical costs and achieving economies of scope. Fully integrated firms can strengthen administrative controls and achieve better cost and quality control through strong group norms, peer pressure, and integrated finances. However, they face attenuated incentives on the part of physicians, if physicians are placed on salary and no longer own and reap direct benefits from their assets ([Gaynor and Gertler, 1995](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib15)). Fully integrated firms are also better able to adapt to changes that require coordinated action, but not individual action.

If there are efficiency gains from economies of scope or better patient care coordination, then the integrated hospital is a better position to compete for managed care contracts. It can offer managed care plans a lower price for the same or better level of quality. In this case, integrated hospitals will have lower costs of care, higher managed care volume, and lower managed care prices.

There is one case, however, where hospital prices might rise due to transaction cost gains. Along with improvements in quality and efficiency, integration may reduce the administrative costs associated with the managed care contracting (“Coasian” transaction costs). Networks may lower contracting costs between a health plan and numerous providers, by creating a single point of contracting. By networking with physicians, hospitals can streamline marketing, contracting and negotiation with health plans, limit the number of parties involved, and reduce transactions costs ([Baker, 1999](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib5)). The surplus (or gain) from lower transactions costs may be shared between the health plan and the integrated entity leading to higher hospital prices. In this case we expect to see (at least weakly) high provider prices and higher managed care volume with no change in the costs of care.

Despite theoretical grounds to believe that hospital–physician integration might lower costs and improve quality, there are few studies that assess these efficiency claims. The few studies that exist provide conflicting results.[7](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "fn7) However, all of these studies used cross-sectional data and treated the organizational form as exogenous.

**1.2. Market-bargaining power**

There are different theories by which hospital–physician integration may be used to increase hospital market power. Managed care organizations design and administer their provider networks in part to redirect demand and render hospital demand more price elastic. Hospitals may be able to attenuate managed care plans’ ability to make demand more price elastic by integrating with physicians who are influential in the demand for hospital care.

[Gal-Or (1999)](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib14) considers the case where hospitals and physicians negotiate with insurers as a unit. If the hospital–physician unit fails to reach an agreement with an insurer, both hospital and physicians drop out of the insurer's network. This would lead to a decline in insurer demand by subscribers, thus the hospital–physician organization can bargain more aggressively. Gal-Or demonstrates that mergers between hospitals and physician practices can enhance their bargaining power relative to insurers, even when the relationship is not exclusive. However, joint profits increase from integration only if the degree of competitiveness in hospital and physician markets is comparable. For example, a hospital in a competitive market may increase its bargaining leverage by tying its fortune to differentiated physicians. The providers in the more competitive markets gain because they can negotiate higher rates through joint negotiation. However, the differentiated physicians would have little incentive to dilute their bargaining power by joining with the hospitals. If the degree of competitiveness is comparable, both can gain. This motivates the use of exclusivity clauses. In the absence of exclusivity clauses, vertical integration may not occur if the relative competitiveness of hospital and physician markets differs sharply.

Second and more generally, [Bernheim and Whinston (1998)](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib7) and [Riordan and Salop (1995)](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib28) demonstrate that vertical relationships can confer market power if there are barriers to entry. Entry barriers can stem from cost advantages, sunk costs, pre-entry strategic behavior, or managed care plans’ propensity to contract with networks of providers. Hospitals and physicians may be able to raise barriers to entry by forming exclusive relationships. If providers or classes of providers cannot compete effectively without access to a network, this may harm competition in those markets. The exclusivity of the network relationship and the competitiveness of the provider market also are important. With exclusive arrangements, health plans may not be able to access high quality or low cost providers without contracting with the integrated entity. Consequently, health plans may not be able to switch easily to other providers or integrated entities in response to price increases. The less competitive the hospital market, the more likely such integrated entities are able to prevent managed care plans from switching their enrollees to other providers.

Third, in a model of price competition with heterogeneous products, hospitals may be able to increase their market power by differentiating their product through physician alignment. Alignments may increase physician loyalty to a given hospital, thereby increasing admissions. Consequently, the price elasticity of demand for a hospital's services would fall and mark-ups could increase. Product differentiation softens competition because price-cutting is less effective at taking rivals’ business. In this sense, integration acts as a form of “rebranding” ([Cabral, 2000](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib10) and [Pepall and Richards, 2000](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib26)).

Finally, vertical relationships also may confer market power by facilitating horizontal collusion ([Baker, 1999](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib5)). The improved data systems and coordination of prices for the network product also may lead to coordination of prices for the unbundled products. In summary, there are a number of theories that explain the mechanisms by which vertical integration might affect the demand for hospital care.

**1.3. Comparison**

The two bodies of theory have very different implications for performance. The transactions costs economic (TCE) models predict lower costs of care, higher managed care volume, and lower managed care prices. These effects should not depend on whether the relationship is exclusive or on the competitiveness of the hospital market. It is theoretically possible that exclusivity offers gains to contracting and administration but these are not emphasized in the organizational literature that describes these arrangements. They are likely to be second-order effects relative to economies of scope. The market power models predict that integration does not affect efficiency (i.e. costs or quality), but rather leads to greater market power and therefore prices. Moreover the price increases are greater if the arrangement is exclusive and in less competitive hospital markets.

**2. Organizational forms**

In practice, hospital–physician integration takes on a variety of forms, reflecting different types of risk sharing, integration of operations, degrees of exclusivity, and capital investment ([Baker, 1989](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib4), [Burns and Thorpe, 1993](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib9), [Morrisey et al., 1996](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib23), [Robinson and Casalino, 1996](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#bib32), [Snail and Robinson, 1998](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib34) and [Burns et al., 2000](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#bib8)). Arrangements range from loosely coupled forms of contracting, such as flexible joint ventures and shared administration to tight arrangements whereby the hospital purchases physician practice assets and the new entity engages in risk-based contracts with insurers. Hospitals also differ with respect to whether these arrangements are centralized or decentralized; in some cases individual hospitals have formed these arrangements, in others they are sponsored at the hospital-system level.

We focus on the five most common types of arrangements as identified in the American Hospital Association's Annual Survey of Hospitals: Independent Physicians Associations (IPAs), Open Physician–Hospital Organizations (OPHOs), Closed Physician–Hospital Organizations (CPHOs), Management Service Organizations (MSOs), and Fully Integrated Organizations (FIOs). The attributes of these arrangements are summarized in [Table 1](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl1). CPHOs and MSOs, as we discuss below, are very similar in characteristics and will be grouped together for our analyses. Fully integrated models include medical foundations and salary models, also described below. [Fig. 2](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#fig2) shows the frequency of each of the forms of integration both nationally and in our sample.

Table 1.

Characteristics of physician–hospital vertical relationships

|  | **Independent Practice Association** | **Open Physician Hospital Organization** | **Closed Physician Hospital Organization** | **Management Services Organization** | **Fully Integrated Organization** |
| --- | --- | --- | --- | --- | --- |
| Contracting w/managed care plans | × | × | × | × | × |
| Administrative services |  | × | × | × | × |
| Coordinate care |  |  | × | × | × |
| Physicians exclusive to hospital |  |  | × | × | × |
| Fully integrated ownership |  |  |  | Some | × |
| Physicians salaried |  |  |  |  | × |
| Provide insurance |  |  |  |  | Some |

[Full-size table](http://wf2dnvr9.webfeat.org/pZ0cK16/url=http:/www.sciencedirect.com/science?_ob=MiamiCaptionURL&_method=retrieve&_udi=B6V8K-4HMNFTC-1&_image=tbl1&_ba=&_user=3546441&_rdoc=1&_fmt=full&_orig=search&_cdi=5873&view=c&_isTablePopup=Y&_acct=C000060832&_version=1&_urlVersion=0&_userid=3546441&md5=75851d181a16dea34e6aa929ffbc20a2)

[View Within Article](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl1)

|  |  |
| --- | --- |
|  | [Full-size image](http://wf2dnvr9.webfeat.org/pZ0cK16/url=http:/www.sciencedirect.com/science?_ob=MiamiCaptionURL&_method=retrieve&_udi=B6V8K-4HMNFTC-1&_image=fig2&_ba=2&_user=3546441&_rdoc=1&_fmt=full&_orig=search&_cdi=5873&view=c&_acct=C000060832&_version=1&_urlVersion=0&_userid=3546441&md5=2868eb90d0854c78ec8597dce374ccf7) (11K) |

Fig. 2. The distribution of hospitals by type of integration, 1998. *Source:* the data on hospital–physician integration are from the American Hospital Association's Annual Survey of Hospitals, 1998.

[View Within Article](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "fig2)

Approximately 10% of hospitals have IPAs. These are loose contractual networks rather than integrated firms whose purpose is to hold managed care contracts and to assist individual physicians in obtaining managed care contracts. Hospitals with IPAs generally do not have risk-based global capitation contracts ([Bazzoli et al., 1999/2000](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib6)).

“Open” Physician Hospital Organizations (OPHOs) are joint ventures between hospitals and physicians, facilitate managed care contracting, provide administrative services to physicians, and manage ambulatory care facilities where the physicians work. The OPHO allows physicians to maintain separate, independent offices and continue to own their own practices, but links physicians together through contracts. The OPHO allows physicians and hospitals to retain their autonomy over business and clinical operations. These arrangements have centralized administration to facilitate contracting with health plans. Previous research finds that OPHOs have only moderate levels of integration as measured by standardized business practices, joint planning, and clinical integration ([Burns et al., 2000](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#bib8)).

“Closed” Physician Hospital Organizations (CPHOs) are similar to OPHOs except that they also selectively contract with physicians based on quality and cost considerations, whereas OPHOs do not. Because closed PHOs form exclusive relationships with physicians they may be able to coordinate care better than their open counterparts. They are given high integration scores in the organizational literature ([Bazzoli et al., 1999/2000](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#bib6)). Because of their close relationships with hospitals, CPHOs may also improve efficiency through standardization, leading to lower productions costs and potentially higher quality. However, they also may raise prices by improving bargaining power with plans, particularly due to their exclusive nature.

Management Service Organizations (MSOs) are similar to CPHOs except they typically buy the physical assets of the participating physicians and provide administrative services (e.g. billing services and record-keeping) to the practice for a fee. Like CPHOs, the relationship with physicians is exclusive and MSOs act as agents to hospital and physicians in contracting with managed care plans ([Morrisey et al., 1996](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#bib23)). They are also given high integration scores in the organizational literature ([Bazzoli et al., 1999/2000](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib6)). In this analysis we treat MSOs as CPHOs, because of their similarities. Together they are referred to as CPHOs.

Fully Integrated Organizations (FIOs), such as medical foundations and salary models, are the most closely related, exclusive entities. They hire physicians as salaried employees, purchasing both physical and intangible assets (i.e., the entire practice) and often consolidate physicians into centralized locations ([Morrisey et al., 1996](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#bib23) and [Snail, 1999](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib35)). Their effect on costs and quality is predicted to be stronger than that of CPHO. Clinically, they have the greatest potential for coordinating care and improving efficiency, although they face the greatest moral hazard risk due to attenuating incentives for physicians who are placed on salary. The FIOs are the most likely to accept risk-based capitation contracts from HMOs ([Burns et al., 2000](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib8)).

The organizational variety of hospital–physician relationships is used to test the competing hypotheses. [Table 2](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl2) maps the predictions from transaction costs and market power theory to the organizational typology. Network-style organizations, IPAs, which are primarily contracting vehicles, allow a test of “Coasian” transaction cost-related explanations for vertical integration. In contrast, OPHOs, CPHOs, and FIOs allow a test of the transactions costs and bargaining power explanations.

Table 2.

Predicted effects of integration on performance

| **Organizational type** | **Performance indicator** | **Predictions of the competing theories** | | | |
| --- | --- | --- | --- | --- | --- |
|  |  | **Coasian contracting transaction costs** | **Transaction cost economies** | **Bargaining/market power****[a](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl3fn1)** | |
|  |  |  |  | **More competitive market** | **Less competitive market** |
| Independent Practice Association | Managed care price | + |  |  |  |
|  | Managed care volume | + |  |  |  |
|  | Indemnity price |  |  |  |  |
|  | Indemnity volume |  |  |  |  |
|  | Costs |  |  |  |  |
|  | | | | | |
| Open Physician Hospital Organization | Managed care price | + | − | + | ++ |
|  | Managed care volume | + | + | + | ++ |
|  | Indemnity price |  | − | + | ++ |
|  | Indemnity volume |  | + | − | − |
|  | Costs |  | − |  |  |
|  | | | | | |
| Closed Physician Hospital Organization | Managed care price | + | − | ++ | ++ |
|  | Managed care volume | + | + | ++ | ++ |
|  | Indemnity price |  | − | ++ | ++ |
|  | Indemnity volume |  | + | − | − |
|  | Costs |  | − |  |  |
|  | | | | | |
| Fully Integrated Organization | Managed care price | + | − | ++ | ++ |
|  | Managed care volume | + | + | ++ | ++ |
|  | Indemnity price |  | − | ++ | ++ |
|  | Indemnity volume |  | + | − | − |
|  | Costs |  | − |  |  |

[Full-size table](http://wf2dnvr9.webfeat.org/pZ0cK16/url=http:/www.sciencedirect.com/science?_ob=MiamiCaptionURL&_method=retrieve&_udi=B6V8K-4HMNFTC-1&_image=tbl2&_ba=&_user=3546441&_rdoc=1&_fmt=full&_orig=search&_cdi=5873&view=c&_isTablePopup=Y&_acct=C000060832&_version=1&_urlVersion=0&_userid=3546441&md5=87522cd4b87a70aae2339b37983d8f88)

a Market power effects of Closed Physician Hospital Organizations and Fully Integrated Organizations are expected to be larger than Open Physician Hospital Organizations because of physician exclusivity; and the effects are expected to be larger in less competitive hospital markets.

[View Within Article](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl2)

**3. Efficiency**

In this section we examine the effect of integration on hospital costs in order to test the hypothesis that integration improved hospital efficiency. We use data for a sample of non-governmental public, general, acute hospitals from Arizona, Florida, and Wisconsin from 1994 to 1998.[8](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "fn8) The three major sources of data are (i) the American Hospital Association's (AHA) Annual Survey of Hospitals, (ii) hospital-level annual financial data collected by each state agency, and (iii) patient-level annual hospital discharge data. The AHA asks whether the hospital or its system operates an IPA, OPHO, CPHO, or FIO as described above.[9](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "fn9) The AHA survey also provides data on hospital ownership, bedsize, and teaching status. The state hospital-level annual financial data provide income statement and balance sheet information, including hospital operating costs and payer discounts. Finally, the patient-level discharge data can be aggregated to determine hospitals’ total discharge by payer, hospitals’ total patient days by payer, hospital case mix—a measure of patient severity or intensity of care, county-level managed care penetration, and hospital inpatient quality indicators. Summary statistics for all variables used in this and subsequent analyses are reported in [Table 3](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl3).

Table 3.

Descriptive statistics

|  | ***N*** | **Grand mean** | **S.D.** | **Mean 1994** | **Mean 1998** |
| --- | --- | --- | --- | --- | --- |
| Independent Practice Association (=1) | 1257 | 0.11 |  | 0.07 | 0.10 |
| Open Physician Hospital Organization (=1) | 1257 | 0.19 |  | 0.17 | 0.18 |
| Closed Physician Hospital Organization (=1) | 1257 | 0.13 |  | 0.10 | 0.10 |
| Fully Integrated Organization (=1) | 1257 | 0.16 |  | 0.08 | 0.18 |
| Managed care patient price per day ($) | 988 | 1389 | 390 | 1280 | 1444 |
| Indemnity patient price per day ($) | 1148 | 2244 | 279 | 2036 | 2370 |
| Number of managed care patients | 1257 | 1665 | 2686 | 1296 | 2005 |
| Number of indemnity patients | 1201 | 1088 | 1259 | 1199 | 948 |
| Average cost per patient day ($) | 1167 | 1874 | 678 | 1581 | 2165 |
| Average cost per patient ($) | 1167 | 7818 | 2575 | 7244 | 8553 |
| Managed care penetration in county | 1257 | 0.21 | 0.13 | 0.17 | 0.26 |
| Market hospital wage index | 1257 | 1332 | 116 | 1236 | 1416 |
| For-profit hospital (=1) | 1228 | 0.23 |  | 0.24 | 0.22 |
| Hospital located in a MSA (=1) | 1228 | 0.59 |  | 0.60 | 0.60 |
| Teaching hospital (=1) | 1228 | 0.20 |  | 0.17 | 0.20 |
| Hospital has <100 beds (=1) | 1228 | 0.37 |  | 0.34 | 0.36 |
| Hospital has 100–299 beds | 1228 | 0.45 |  | 0.47 | 0.47 |
| Hospital inpatient mortality rate (000s) | 1149 | 0.001 | 0.004 | 0.001 | 0.001 |
| Hospital discretionary procedure rate (000s) | 1214 | 0.076 | 0.053 | 0.071 | 0.073 |
| Hospital surgical complication rate (000s) | 1169 | 0.032 | 0.027 | 0.031 | 0.030 |

[Full-size table](http://wf2dnvr9.webfeat.org/pZ0cK16/url=http:/www.sciencedirect.com/science?_ob=MiamiCaptionURL&_method=retrieve&_udi=B6V8K-4HMNFTC-1&_image=tbl3&_ba=&_user=3546441&_rdoc=1&_fmt=full&_orig=search&_cdi=5873&view=c&_isTablePopup=Y&_acct=C000060832&_version=1&_urlVersion=0&_userid=3546441&md5=82740891cf05e11b1dcc366ff3ae7521)

[View Within Article](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl3)

**3.1. Methods**

We first estimate a Cobb Douglas cost function with hospital-specific fixed effects. The output vector includes the total number of hospital admissions, the average length of stay, the average casemix index of illness severity, and the total number of outpatient visits. Input prices are proxied with the local market hospital wage index. Additional covariates include the total number of beds and an interaction of teaching status and total beds to reflect technology and sophistication. The main effect teaching status is subsumed in the hospital fixed effect.

We include indicators for the vertical integration types to test the transaction costs and economies of scope hypotheses. These indicators measure differences in costs for these organizational types, holding output mix, costs, and technology constant. This assumes that vertical integration has a Hicks neutral effect on efficiency. If the integration measures are found not to be statistically significant when entered as Hicks neutral shift parameters, they are not likely to have an interactive effect and be capital or labor augmenting.

Because the Cobb Douglas cost function imposes parametric restrictions on scale and scope we also estimate a model that that is more flexible in the output space by including squares and interactions of the outputs. Our final model, which is equivalent to a translog specification, includes interactions of outputs and the wage index.

To address the endogeneity of vertical integration all models are estimated with hospital fixed effects that control for other hospital characteristics that are fixed over time. A key methodological concern is that the existence of an integrated entity is not randomly determined across hospitals, but rather is the result of a strategic choice. We provide evidence that this is not the case later in the paper.

In addition, if we have not completely accounted for hospital heterogeneity in the error term, despite using fixed effects, this could lead to potentially incorrect standard errors. To capture heterogeneity in time-series rather than cross-section, the models allow for separate time trends within state. The time indicators are interacted with state indicators to control for time varying changes that are common to all hospital within a state. This will control for regulatory changes, other input prices, and state economic conditions.

**3.2. Results**

The cost function results are shown in [Table 4a](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl4). The results show that hospitals with an integrated organization of any type do not have costs different from unintegrated hospitals. In fact, the integrated organization variables are individually and jointly not statistically significant from zero even at the 10% level. This suggests that there were virtually no gains in efficiency from integrated organizations. The integration measures are found not to be statistically significant when entered as Hicks neutral shift parameters. Consequently, they are not likely to have an interactive effect and be capital or labor augmenting. The other coefficients are significantly different from zero and consistent with behavior one would expect for cost functions, e.g., costs increase with wages.

Table 4a.

Hospital cost functions: full sample

| **ln (operating expenses)** | **Full sample** | | |
| --- | --- | --- | --- |
|  | **(1)** | **(2)** | **(3)** |
| Independent Practice Association (=1) | 0.012 (0.021) | 0.011 (0.021) | 0.011 (0.021) |
| Open Physician Hospital Organization (=1) | 0.023 (0.018) | 0.020 (0.018) | 0.021 (0.018) |
| Closed Physician Hospital Organization (=1) | 0.008 (0.018) | 0.002 (0.018) | 0.001 (0.019) |
| Fully Integrated Organization (=1) | 0.012 (0.017) | 0.019 (0.018) | 0.019 (0.018) |
| ln (total admissions) | 0.314[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn3) (0.045) | 0.073 (0.286) | 1.177 (0.860) |
| ln (average length of stay) | 0.140[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn2) (0.069) | −1.540[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn2) (0.615) | −0.691 (2.820) |
| ln (case mix index) | 0.076[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn2) (0.031) | −0.024 (0.249) | −2.242 (1.906) |
| ln (outpatient visits) | 0.037[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn2) (0.016) | 0.092 (0.173) | −0.741 (0.863) |
| ln (wage index) | 0.0002[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl5fn1) (0.0001) | 0.0002 (0.0001) | 0.0003 (0.0007) |
| ln (total beds) | −0.034 (0.035) | −0.037 (0.035) | −0.037 (0.035) |
| ln (total beds) × teaching | −0.001 (0.008) | −0.002 (0.008) | −0.001 (0.008) |
| ln (total admissions)2 |  | 0.028 (0.018) | 0.027 (0.019) |
| ln (average length of stay)2 |  | 0.140 (0.133) | 0.147 (0.136) |
| ln (case mix index)2 |  | −0.063 (0.067) | −0.070 (0.067) |
| ln (total outpatient visits)2 |  | −0.002 (0.010) | −0.006 (0.010) |
| ln (total admissions) × ln (case mix index) |  | 0.092[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn2) (0.038) | 0.101[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn2) (0.039) |
| ln (total admissions) × ln (average length of stay) |  | 0.002 (0.055) | −0.007 (0.057) |
| ln (total admissions) × ln (outpatient visits) |  | −0.021 (0.023) | −0.016 (0.024) |
| ln (case mix index) × ln (average length of stay) |  | −0.047 (0.141) | −0.079 (0.143) |
| ln (case mix index) × ln (outpatient visits) |  | −0.049 (0.042) | −0.066 (0.043) |
| ln (average length of stay) × ln (outpatient visits) |  | 0.119[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn1) (0.062) | 0.121[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn1) (0.066) |
| ln (total admissions) × ln (wage index) |  |  | −0.155 (0.110) |
| ln (average length of stay) × ln (wage index) |  |  | −0.114 (0.402) |
| ln (case mix index) × ln (wage index) |  |  | 0.331 (0.279) |
| ln (total outpatient visits) × ln (wage index) |  |  | 0.119 (0.122) |
| Constant | 6.910[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn3) (0.419) | 8.815[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn3) (1.590) | 8.532[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn3) (1.823) |
| Test of year × state fixed effects *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn3) |
| Hausman test *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn3) |
| Test of hospital fixed effects *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl5fn3) |
| Sample size | 1066 | 1066 | 1066 |

[Full-size table](http://wf2dnvr9.webfeat.org/pZ0cK16/url=http:/www.sciencedirect.com/science?_ob=MiamiCaptionURL&_method=retrieve&_udi=B6V8K-4HMNFTC-1&_image=tbl4&_ba=&_user=3546441&_rdoc=1&_fmt=full&_orig=search&_cdi=5873&view=c&_isTablePopup=Y&_acct=C000060832&_version=1&_urlVersion=0&_userid=3546441&md5=f5347ad1fe78cab8b2cc6736999b2655)

*Notes*: S.E.s are in parentheses. The outputs variables are measured as patient days in the cost per day models and as patients in the cost per patient models.

\* Indicates that the estimated coefficient is significantly different from zero at 10% level.  
\*\* Indicates the coefficient is significant at 5% level.  
\*\*\* Signifies significance at 1% level.

[View Within Article](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl4)

A potential problem arises because a large number of hospitals had already integrated at the beginning of our sample period. Hospitals that integrated early may have been able to exploit efficiency gains differently from those that integrated later. Consequently, the above results could be driven by differences between early and late adopters. We re-estimated the models excluding hospitals that had already integrated by the first year and those results are reported in the first three columns of [Table 4b](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl5). The results did not change suggesting that there were no differences between early and late adopters.

Table 4b.

Hospital cost functions: excluding hospitals already integrated or disintegrated

| **ln (operating expenses)** | **Excluding hospitals that already integrated** | | | **Excluding hospitals that disintegrated** | | |
| --- | --- | --- | --- | --- | --- | --- |
|  | **(1)** | **(2)** | **(3)** | **(1)** | **(2)** | **(3)** |
| Independent Practice Association (=1) | −0.003 (0.024) | −0.003 (0.024) | −0.002 (0.024) | 0.016 (0.024) | 0.016 (0.024) | 0.015 (0.024) |
| Open Physician Hospital Organization (=1) | 0.009 (0.021) | 0.008 (0.021) | 0.008 (0.021) | 0.025 (0.021) | 0.023 (0.021) | 0.024 (0.021) |
| Closed Physician Hospital Organization (=1) | −0.010 (0.021) | −0.015 (0.021) | −0.013 (0.021) | 0.018 (0.021) | 0.011 (0.021) | 0.011 (0.021) |
| Fully Integrated Organization (=1) | 0.008 (0.018) | 0.015 (0.018) | 0.016 (0.018) | 0.015 (0.019) | 0.020 (0.019) | 0.020 (0.019) |
| ln (total admissions) | 0.347[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) (0.050) | −0.040 (0.325) | 1.288 (1.025) | 0.318[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) (0.049) | 0.275 (0.329) | 1.374 (0.927) |
| ln (average length of stay) | 0.134[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn1) (0.073) | −1.544[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn2) (0.668) | 0.171 (3.294) | 0.162[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn2) (0.076) | −1.372 (0.675) | −0.055 (3.021) |
| ln (case mix index) | 0.060[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn1) (0.032) | 0.070 (0.260) | −1.342 (2.045) | 0.085[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn1) (0.035) | 0.018 (0.270) | −2.566 (2.079) |
| ln (outpatient visits) | 0.037[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn2) (0.017) | 0.065 (0.182) | −1.097 (0.998) | 0.049[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) (0.018) | 0.127 (0.186) | −0.848 (0.942) |
| ln (wage index) | 0.0003[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn1) (0.0002) | 0.0002 (0.0002) | 0.0003 (0.0008) | 0.0002 (0.0001) | 0.0002 (0.0002) | 0.0003 (0.0007) |
| ln (total beds) | −0.099[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn2) (0.039) | −0.101[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn2) (0.039) | −0.103[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) (0.040) | −0.022 (0.038) | −0.023 (0.038) | −0.025 (0.038) |
| ln (total beds) × teaching | 0.001 (0.009) | 0.001 (0.009) | 0.001 (0.009) | 0.000 (0.008) | −0.002 (0.008) | −0.001 (0.008) |
| ln (total admissions)2 |  | 0.034 (0.021) | 0.033 (0.022) |  | 0.025 (0.020) | 0.023 (0.020) |
| ln (average length of stay)2 |  | 0.085 (0.145) | 0.070 (0.146) |  | 0.147 (0.145) | 0.151 (0.148) |
| ln (case mix index)2 |  | −0.064 (0.068) | −0.068 (0.068) |  | −0.087 (0.074) | −0.097 (0.074) |
| ln (total outpatient visits)2 |  | −0.006 (0.010) | −0.009 (0.010) |  | 0.001 (0.011) | −0.003 (0.011) |
| ln (total admissions) × ln (case mix index) |  | 0.108[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) (0.040) | 0.111[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) (0.040) |  | 0.107[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn2) (0.043) | 0.117[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) (0.044) |
| ln (total admissions) × ln (average length of stay) |  | −0.016 (0.057) | −0.034 (0.060) |  | −0.020 (0.061) | −0.024 (0.064) |
| ln (total admissions) × ln (outpatient visits) |  | −0.014 (0.025) | −0.010 (0.025) |  | −0.031 (0.026) | −0.024 (0.027) |
| ln (case mix index) × ln (average length of stay) |  | −0.064 (0.151) | −0.090 (0.152) |  | −0.046 (0.154) | −0.072 (0.158) |
| ln (case mix index) × ln (outpatient visits) |  | −0.069 (0.044) | −0.076[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn1) (0.045) |  | −0.063 (0.046) | −0.084[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn1) (0.048) |
| ln (average length of stay) × ln (outpatient visits) |  | 0.149[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn2) (0.070) | 0.159[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn2) (0.073) |  | 0.119[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn1) (0.067) | 0.123[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn1) (0.072) |
| ln (total admissions) × ln (wage index) |  |  | −0.184 (0.133) |  |  | −0.160 (0.121) |
| ln (average length of stay) × ln (wage index) |  |  | −0.230 (0.467) |  |  | −0.188 (0.431) |
| ln (case mix index) × ln (wage index) |  |  | 0.209 (0.298) |  |  | 0.386 (0.305) |
| ln (total outpatient visits) × ln (wage index) |  |  | 0.166 (0.142) |  |  | 0.138 (0.132) |
| Constant | 6.886[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) (0.467) | 9.555[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) (1.686) | 9.244[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) (1.919) | 6.696[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) (0.455) | 7.569[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) (1.843) | 7.601[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) (2.057) |
| Test of year × state fixed effects *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) |
| Hausman test *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) |
| Test of hospital fixed effects *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl6fn3) |
| Sample size | 961 | 961 | 961 | 978 | 978 | 978 |

[Full-size table](http://wf2dnvr9.webfeat.org/pZ0cK16/url=http:/www.sciencedirect.com/science?_ob=MiamiCaptionURL&_method=retrieve&_udi=B6V8K-4HMNFTC-1&_image=tbl5&_ba=&_user=3546441&_rdoc=1&_fmt=full&_orig=search&_cdi=5873&view=c&_isTablePopup=Y&_acct=C000060832&_version=1&_urlVersion=0&_userid=3546441&md5=88e2bb3e1fb53c1cc05f638dd39c49d7)

*Notes*: S.E.s are in parentheses. The outputs variables are measured as patient days in the cost per day models and as patients in the cost per patient models.

\* Indicates that the estimated coefficient is significantly different from zero at 10% level.  
\*\* Indicates the coefficient is significant at 5% level.  
\*\*\* Signifies significance at 1% level.

[View Within Article](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl5)

Another possible weakness is that we treat hospitals that add and drop integrated organizations symmetrically. We examine whether the results change when hospitals that disintegrate are excluded from the analysis. The results from these analyses are reported in the last three columns of [Table 4b](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl5) and demonstrate that there is no difference between those that add and drop integrated organizations.

**4. Prices and volumes**

To examine the effects of integration on prices and volumes we regress prices and volumes against the integration variables controlling for the wage index, managed care penetration in the county, hospital fixed effects, and year fixed effects that were allowed to differ by state. We exclude Fully Integrated Organizations that also sponsor their own integrated insurance products since the observed price likely reflects an internal transfer price, rather than a market price.

**4.1. Methods**

Payer volumes are measured as the number of patients treated (discharged) in a year and is obtained from the patient-level discharge data. The data contain whether a patient was covered by managed care or indemnity coverage. Total payer volume is the sum of all discharges for a given payer type in the hospital. These variables also are log-transformed due to their skewed distribution.

Prices were constructed in two steps using both states’ hospital financial and discharge data. The first step is to adjust the hospital charge per day for the differing health status of patients across hospitals, by creating a standardized charge for each hospital using the patient-level discharge data. These are obtained for each year by regressing the patients per diem charges on diagnosis related group dummies, length of stay, age dummies, gender, and a fixed effect for each hospital, similar to [Keeler et al. (1999)](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib20). For each year, the analysis then calculates the average predicted price for each hospital using the entire patient sample for all hospitals. This predicted average charge represents the adjusted hospital-specific charge per day or “standardized price”. These standardized prices are calculated for indemnity and managed care payers separately. Due to the skewed nature of the log-scale residuals, prices in this stage were estimated using a generalized linear model with gamma distribution and log link function ([Manning and Mullahy, 2001](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib22)).

The discharge data contain information on a patient's total charge; however, these “charges” are effectively list prices, gross of insurer discounts. Hospital average price discounts are calculated from the annual financial datasets for managed care and indemnity insurers, respectively.[10](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "fn10) To obtain an estimate of transaction prices rather than list prices, the average discounts for managed care and indemnity lines of business are obtained from the financial data and are applied to the standardized charges.

**4.2. Results**

[Table 5](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl6) presents results for managed care prices and managed care patients. The first three columns show results for managed care prices using three different specifications, the next two for the number of managed care patients. The key independent variables are the vertical integration measures. Other independent variables are the area input costs and managed care penetration, hospital fixed effects, year effects, and hospital-year interactions.

Table 5.

Fixed-effects managed care prices and patients models

|  | **Price per day** | | | **ln (patients)** | |
| --- | --- | --- | --- | --- | --- |
|  | **(1)** | **(2)** | **(3)** | **(1)** | **(2)** |
| Independent Practice Association | 11 (53) | 1 (80) |  | 0.02 (0.07) | 0.01 (0.10) |
| Open Physician Hospital Organization | 93[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn1) (41) | 85 (78) | 89[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn1) (39) | 0.14[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn1) (0.06) | 0.16 (0.11) |
| Closed Physician Hospital Organization | 82[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn1) (42) | 372[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) (106) | 368[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) (101) | 0.19[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) (0.06) | 0.13 (0.16) |
| Fully Integrated Organization | −25 (43) | −31 (71) |  | 0.06 (0.06) | 0.09 (0.09) |
| Market hospital wage index | −0.01 (0.31) | 0.10 (0.31) | 0.08 (0.30) | 0.00 (0.00) | 0.00 (0.00) |
| Managed care penetration in county | −424 (386) | −481 (387) | −474 (382) | 4.20[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) (0.54) | 4.23[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) (0.52) |
| Independent Practice Association (Profit) |  | −99 (117) |  |  | 0.17 (0.13) |
| Open Physician Hospital Organization (Profit) |  | 3 (96) |  |  | −0.20 (0.14) |
| Closed Physician Hospital Organization (Profit) |  | −205[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn1) (86) | −193[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn1) (77) |  | −0.18 (0.12) |
| Independent Practice Association (MSA) |  | 78 (106) |  |  | 0.08 (0.15) |
| Open Physician Hospital Organization (MSA) |  | 1 (93) |  |  | 0.02 (0.13) |
| Closed Physician Hospital Organization (MSA) |  | −255[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn1) (112) | −264[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn1) (105) |  | −0.10 (0.16) |
| Fully Integrated Organization (MSA) |  | 9 (85) |  |  | −0.04 (0.11) |
| Constant | 1401[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) (388) | 1256[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) (389) | 1278[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) (386) | 4.76[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) (0.55) | 4.71[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) (0.55) |
| Joint test of year × state fixed effects *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) |
| Hausman test *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) |
| Joint test of hospital fixed effects *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl7fn2) |
| Number of observations | 880 | 880 | 880 | 951 | 951 |

[Full-size table](http://wf2dnvr9.webfeat.org/pZ0cK16/url=http:/www.sciencedirect.com/science?_ob=MiamiCaptionURL&_method=retrieve&_udi=B6V8K-4HMNFTC-1&_image=tbl6&_ba=&_user=3546441&_rdoc=1&_fmt=full&_orig=search&_cdi=5873&view=c&_isTablePopup=Y&_acct=C000060832&_version=1&_urlVersion=0&_userid=3546441&md5=3c63417e0a6e934db08f1fda90af3a4f)

*Note*: S.E.s are in parentheses.

\*Indicates that the estimated coefficient is significantly different from zero at 10% level.

\*\* Indicates the coefficient is significant at 5% level.  
\*\*\* Signifies significance at 1% level.

[View Within Article](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl6)

Columns labeled (1) show the simplest specification. Here, both Open and Closed PHOs had positive and significant effects on managed care prices and volumes as predicted by the market power theories. As IPAs do not exhibit similar increases, there is no evidence that these increased prices results from administrative or Coasian transaction costs savings. The Fully Integrated Organization appears to have no effect on managed care prices and volumes. Further, while wages and managed care penetration does not seem to affect price, managed care penetration does significantly and not surprisingly increase volume. The state-year and hospital fixed effects are jointly significant, and a Hausman test rejects random effects.

The market power theories further predicted that price effects would be greater in less competitive markets. The models in column (2) explore whether the increases in prices and volumes are driven by hospitals that are located in competitive markets by including interactions between the integration variables and whether the hospital was located in an urban, metropolitan statistical area (MSA). The MSA variable is used a proxy for the competitiveness of the market, with MSAs having greater competition than nonMSAs. This permits a test of whether the effect of vertical relationships is associated with the degree of local competition. An *F*-test of the hypothesis that the MSA-integration interactions are jointly zero is rejected at 0.05 level for managed care prices, but not rejected for volume.

Furthermore, the specifications in columns (2) also explore whether ownership type affects the extent to which market power is used. For-profit and nonprofit hospitals may have different capacities to exploit their market power or may have different objective functions that alter the use of that power. Consequently, the models include interactions between the vertical relationship and the for-profit status of the hospitals. This permits a test of whether the effects of vertical relationships are driven by the ownership status of the hospital. An *F*-test of the hypothesis that ownership-integration interactions are jointly zero is rejected at the 0.05 for the price model, but is not rejected for the volume model.

Finally, we estimated parsimonious models that only include the significant interactions. This model for prices is reported in column (3). Since all the interactions where rejected for volume, we take the model in column (1) as the preferred model. Using the price model in column (3) and the volume model is column (1), we calculate the estimated effect of integration on managed care prices and volumes by market and ownership type and report these results in [Table 6](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl7).

Table 6.

Estimated percentage changes in managed care prices and volumes

|  |  | **Prices** | | **Volume** |
| --- | --- | --- | --- | --- |
|  |  | **Nonprofit** | **For-profit** | **For and nonprofit** |
| Open Physician Hospital Organization | NonMSA | 0.06[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl8fn1) (0.03) | 0.06[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl8fn1) (0.03) | 0.14[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl8fn2) (0.06) |
|  | MSA | 0.06[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl8fn1) (0.03) | 0.06[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl8fn1) (0.03) | 0.14[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl8fn2) (0.06) |
|  | | | | |
| Closed Physician Hospital Organization | NonMSA | 0.26[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl8fn2) (0.07) | 0.13[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl8fn1) (0.06) | 0.19[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl8fn2) (0.06) |
|  | MSA | 0.07[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl8fn1) (0.04) | 0.04 (0.04) | 0.19[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl8fn2) (0.06) |

[Full-size table](http://wf2dnvr9.webfeat.org/pZ0cK16/url=http:/www.sciencedirect.com/science?_ob=MiamiCaptionURL&_method=retrieve&_udi=B6V8K-4HMNFTC-1&_image=tbl7&_ba=&_user=3546441&_rdoc=1&_fmt=full&_orig=search&_cdi=5873&view=c&_isTablePopup=Y&_acct=C000060832&_version=1&_urlVersion=0&_userid=3546441&md5=5ebc845d495af134d65041ea0b29a245" \o "Full-size table - Opens new window)

*Note*: S.E.s are in parentheses.

\*Indicates that the estimated coefficient is significantly different from zero at 10% level.

\*\* Indicates the coefficient is significant at 5% level.  
\*\*\* Signifies significance at 1% level.

[View Within Article](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl7)

The results indicate that OPHOs have prices that are about 6% higher than unintegrated hospitals and these differences do not vary with ownership or market. The CPHOs show similar price increases as the OPHOs in competitive (MSA) markets. However, CPHOs obtain two to four times the price increase of OPHOs in the less competitive (nonMSA) markets. This is consistent with market power theoretical predictions that price effects would be greatest for exclusive arrangements in less competitive markets. With regard to volumes, both Open and Closed PHOs have larger volumes than unintegrated hospitals, with the Closed type getting about one-quarter more than the Open type. Overall, the results suggest that Open and Closed PHOs have market power that results in higher managed care prices and volumes.

Results for indemnity prices and volumes are presented in [Table 7](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl8) in a similar fashion to the managed care results in [Table 5](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl6). Similar to the managed care results, Open and Closed PHOs have higher indemnity prices than unintegrated hospitals, which is consistent with the market power theories. Moreover, the MSA-integration and ownership-integration interactions as reported in column (2) are both jointly significant. The parsimonious version of the interactions model is reported in column (3). While there seem to be positive price effects, all forms of integration have the same volume of indemnity patients as unintegrated hospitals in both the simple and interacted models.

Table 7.

Fixed-effects indemnity prices and patients models

|  | **Price per day** | | | **ln (patients)** | |
| --- | --- | --- | --- | --- | --- |
|  | **(1)** | **(2)** | **(3)** | **(1)** | **(2)** |
| Independent Practice Association | 58 (62) | 3 (85) |  | −0.01 (0.06) | 0.12 (0.08) |
| Open Physician Hospital Organization | 161[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) (53) | 34 (90) |  | −0.00 (0.05) | −0.03 (0.09) |
| Closed Physician Hospital Organization | 128[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) (54) | 263[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn2) (109) | 245[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn2) (103) | 0.07 (0.05) | −0.11 (0.11) |
| Fully Integrated Organization | 86[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl9fn1) (52) | 33 (71) |  | −0.05 (0.05) | 0.03 (0.07) |
| Market hospital wage index | 0.50 (0.41) | 0.38 (0.40) | 0.36 (0.40) | 0.00 (0.00) | 0.00 (0.00) |
| Managed care penetration in county | −60 (466) | −56 (459) | −15.6 (456) | −1.45[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) (0.44) | −1.38[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) (0.44) |
| Independent Practice Association (Profit) |  | −99 (134) |  |  | −0.18 (0.13) |
| Open Physician Hospital Organization (Profit) |  | 596[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) (122) | 632[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) (106) |  | −0.14 (0.13) |
| Closed Physician Hospital Organization (Profit) |  | 363[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) (112) | 395[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) (110) |  |  |
|  | −0.16 (0.11) |  |  |  |  |
| Independent Practice Association (MSA) |  | 171 (123) |  |  | −0.18 (0.12) |
| Open Physician Hospital Organization (MSA) |  | 21 (111) |  |  | 0.06 (0.11) |
| Closed Physician Hospital Organization (MSA) |  | −240[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn2) (120) | −280[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn2) (112) |  | 0.15 (0.12) |
| Fully Integrated Organization (MSA) |  | 46 (95) |  |  | −0.13 (0.09) |
| Constant | 1295[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn2) (511) | 1447[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) (504) | 1473 (503) | 7.28[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn2) (0.50) | 7.23[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) (0.50) |
| Joint test of year × state fixed effects *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) |
| Hausman test *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) |
| Joint test of hospital fixed effects *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl9fn3) |
| Number of observations | 1059 | 1059 | 1059 | 1113 | 1113 |

[Full-size table](http://wf2dnvr9.webfeat.org/pZ0cK16/url=http:/www.sciencedirect.com/science?_ob=MiamiCaptionURL&_method=retrieve&_udi=B6V8K-4HMNFTC-1&_image=tbl8&_ba=&_user=3546441&_rdoc=1&_fmt=full&_orig=search&_cdi=5873&view=c&_isTablePopup=Y&_acct=C000060832&_version=1&_urlVersion=0&_userid=3546441&md5=72e76fece6bb52b0421a50b77af6a09c)

*Note*: S.E.s are in parentheses.

\* Indicates that the estimated coefficient is significantly different from zero at 10% level.  
\*\* Indicates the coefficient is significant at 5% level.  
\*\*\* Signifies significance at 1% level.

[View Within Article](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl8)

Finally, using the price model in column (3), we calculate the estimated percentage effect of integration on indemnity prices and volumes and report these results in [Table 8](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl9) by market and ownership type. The results indicate that for-profit Open PHOs have prices that are about 18% higher than unintegrated hospitals and these differences do not vary with market. The Closed PHOs show similar price increases as the Open PHOs in competitive (MSA) markets. However, Closed PHOs obtain higher price increases than Open PHOs in the less competitive (nonMSA) markets. This is consistent with market power theoretical predictions that price effects would be greatest for exclusive arrangements in less competitive markets.

Table 8.

Estimated percentage changes in indemnity prices and volumes

|  |  | **Prices** | | **Volume** |
| --- | --- | --- | --- | --- |
|  |  | **Nonprofit** | **For-profit** | **For and nonprofit** |
| Open Physician Hospital Organization | NonMSA | 0 | 0.18[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl10fn1) (0.05) | 0 |
|  | MSA | 0 | 0.18[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl10fn1) (0.05) | 0 |
|  | | | | |
| Closed Physician Hospital Organization | NonMSA | 0.11[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl10fn1) (0.05) | 0.29[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl10fn1) (0.06) | 0 |
|  | MSA | 0 | 0.16[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl10fn1) (0.05) | 0 |

[Full-size table](http://wf2dnvr9.webfeat.org/pZ0cK16/url=http:/www.sciencedirect.com/science?_ob=MiamiCaptionURL&_method=retrieve&_udi=B6V8K-4HMNFTC-1&_image=tbl9&_ba=&_user=3546441&_rdoc=1&_fmt=full&_orig=search&_cdi=5873&view=c&_isTablePopup=Y&_acct=C000060832&_version=1&_urlVersion=0&_userid=3546441&md5=1450440abc288864bd6e078ee7e2ed68" \o "Full-size table - Opens new window)

*Note*: S.E.s are in parentheses.

\*Indicates that the estimated coefficient is significantly different from zero at 10% level.

\*\*Indicates the coefficient is significant at 5% level.

\*\*\* Signifies significance at 1% level.

[View Within Article](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl9)

As discussed in the cost function analysis, there are two potential problems with our data. First, a number of hospitals had already integrated by the beginning of our sample period and they may be different from hospitals that integrated during our sample period. Second, our analysis so far treats hospitals that add and drop integrated organizations symmetrically. To test the robustness of the findings, we reestimated the price and volume models first excluding the hospitals that were integrated at the beginning of our sample period and second excluding the hospitals that disintegrated during our sample period. While the reduction in sample size creates some sparse cells for the interactions, our primary results and conclusions appear to be robust to these concerns. In these models we still find that integrated organizations had higher prices and that the differences where greater in exclusive organizations and in small markets.[11](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "fn11)

**5. Quality**

The transactions cost economies and economies of scope theories predict that quality of patient care could rise if physicians and hospitals are better able to coordinate the clinical process of patient care across settings. These changes are more likely to occur among the more integrated relationships, because these organizations are better able to implement the institutions necessary to change the process of patient care.

An understanding of how quality changes as a result of integration is important from the perspective of both market power and efficiency theories ([Gaynor and Haas-Wilson, 1999](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib16)). While it is possible that higher prices are the result of greater bargaining power from vertical integration, it is also possible that they reflect higher quality. If the observed price increases are associated with quality improvements, this is consistent with hospitals attempting to appeal to managed care firms that selectively contract with quality providers. Observing higher prices without changes in quality is consistent with a finding of market power.

The quality analysis also is important for drawing conclusions about efficiency gains. The cost analyses alone cannot separate the effects of cost changes due to production efficiency from cost changes due to changes in quality. The lack of findings regarding costs may be due to offsetting effects of simultaneously experiencing greater efficiency and higher quality. If we observe quality improvement with no change in costs, this is evidence of overall improvements in efficiency, while no quality improvement paired with no cost changes implies no efficiency effects.

**5.1. Methods**

Three quality measures were created from the patient-level discharge data[12](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "fn12): (1) rates of inpatient-mortality following certain hospital conditions and procedures, (2) rates of procedures considered overused, and (3) patient safety indicators.[13](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "fn13) The mortality indicators include procedures and conditions for which evidence suggests that high mortality rates may reflect deficiencies in quality of care. The patient safety indicators encompass twenty potential in-hospital complications and adverse events following surgeries, procedures, and childbirth. Previous research has shown that that similar quality indicators are sensitive to changes in financial incentives for hospitals ([Ho and Hamilton, 2000](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib19)). We test whether they rise or fall with changes in organizational integration.

Our dependent variable is the proportion of adverse events in each hospital by type. Similar to our measure of price we adjust for differing patient characteristics across hospitals using the patient-level discharge data. Quality measures are examined separately for managed care and indemnity patients. We use fixed effects models at the hospital level. Our key independent variables are the integration indicators.

**5.2. Results**

[Table 9](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl10) and [Table 10](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl11) present the quality regression results for managed care patients and indemnity patients, respectively. Columns labeled (1) show the average effects of integration on quality while columns labeled (2) use the parsimonious specification from the price analyses to examine whether these effects vary by hospital ownership or by local competitiveness (MSA area). A Hausman test of a random versus fixed effects does not reject that the coefficients are systematically different for the patient safety models. Nonetheless, the statistical significance of the integration variables does not change appreciably in the random effects model. For ease of comparison we show the fixed effect results for all quality indicators.

Table 9.

Quality measures for managed care patients

|  | **Utilization** | | **Mortality** | | **Patient safety** | |
| --- | --- | --- | --- | --- | --- | --- |
|  | **(1)** | **(2)** | **(1)** | **(2)** | **(1)** | **(2)** |
| Independent Practice Association | −0.0013 (0.0078) | −0.0003 (0.0078) | −0.0075 (0.0068) | −0.0079 (0.0069) | −0.0007 (0.0072) | −0.0007 (0.0072) |
| Open Physician Hospital Organization | −0.0080 (0.0061) | −0.0109 (0.0067) | 0.0016 (0.0054) | 0.0045 (0.0060) | −0.0070 (0.0057) | −0.0061 (0.0063) |
| Closed Physician Hospital Organization | 0.0062 (0.0063) | −0.0037[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn1) (0.0168) | −0.0013 (0.0055) | −0.0053 (0.0136) | −0.0022 (0.0058) | −0.0229 (0.0145) |
| Fully Integrated Organization | −0.0030 (0.0063) | −0.0034 (0.0063) | −0.0112[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn1) (0.0055) | −0.0109[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn1) (0.0055) | −0.0024 (0.0058) | −0.0019 (0.0058) |
| Market hospital wage | −0.00009[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn1) (0.00004) | −0.0001[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn1) (0.00004) | 0.00002 (0.00004) | 0.0000 (0.0000) | −0.0000 (0.0000) | −0.0000 (0.0000) |
| Managed care penetration | −0.0648 (0.0540) | 0.0687 (0.0537) | −0.0322 (0.0474) | 0.0310 (0.0476) | −0.0076 (0.0502) | 0.0100 (0.0503) |
| Open Physician Hospital Organization (for-profit) |  | 0.0164 (0.0136) |  | −0.0121 (0.0121) |  | −0.0030 (0.0129) |
| Closed Physician Hospital Organization (for-profit) |  | 0.0280[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn1) (0.0125) |  | 0.0012 (0.0110) |  | 0.0046 (0.0118) |
| Closed Physician Hospital Organization (MSA) |  | 0.0405[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn1) (0.0172) |  | 0.0033 (0.0140) |  | 0.0225 (0.0150) |
| Constant | 0.3214[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn2) (0.059) | 0.3322[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn2) (0.0585) | 0.0112 (0.0512) | 0.0130 (0.0517) | 0.0631 (0.0544) | 0.0674 (0.0548) |
| Joint test of year × state fixed effects *P*-value | 0.04[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn1) | 0.02[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn1) | 0.92 | 0.89 | 0.89 | 0.91 |
| Hausman test *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn2) | 0.29 | 0.22 |
| Joint test of hospital fixed effects *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn2) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl11fn2) | 0.32 | 0.32 |
| Observations | 858 | 858 | 880 | 880 | 895 | 895 |

[Full-size table](http://wf2dnvr9.webfeat.org/pZ0cK16/url=http:/www.sciencedirect.com/science?_ob=MiamiCaptionURL&_method=retrieve&_udi=B6V8K-4HMNFTC-1&_image=tbl10&_ba=&_user=3546441&_rdoc=1&_fmt=full&_orig=search&_cdi=5873&view=c&_isTablePopup=Y&_acct=C000060832&_version=1&_urlVersion=0&_userid=3546441&md5=b0e4f10fa2d173774715d3d583b0c4cd)

*Note*: S.E.s are in parentheses.

\*Indicates that the estimated coefficient is significantly different from zero at 10% level.

\*\* Indicates the coefficient is significant at 5% level.  
\*\*\* Signifies significance at 1% level.

[View Within Article](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl10)

Table 10.

Quality measures for indemnity patients

|  | **Utilization** | | **Mortality** | | **Patient safety** | |
| --- | --- | --- | --- | --- | --- | --- |
|  | **(1)** | **(2)** | **(1)** | **(2)** | **(1)** | **(2)** |
| Independent Practice Association | −0.0092 (0.0106) | −0.0095 (0.0107) | 0.0142 (0.0053) | 0.0148[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn3) (0.0053) | −0.0076 (0.0091) | −0.0083 (0.0091) |
| Open Physician Hospital Organization | −0.0173[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn2) (0.0087) | −0.0133 (0.0094) | 0.0013 (0.0046) | 0.0018 (0.0051) | 0.0020 (0.0079) | −0.0049 (0.0085) |
| Closed Physician Hospital Organization | 0.0013 (0.0089) | −0.0134 (0.0188) | 0.0046 (0.0047) | −0.0071 (0.0093) | 0.0036 (0.0081) | −0.0117 (0.0159) |
| Fully Integrated Organization | −0.0084 (0.0082) | −0.0086[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn2) (0.0082) | −0.0023 (0.0044) | −0.0016 (0.0044) | −0.0026 (0.0074) | −0.0049 (0.0074) |
| Market hospital wage | −0.0001 (0.00006) | −0.00012[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn1) (0.00007) | 0.0000 (0.0000) | −0.0000 (0.0000) | 0.00011[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn1) (0.00006) | 0.0001 (0.0001) |
| Managed care penetration | −0.0529 (0.0733) | −0.0498[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn1) (0.0733) | 0.0424 (0.0391) | 0.0467 (0.0391) | −0.0548 (0.0672) | −0.0584 (0.0667) |
| Open Physician Hospital Organization (for-profit) |  | −0.0159 (0.0203) |  | −0.0036 (0.0109) |  | 0.0504[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn2) (0.0188) |
| Closed Physician Hospital Organization (for-profit) |  | 0.0306[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn1) (0.0186) |  | −0.0064 (0.0101) |  | 0.0716[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn3) (0.0175) |
| Closed Physician Hospital Organization (MSA) |  | 0.0067 (0.0201) |  | 0.0172[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn1) (0.0101) |  | −0.0002 (0.0172) |
| Constant | 0.3764[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn3) (0.0865) | 0.3907[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn3) (0.0869) | −0.0505 (0.0457) | 0.0478 (0.0460) | −0.1135 (0.0779) | −0.0821[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn1) (0.0775) |
| Joint test of year × state fixed effects *P*-value | 0.00[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn2) | 0.00[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn2) | 0.49 | 0.46 | 0.16 | 0.28 |
| Hausman test *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn3) | 0.94 | 0.16 |
| Joint test of hospital fixed effects *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn3) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl12fn3) |
| Observations | 997 | 997 | 1080 | 1080 | 1077 | 1077 |

[Full-size table](http://wf2dnvr9.webfeat.org/pZ0cK16/url=http:/www.sciencedirect.com/science?_ob=MiamiCaptionURL&_method=retrieve&_udi=B6V8K-4HMNFTC-1&_image=tbl11&_ba=&_user=3546441&_rdoc=1&_fmt=full&_orig=search&_cdi=5873&view=c&_isTablePopup=Y&_acct=C000060832&_version=1&_urlVersion=0&_userid=3546441&md5=6777d7f2bc8da02680c725e05ca4f81f)

*Note*: S.E.s are in parentheses.

\* Indicates that the estimated coefficient is significantly different from zero at 10% level.  
\*\* Indicates the coefficient is significant at 5% level.  
\*\*\* Signifies significance at 1% level.

[View Within Article](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl11)

Hospitals with IPAs exhibited no improvements in the quality measures. In fact, mortality increased for indemnity patients. Closed PHOs reduced overused procedures for managed care patients, while Open PHOs reduced overused procedures for indemnity patients. This means that a portion of the higher price in hospitals in CPHOs may be due to modestly higher quality and not bargaining power alone. However, the effect is no larger in less competitive (MSA) markets where there the price is higher nor is it different by ownership status. This and lack of improvement formortality and patient safety quality measures suggest that this effect on price is likely to be small. Therefore, we conclude that quality improvement does not explain much if any of the higher prices for CPHOs.

Fully Integrated Organizations are associated with improvements in the mortality measure for managed care. The coefficient is negative, but not significant, for indemnity patients. Unlike the CPHOs, the FIOs experienced these quality improvements without associated price gains.

**6. Integration**

In the previous sections we examined the effect of vertical integration on hospital performance. Our identification strategy is to take advantage of the panel nature of the data and use fixed effects to control for unobserved hospital and market characteristics that might confound the estimated impacts. The fixed effects specification essentially compares the change in outcomes in hospitals that integrate to the change in the outcome of comparison hospitals that do not integrate over the same period of time. Fixed effects control for unobservable characteristics that are constant over time. If some hospitals choose to integrate as a response to managed care and unobserved fixed factors, then fixed effects estimates are consistent. A key methodological concern is that the existence of an integrated entity is not randomly determined across hospitals, but rather is the result of a strategic choice.

If integration is driven by time varying idiosyncratic shocks, then the fixed effects strategy breaks down. Such time-varying shocks could be market-wide, such as managed care penetration or input costs. They could also be hospital-specific, such as productivity or cost shocks or firm-specific demand or technology shocks that improve quality but are not captured in the cost measures. While market demand shocks are not captured through fixed effects, they are in part controlled for using observed market changes, such as managed care penetration, wage index variables, and time dummies. We are not able to control for hospital-specific productivity shocks, which could be a problem if they drive organizational change.

We view integration as a response to the rise of managed care. As managed care penetrates into a market, those providers that think they are most likely to capitalize from integration will be the ones to choose this strategy. Whether providers respond by integrating depends in part on (partially) unobservable factors such managerial ability, competitive strategy, and technology. These unobserved characteristics are probably correlated with performance, i.e., costs, quantities, prices, and quality. Consequently, we might falsely attribute performance differences estimated from cross-sectional analyses to integration when, in fact, performance reflects these underlying but unobserved organizational abilities.

**6.1. Methods**

In order to better understand what drives integration and to evaluate our fixed effects strategy, we investigate the empirical determinants of integration. We estimate a first-order Markov transition model of change of organization type. The model estimates the determinants of the probability that a hospital transitions from one organizational type into another. This model can be estimated using a multinomial logit where the dependent variable is the state to which the hospital transitioned, as a function of its previous state and other covariates ([Amemiya, 1985](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib2)).

The other covariates include measures of the importance of managed care, productivity shocks, and hospital and market characteristics. To examine the role of managed care in integration decisions we include three covariates: (i) lagged managed care penetration into the county in which the hospital is located to account for the size of the managed care market, (ii) lagged change in managed care penetration to account for whether the managed care market is growing, and (iii) lagged share of the hospital's patients who are enrolled in managed care to account for the importance of managed care to the hospital. To examine whether integration is driven by productivity shocks we include the lagged change in average cost per day. The characteristics include, bed size, teaching status, ownership status, whether the hospital is located in a metropolitan statistical area (MSA), and a market hospital wage index.

[Table 11](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl12) presents a transition matrix showing the proportion of hospitals that switch from one type of vertical relationship (including none) to another. An observation is a hospital in a given year. Over the sample period, more than one-quarter of the observations changed their organizational status. Notice that while there are a substantial number of hospitals that transition into more integrated organizational forms, there is also a large number of hospitals that transition into less integrated states.

Table 11.

Transitions in hospital–physician organizational integration 1994–98[a](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl13fn1)

| **Change from** | **Change to** | | | | | |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Not integrated** | **Independent Practice Association** | **Open Physician Hospital Organization** | **Closed Physician Hospital Organization** | **Fully Integrated Organization** | **Total** |
| Not integrated | 257 (0.30) | 15 (0.02) | 26 (0.03) | 19 (0.02) | 50 (0.06) | 367 (0.42) |
| Independent Practice Association | 15 (0.02) | 60 (0.07) | 3 (0.00) | 2 (0.00) | 9 (0.01) | 89 (0.10) |
| Open Physician Hospital Organization | 18 (0.03) | 4 (0.00) | 125 (0.14) | 9 (0.01) | 7 (0.01) | 163 (0.19) |
| Closed Physician Hospital Organization | 8 (0.01) | 3 (0.00) | 10 (0.01) | 75 (0.09) | 6 (0.01) | 102 (0.12) |
| Fully Integrated Organization | 37 (0.04) | 9 (0.01) | 3 (0.00) | 2 (0.00) | 99 (0.11) | 150 (0.17) |
| Total | 335 (0.38) | 91 (0.10) | 167 (0.19) | 107 (0.12) | 171 (0.17) | 871 (1.00) |

[Full-size table](http://wf2dnvr9.webfeat.org/pZ0cK16/url=http:/www.sciencedirect.com/science?_ob=MiamiCaptionURL&_method=retrieve&_udi=B6V8K-4HMNFTC-1&_image=tbl12&_ba=&_user=3546441&_rdoc=1&_fmt=full&_orig=search&_cdi=5873&view=c&_isTablePopup=Y&_acct=C000060832&_version=1&_urlVersion=0&_userid=3546441&md5=f92dd8efb510a18cc681cf2d159ea453)

a Total number of off diagonal changes = 255.

[View Within Article](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl12)

**6.2. Results**

[Table 12](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl13) presents the estimation results. The results are consistent with the hypothesis that integration is a response to managed care. Specifically, hospitals in high managed care markets, in markets with high managed care growth, and with high-managed care dependence are more likely to integrate. Another important result is that the measure of idiosyncratic productivity shocks in not a significant predictor of adopting any of these types of integration (fourth row). These results lend support for the use of fixed effects to control for unobserved heterogeneity bias. The formation of the Fully Integrated Organization (FIO) is somewhat different because nonprofit, teaching hospitals are the ones most likely to form FIOs. In fact, there are no for-profit FIOs in the data set. It is likely that these hospitals are large nonprofit research and teaching institutions. This suggests that these hospitals may be integrating for other reasons. We will test this hypothesis by examining the effect of integration on other performances measures, such as the quality of care.

Table 12.

Markov transition model of organizational adoption (*N* = 541)

|  | **Transition to** | | | |
| --- | --- | --- | --- | --- |
|  | **IPA** | **Open PHO** | **Closed PHO** | **Fully integrated** |
| Lagged change in managed care penetration in county in which hospital is located | 16.64 (10.22) | 5.98 (14.54) | 17.94[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl14fn3) (6.84) | 13.21[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl14fn1) (7.78) |
| Lagged managed care penetration in county in which hospital is located | 6.55 (5.16) | −0.06 (2.66) | 0.92 (3.46) | −2.89 (3.22) |
| Lagged managed care share of hospital's patients | −4.84 (4.90) | 5.38[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl14fn3) (1.60) | 0.63 (2.50) | −0.02 (2.27) |
| Lagged change in average cost per patient | 0.02 (0.05) | 0.08 (0.06) | −0.08 (0.06) | −0.02 (0.10) |
| County hospital wage index | −0.01 (0.01) | −0.01 (0.00) | −0.00 (0.00) | 0.00 (0.00) |
| Hospital is located in a MSA (=1) | 0.67 (0.81) | 1.44 (1.04) | 0.50 (0.94) | −0.12 (0.80) |
| Teaching hospital (=1) | −42.36[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl14fn2) (0.89) | 0.01 (0.82) | −0.18 (0.69) | 1.54[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl14fn1) (0.83) |
| Small hospital with less than 100 beds (=1) | −0.62 (1.05) | 2.55 (1.37) | −1.47[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl14fn2) (0.75) | −0.35 (0.93) |
| Medium size hospital with 100–299 beds (=1) | −1.74[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl14fn1) (1.05) | 1.94 (1.02) | −0.58 (0.56) | 1.01 (0.79) |
| For profit hospital (=1) | 0.35 (0.80) | −0.53 (0.78) | 0.43 (0.64) | −42.10[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl14fn3) (0.47) |
| Transition from Independent Practice Assciation (=1) |  | 0.62 (1.23) | −0.26 (0.82) | 1.38[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl14fn2) (0.67) |
| Transition from Open PHO (=1) | 0.13 (0.91) |  | −0.48 (0.64) | −1.02 (0.98) |
| Transition from Closed PHO (=1) | 0.58 (1.00) | 2.16[\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl14fn2) (0.85) |  | 0.11 (0.67) |
| Transition from Fully Integrated Organization (=1) | 1.27[\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl14fn1) (0.70) | 0.74 (1.09) | −1.22 (0.84) |  |
| Constant | 12.67 (10.86) | −0.46 (4.75) | 2.82 (3.67) | −5.46 (5.13) |

[Full-size table](http://wf2dnvr9.webfeat.org/pZ0cK16/url=http:/www.sciencedirect.com/science?_ob=MiamiCaptionURL&_method=retrieve&_udi=B6V8K-4HMNFTC-1&_image=tbl13&_ba=&_user=3546441&_rdoc=1&_fmt=full&_orig=search&_cdi=5873&view=c&_isTablePopup=Y&_acct=C000060832&_version=1&_urlVersion=0&_userid=3546441&md5=e268ad3d47c5a1b49deec559801a4955)

*Notes*: S.E.s are in parentheses. For the Fully Integrated option, the *F*-statistic for the joint significance of the three managed care variables is 3.08 and is not significant at the 10% level.

\* Indicates that the estimated coefficient is significantly different from zero at 10% level.  
\*\* Indicates the coefficient is significant at 5% level.  
\*\*\* Signifies significance at 1% level.

[View Within Article](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "tbl13)

**7. Conclusions**

In this paper, we argue that the recent wave of hospital–physician integration is a strategic response to counter the rising monopsony power of managed care and is one of the sources of the recent increase in health care costs. The empirical evidence indeed demonstrates that most of the forms of hospital–physician integration occurred in markets where managed care grew rapidly. Moreover, we find strong support for the market power explanations and little support for the transaction costs economies explanations of hospital–physician integration. Specifically, we find that integrated organizations have higher prices than stand-alone hospitals and that the differences are larger for exclusive arrangements and in less competitive markets. However, we found that integrated organizations are no more efficient than stand-alone hospitals.

There is one notable exception. Large nonprofit teaching hospitals were more likely to form Fully Integrated Organizations. The FIOs do not have higher prices or lower costs than stand-alone hospitals. However, they do provide higher quality care than stand-alones and the other forms of integrated organizations.

Whether a hospital is located in an MSA is only a gross proxy for competitiveness. Market definition, particularly for antitrust cases, has been the subject of much nuanced research and controversy, as it relates directly to the required calculation of competition indices. MSA status, as used here, may proxy for demographic characteristics and epidemiological conditions. Without a doubt, however, large markets are more competitive than small markets on average.

Another limitation of our analysis is that we only investigate the effect of integration on hospital performance and not on primary care performance. It is possible that cost savings occurred in the physician sector and are not captured here. Physician prices may have changed in ways that we cannot measure, in response to changes in the bargaining with health plans after integration. However, from the standpoint of health plans hospital expenditures constitute the lion's share of inpatient expenditures.

Nonetheless, the findings have important implications for public policy and how vertical integration between hospitals and physicians is viewed. This study provides evidence to support efforts by antitrust policymakers to more closely scrutinize hospital–physician integration, and public programs, such as Medicare and Medicaid, should reconsider their policies that promote hospital–physician integration.

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**Appendix A.**

Fixed effects estimates of exclusive physicians (*N* = 546)

| **Number of MDs exclusive to hospital** | **Coefficient** | **S.E.** |
| --- | --- | --- |
| Independent Practice Association | −7.64 | 8.00 |
| Open Physician Hospital Association | 2.09 | 7.44 |
| Closed Physician Hospital Association | 16.40 | 5.95[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl1fn1) |
| Fully Integrated Organization | 0.03 | 7.55 |
| Market hospital wage index | −0.04 | 0.05 |
| Managed care penetration in county | 121.48 | 80.31 |
| Constant | 101.75 | 62.02 |
| Joint test of year × state fixed effects *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl1fn1) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl1fn1) |
| Hausman test *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl1fn1) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl1fn1) |
| Joint test of fixed effects *P*-value | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl1fn1) | 0.00[\*\*\*](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#tbl1fn1) |

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*Notes*: S.E.s are in parentheses.

\*Indicates that the estimated coefficient is significantly different from zero at 10% level.

\*\*Indicates the coefficient is significant at 5% level.

\*\*\* Signifies significance at 1% level.

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[2](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bfn2) One study in the railroad industry finds support for foreclosure effects ([Grimm et al., 1992](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib18)); studies of stock market responses to vertical integration announcements in the beer and steel industries find conflicting results ([Mullin and Mullin, 1997](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib24) and [Snyder, 1996](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib36)); and a recent study of vertical integration between programming and distribution in the cable television industry that finds evidence of both exclusionary effects and efficiency gains ([Chipty, 2001](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib11)).  
[3](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bfn3) At the same time that managed care expanded, indemnity insurers also started trying to negotiate discounted rates putting further pressure on providers.  
[4](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bfn4) Under capitation, managed care plans pay a provider a fixed fee per insured person per month and the provider is at risk for the cost of care should the person become ill. Capitation provides an incentive for providers to keep the cost of care to a minimum.  
[5](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bfn5) Other forms of prospective payment include paying a fixed fee to treat an illness such as Medicare Diagnostic Related Groups.  
[6](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bfn6) There is a large literature describing the pathways by which hospital–physician integration might be able to improve efficiency and quality. For example see [Burns and Thorpe (1993)](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib9), [Morrisey et al. (1996)](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib23), [Robinson and Casalino (1996)](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib32), [Robinson (1997)](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib29), and [Snail and Robinson (1998)](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib34).  
[7](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bfn7) Empirical studies of the effect of hospital–physician integration on hospital costs and profits include [Alexander and Morrisey (1988)](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib1), [Conrad and Shortell (1996)](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib12), [Dynan et al. (1992)](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib13), and [Project Hope (1996)](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib27).  
[8](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bfn8) Public hospitals, specialty hospitals (e.g., psychiatric) and those with less than 100 discharges are excluded.  
[9](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bfn9) We attempted to validate the measures of integration using Florida patient discharge data. These data provide individual physician identifiers and allows us to identify whether a physician admits exclusively to one hospital or not. We were able to calculate the proportion of physicians who operate exclusively in a given hospital using the Florida discharge data. We defined a physician as admitted exclusively to a given hospital if 90% or more of his or her patients were admitted there. Then, we regressed the number of physicians who operate exclusively in a given hospital on the integration measures with controls and hospital fixed effects (see [Appendix A](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm#app1)). We find that the number of physicians with an exclusive relationship with the hospital significantly increases for hospitals that report adopting an exclusive physician arrangement, but not for hospitals that adopt nonexclusive arrangements. The results were robust to changes in our physician measure (80% of patients and 70% of patients). While not prefect, this suggests that the AHA exclusive categorizations are consistent with the micro data in Florida. We did not have similar data for the other states.  
[10](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bfn10) For each payer, the average discount is calculated as total charges less total discounts divided by total charges.  
[11](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bfn11) The results of these analyses are available from the authors upon request.  
[12](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bfn12) We used quality indicators developed by the “Healthcare Cost and Utilization Project”. The HCUP was intended to develop standardized, user-friendly quality indicators that could be calculated from available patient-level discharge data as used in this project ([AHRQ, 2003](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bib3)).  
[13](http://members.cox.net/mshachar/Cuellar_2006_via_TUI.htm" \l "bfn13) Mortality Rates for Conditions and Procedures are combined and include acute myocardial infarction, congestive heart failure, gastrointestinal hemorrhage, hip fracture, pneumonia, stroke, abdominal aortic aneurysm repair, coronary artery bypass graft, craniotomy esophageal resection, hip replacement, pancreatic resection, and pediatric heart surgery. The procedures utilization rates combine three procedures, cesarean section delivery; incidental appendectomy in the elderly; and bi-lateral cardiac catheterization. Patient safety indicators include accidental puncture and laceration, birth trauma—injury to neonate, complications of anesthesia, death in low mortality DRGs, decubitus ulcer, failure to rescue, foreign body left in during procedure, iatrogenic pneumothorax, obstetric trauma—cesarean delivery, obstetric trauma—vaginal delivery with instrument, obstetric trauma—vaginal delivery without instrument, postoperative hemorrhage or hematoma postoperative hip fracture, postoperative physiologic and metabolic derangements, postoperative pulmonary embolism or deep vein thrombosis, postoperative respiratory failure, postoperative sepsis, postoperative wound dehiscence in abdominopelvic surgical patients, selected infections due to medical care, and transfusion reaction. Because in some cases many patients are at risk for these conditions, random samples were drawn for large hospitals, leading to a maximum sample of 10,000 discharges per hospital in the analysis.

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