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DOES ORGANIZATIONAL FORM AFFECT INVESTMENT DECISIONS?*

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I investigate whether organizational changes affect investment decisions using evidence from the hospital industry in the United States. During the 1990s, hospitals and physicians have reorganized the way they trade with each other, vertically consolidating the provision of healthcare services. I provide empirical evidence that hospitals adopting the new organizational forms add more healthcare services over time than hospitals that are independent of their physicians. I also find that when the average percentage of county population covered by each HMO increases, the differences in investment behavior between vertically consolidated and independent hospitals become larger.

I. INTRODUCTION

I INVESTIGATE WHETHER ORGANIZATIONAL CHANGES affect investment decisions using evidence from the hospital industry in the United States. Until the early 1990's, hospitals and physicians operated independently of each other. Individual physicians could admit patients at all hospitals where the physicians had admission privileges, and the hospital had no influence on where the physicians admitted their patients. By 1994, 32 per cent of the hospitals had reorganized their relationship with physicians. Some hospitals bought physician practices, converting doctors into employees of the hospital. Other hospitals and physicians formed joint ventures through which they share the costs and profits from the provision of patient care to their patients. Such reorganization was still widespread in 1999, when 33 per cent of the hospitals were still vertically integrated or formed joint ventures with physicians. This paper provides empirical evidence that hospitals adopting the new organizational forms have added new service levels at a faster pace than hospitals that remained independent of their physicians.

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The notion of a causal relationship between firms' organizational form and investment decisions goes back to the theory of transaction costs developed by Klein, Crawford, and Alchian [1978], Williamson [1979, 1985], and fully formalized in the theory of property rights by Grossman and Hart [1986]. The theories of transaction costs and property rights are based on two critical assumptions. First, the firms cannot write complete contracts concerning their investments. Second, investments are specific to firms' assets so that the same investments are less valuable with different assets. When both assumptions hold, the theories predict that firms under-invest because they are afraid their relationship with the other firm may end at some point. To minimize under-investment, firms reallocate the control rights over the assets.

In the relationship between hospitals and physicians the asset is the collection of their patients (the 'list of customers'). The control rights over the asset (the patients) lies with the physicians, who admit patients at hospitals. Until the late 1980s patients not covered by Medicare or Medicaid were individually insured and the demand for healthcare services was highly disintegrated. Patients had little or no bargaining power against the hospital or physicians, but could choose to get health care from any physician in the market area. Their insurance companies simply paid for services rendered, and charged their patients premiums sufficient to cover expected costs. Losing one patient, or the business relationship with one physician, was inconsequential for a hospital.

Today, Managed Care Organizations (MCOs) pool patients, usually on an employer basis, and bargain with hospitals and physicians on behalf of their patients. Hospitals and physicians negotiate terms of healthcare coverage with MCOs knowing that they are bargaining over many patients at once. Hospitals and physicians know that they can face excess capacity at any point in time if the MCO terminates its business relationship with them. As a result, hospitals' investments have acquired what Williamson and Joskow [1985] call *dedicated asset specificity*, which refers to investments that take place with the prospect of selling a significant amount of product to a particular customer.

To gain some leverage against the MCO and restrict the MCO's opportunistic behavior, some hospitals have decided that they would be better off negotiating with the MCOs jointly with the physicians rather than on their own. Ideally, physicians and hospitals would write a complete contract through which they would share their profits from the managed care contract. In particular, physicians would commit to admit their patients to the hospital.[1] However, contracts between hospitals and physicians are

[1] Physicians still have the control rights over the patients enrolled with the managed care company. However, the managed care contract usually restricts the hospitals at which the physician can admit patients.

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incomplete because of regulatory reasons and because they are difficult to enforce.[2]

The theories of transaction costs and of property rights predict that hospitals and physicians should then reallocate the control rights over the list of patients. This is what has happened in the 1990's, as hospitals have vertically integrated or formed joint ventures with physicians. A vertically integrated hospital owns the physicians' practices, gains full control over their patients, and can thus ensure a steady stream of patients from its own physicians. A MCO that terminates its contract with the hospital must also terminate the contract with the physicians that the hospital employs, with the consequence of upsetting its managed care enrollees. A joint venture is jointly owned by hospital and physician, and thus hospital and physicians share profits and costs from the provision of health care. The hospital gains some control over the patients of the doctors because the doctors have a strong incentive to admit their patients to the hospital. The MCO has the contract with the joint venture; therefore, if the MCO terminates its contract with the joint venture, it terminates its relationship with both physicians and the hospital. Only when the hospital is independent of the physicians, do the physicians continue to deal with the MCO when the contract with the hospital is terminated.

I first test the hypothesis that hospitals that have vertically integrated or formed joint ventures invest more than hospitals that negotiate managed care contracts independently of their physicians. This is exactly the prediction of the theories of property rights and of transaction costs. Then, I use the fact that dedicated asset specificity should be increasing in the average percentage of county population covered by each HMO in the local market. The idea is that an MCO that controls 50 per cent of the patients in a market has more leverage than a managed care organisation that controls only 20 per cent. I test the hypothesis that the difference in investment behavior between independent and vertically consolidated hospitals is stronger when each MCO controls a large percentage of patients.

The main tests of the paper consist of estimating the investment equations for the three different types of hospitals, allowing the organizational variables to be interacted with measures of managed care concentration. The results support the theories of transaction costs and of property rights. I find that hospitals that are vertically integrated, or that form joint ventures, add more healthcare services over time than hospitals that are independent of their physicians. I also find that when the average percentage of county population covered by each HMO increases, the differences in investment behavior between vertically consolidated and independent hospitals become larger.

[2] Hospitals and physicians could not write complete contracts before the 1990's, but they chose to remain independent. The implication is that the benefits to physicians from relinquishing control over their patient lists to hospitals were not sufficient to outweigh the costs of doing so.

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Previous empirical tests of the theory of transaction costs and of the theory of property rights have estimated the likelihood of vertical integration conditional on the investments' specificity (Chiappori and Salanié [2003]). These indirect tests of the theories used proxies for contractibility and specificity of the investments that might actually measure the existence of economies of vertical scope or economies of scale (Hubbard [2001]). I provide a *direct* test using evidence on investment decisions, and on how they depend on organizational changes.

There is a second problem with previous empirical work: organizational form and investments' specificity are chosen at the same time (Chiappori and Salanié [2003]). We should expect different hospitals to make different choices, and we should be concerned that self-selectivity could bias the regression estimates. I deal with this self-selectivity issue using fixed-effects regressions.

In Section II, I present the relevant institutional facts; in particular I discuss why contracts between doctors and hospitals are incomplete, and why investments have become specific to the list of patients insured with MCOs. Most of the evidence that I provide to describe why contracts are incomplete and why investments are (dedicated) asset specific is from law suits from Lexis-Nexus. Contracts between hospitals and physicians are confidential and the only available evidence is on contracts that are disputed. In Section III, the testable hypotheses are derived from the general theories of transaction cost economics and property rights. Section IV describes the data and the relevant variables, and discuss the source of identification in the data. Section V presents the empirical model and the main results of this paper. Section VI concludes.

II. INCOMPLETE CONTRACTS AND SPECIFIC INVESTMENTS

II(i). *Institutional Characteristics*[3]

There are four participants in the health care industry: the patient, the physician, the hospital, and the MCO. There are two markets: the market for hospital services and the market for physician services. In the former market, the hospitals are providers of services and the physicians are those who demand the services on behalf of their patients. In the latter market, the physicians are the providers of services, and the buyers of these services are the patients.

Until the early 1990's, hospitals and physicians operated independently of each other. Individual physicians could admit patients at all hospitals where

[3] Within the 'vertical integration' and the 'joint venture' categories there are subclasses. These subclasses are not important for my analysis. An appendix available from the author provides an analysis of these subclasses, and more institutional details on joint ventures and vertical integration. See also Dynan, Bazzoli, and Burns [1998].

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the physicians had admission privileges. The hospital had very little formal influence on where the physicians admitted their patients.

Since the early 1990's, managed care organizations negotiate the medical care coverage of employees with their employers, such as private firms and public institutions. MCOs are able to collect sets of patients and then negotiate on their behalf access and compensation with hospitals and physicians. In exchange for lower coverage fees, MCOs restrict patients to using certain physicians and to be admitted to certain hospitals. If hospitals and physicians do not sign a contract with the managed care organization, the managed care enrollees cannot receive care from these providers.

As a result of this change in the demand of healthcare services, more than one third of the hospitals in the United States have changed the way they operate with their physicians. Both hospitals and physicians have an interest in successfully negotiating contracts with the MCOs, since failing to do so can mean losing thousands of patients. To this end, hospitals and physicians have reorganized their business relationship either through vertical integration, forming Integrated Salary Models, or through joint ventures, forming Physician Hospital Organizations.

Under vertical integration, the hospital buys the physicians' practices, whose main asset is the list of patients. Physicians become employees of the hospital, are remunerated on a salary basis, and admit their patients to the hospital. Physicians can resign from their position at the hospital at any time, but the employment contracts between doctors and hospitals usually establish that if a doctor leaves her employment at the hospital then she must either refrain from practicing in the same market area for some years, or she must pay penalty fees.[4] Under vertical integration, the hospital assumes rights and liabilities associated with the contracts that the hospital negotiates with MCOs. If a physician resigns from her position at the hospital, the contract between the MCO and the vertically integrated hospital is unaffected.

A joint venture is different from vertical integration. In a joint venture, the hospital and the physicians form a joint venture to negotiate with MCOs. The physicians keep the ownership of their practices and, if they leave the joint venture, they can take their patients with them but the contract between the joint venture and the MCO is broken off. However, as long as the contract between the joint venture and the MCO holds, the physicians are relinquishing some of their control rights over the list of patients to the hospital. This is because the contract that the joint venture has signed with the MCO ensures that physicians admit patients to the hospital.

[4] For example, in *Wichita Clinic and Integrated Healthcare Systems vs. Columbia/HCA Healthcare Corp. (March 31, 1999)* it was the case that upon termination of the employment contract, physicians could either refrain from practicing in Sedgwick County for three years, or pay 25 per cent of their earnings over three years as liquidated damages. The noncompete clause creates a significant disincentive for physicians to leave their employment contracts.

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II(ii). *Incomplete Contracts*

As discussed in the introduction, the theories of transaction costs and property rights are based on two critical assumptions. First, firms cannot write complete contracts concerning their investments. Second, investments are specific to firms' assets, so the same investments are less valuable with different assets. I discuss the two assumptions in turn.

Investments are not contractible when hospitals and physicians cannot write a complete, contingent, contract on the amount of investments that the hospital makes. The complete contract between hospitals and physicians should determine the amount of investments that the hospital makes in exchange for the number of patients that the physicians admit at the hospital. There are several reasons why contracts between physicians and hospitals are necessarily incomplete. First, there are regulatory reasons why contracts are incomplete. The Medicare Anti-kickback statute prohibits any physician or hospital from receiving compensation for the patients that she admits to the hospital.[5] Second, contracts between physicians and hospitals are difficult to enforce because excluded physicians might bring an action on grounds that the contract is anti-competitive, even when the contracts do not include any agreement on remuneration. For example, in California Medical Association v. The Regents of The University of California (March 29, 2000) UCLA decided that the only feasible way to operate the UCLA-Santa Monica anesthesia service was as 'closed' service staffed by members of the UCLA anesthesia faculty. The plaintiffs, who had provided anesthesia services as independent members of the medical staff, claimed that UCLA's objective was to force community based physicians into unlawful fee-splitting and referral schemes. In Gibbons vs. Alta Anesthesia Associates of Georgia (July 13, 2000) the Southeast Georgia Regional Medical Center 'wanted to prepare for the advent of managed care.' The hospital decided that one of the best ways to do so was to encourage the formation of an organized group of anesthesiologists. Some members of the anesthesiology staff formed Alta, and signed a contract for exclusive services with the hospital. Gibbons, an independent anesthesiologist, asserted that 'after the implementation of the exclusive contract, Alta manipulated scheduling in the anesthesia department, so that Alta anesthesiologists were assigned increased percentages of more lucrative surgeries and the operations where

[5] The Medicare Anti-kickback statute prohibits any physician or hospital to 'solicit or receive any remuneration, including any kickback, bribe or rebate (directly or indirectly, overtly or covertly, in cash or in kind), in return for referring an individual to a person for the furnishing or arranging for the furnishing of any item or service for which payment may be made in whole or in part under [Medicare] or a State health care program, or in return for purchasing, leasing, ordering, or arranging for or recommending purchasing, leasing, or ordering any good, facility, service, or item for which payment may be made in whole or in part under [Medicare] or a State health care program.' The Medicare Anti-kickback statute is codifed at 42 U.S.C 1320a-7b. See http://www4.law.cornell.edu/uscode/42/1320a-7b.html

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no anesthesiologists had been pre-selected; and that Alta intimated surgeons and other staff persons to switch preferences from independent anesthesiologists to Alta.'

Finally, contracts between hospitals and physicians might require the parties to take actions that are observable by them, but are not verifiable by a third party, such as a court. For example, when adding a new service, hospitals and physicians must adopt new clinical guidelines and protocols whose implementation cannot be verified by a third party.[6]

II(iii). *Asset-Specific Investments*

The key insight of this paper is that managed care penetration makes hospitals' investments specific to the managed care patients, and thus might discourage hospitals' investment in new technologies. Once the hospital knows how many potential patients they have 'lined up,' and the characteristics of these patients (age, gender, health needs), the hospital can make specific investments appropriate for that list. The MCO's control over large number of patients discourages the hospital from adding new facilities because the MCO can pull a large number of patients at once.[7] A striking example is given by the case of Wichita Clinic, which was the largest multi-specialty physician group in Kansas in 1994. In 1994, two Wichita hospitals merged into a single hospital system known as 'Via Christi.' Wichita Clinic tried to form a joint venture with another hospital in the market area, called Wesley hospital and owned by Columbia/HCA Healthcare Corp. The objective of the joint venture was to compete effectively with 'Via Christi' and to maintain existing relationships with insurance providers. In particular, the loss of Blue Cross business could cost the Wesley hospital $24 million in pretax earnings. Hence, 'to keep Blue Cross at Wesley exclusively, a deal to bring Wichita Clinic and Blue Cross together was imperative.' When the negotiation failed, Wesley hospital started recruiting physicians from the Wichita Clinic.[8]

[6] Not even managed care organizations are able to verify a hospitals' compliance. As Gabel, p. 478 [1997] reports, 'most HMOs lack an information system that can measure physicians' and patients' compliance with specific guidelines.' The same can be said with regard to hospitals' use of resources: '[not] many HMOs are able to determine the effectiveness of guidelines in improving medical outcomes and patient satisfaction or their impact on the cost and use of resources of specific medical conditions.'

[7] Evidence from a survey conducted by the American Hospital Association in 1995, and discussed in the Appendix of this paper, shows that hospitals that adopted the new organizational forms often operated in markets where there was a dominant HMO. Unfortunately, the data from the survey are only for 1995.

[8] This is the same case discussed before: *Wichita Clinic and Integrated Healthcare Systems vs. Columbia/HCA Healthcare Corp.* (*March 31, 1999*).

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III. THE HYPOTHESES TO BE TESTED

The theories of property rights and of transaction costs predict that firms under-invest when contracts are incomplete and investments are characterized by dedicated asset specificity. The theories predict that firms reallocate the control over their assets to minimize under-investment. I now present the econometric approach taken in this paper to test whether the data are consistent with the predictions of the theories of property rights and of transaction costs.

III(i). *Organizational Forms and Managed Care*

In this paper, I maintain that hospitals' investments have become (dedicated asset) specific to the list of patients covered by MCOs in a market area. If this is so, hospitals and physicians will be more likely to vertically integrate or to form joint ventures in local markets where the average percentage of county population covered by each HMO is large. The key insight is that an MCO that controls 50 per cent of the patients in a market has more leverage than a managed care organisation that controls only 20 per cent. In other words, it is the bargaining power of the MCOs that forced some physicians into signing exclusive agreements with hospitals in the 1990's, and it is the variation in the bargaining power of the MCOs across markets and time that explains the changes in organizational form. These organizational changes in turn allow me to identify the positive impact of vertical integration and joint ventures on hospital investment that contract theory predicts should be present.

To test this hypothesis, I run the following multinomial logit regression:

$$P(d_{it} = org) = \frac{\Lambda(Joint_{it-1}, Vertical_{it-1}, HMONBR_{it}, Z_{it})}{1 + \sum_{org \in \{Joint, Vertical\}} \Lambda(Joint_{it-1}, Vertical_{it-1}, HMONBR_{it}, Z_{it})}$$

where

$$\Lambda(Joint_{it-1}, Vertical_{it-1}, HMONBR_{it}, Z_{it}) = \exp\left(\alpha_1^{org} Joint_{it-1} + \alpha_2^{org} Vertical_{it-1} + \alpha_3^{org} HMONBR_{it} + \alpha_4^{org} Z_{it}\right),$$

and *org* can take three values: $org = Joint$, $org = Indep$, and $org = Vertical$. For identification purposes, I assume $\alpha_1^{Indep} = 0$, $\alpha_2^{Indep} = 0$, $\alpha_3^{Indep} = 0$, $\alpha_4^{Indep} = 0$. $Joint_{it}$ is a categorical variable equal to 1 if the hospital *i* formed a joint venture at time *t* with the physicians; $Vertical_{it}$ is a categorical variable equal to 1 if the hospital bought the physician practices and vertically integrated with its doctors at time *t*. Z_{it} are control variables, such as the teaching status of the hospital, and the percentage of county population covered by all HMOs ($HMOPEN_{it}$).[9] I include $HMOPEN_{it}$ to account for the scale effects associated with managed care penetration. For example,

[9] The variable is constructed as explained in Wholey, Christianson, Engberg and Bryce [1997].

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new entry of MCOs could become easier as more individuals buy managed care products. Finally,

$$HMONBR = \frac{percentage\ of\ county\ population\ \text{covered}\ by\ all\ HMOs}{number\ of\ HMOs\ in\ the\ county},$$

is the average percentage of county population covered by each HMO.

The prediction to be tested is $\alpha_3^{Joint} > 0$ and $\alpha_3^{Vertical} > 0$. Furthermore, under vertical integration there is a common governance mechanism and it is essentially impossible for physicians to negotiate prices separately. To the extent that vertical consolidation matters, we would expect to see the biggest effect on the investment decisions of vertically integrated hospitals rather than on hospitals in joint ventures. Hence, I expect $\alpha_3^{Vertical} > \alpha_3^{Joint}$.

III(ii). *Organizational Forms and Investment Decisions*

I first test the prediction that hospitals that vertically integrated or formed joint ventures invested over the 1990s more than hospitals that negotiate managed care contracts independently of their physicians. To test the hypothesis, I run the hospital fixed-effects regression:

$$(1) \qquad INV_{it} = \beta + \beta^{Joint} Joint_{it} + \beta^{Vertical} Vertical_{it} + X_{\mathbf{it}}\alpha + u_{it},$$

where $X_{\mathbf{it}}$ are control variables, such as the number of beds at the hospital. INV_{it} represent the investments made at time t by the hospital. The prediction to be tested is that $\beta^{Joint} > 0$ and $\beta^{Vertical} > 0$. I also expect $\beta^{Vertical} > \beta^{Joint}$.

III(iii). *Organizational Forms, Investment Decisions and Managed Care*

I expect that the effect of changes in organizational forms is stronger where the average percentage of county population covered by each HMO is larger. The larger the set of patients that each MCO controls in the market area of the hospital, the larger the risk of excess capacity that a hospital faces.

The set of tests consists of estimating the following ordinary least squares regression:

$$(2) \qquad \begin{aligned} INV_{it} = {} & \gamma HMONBR_{it} + \gamma^{Joint} Joint_{it} \cdot HMONBR_{it} \\ & + \gamma^{Vertical} Vertical_{it} \cdot HMONBR_{it} + X_{\mathbf{it}}\alpha + u_{it}, \end{aligned}$$

I test whether $\gamma^{Joint} > 0$ and $\gamma^{Vertical} > 0$ are both positive. I also expect $\gamma^{Vertical} > \gamma^{Joint}$.

III(vi). *Identification Strategy*

The major identification issue is that a hospital most likely chooses the organizational form that best fits its unobservable and observable

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characteristics. To control for the self-selectivity bias, I run a hospital fixed-effect regression. There are some concerns that need to be addressed when using fixed effects. First, the source of identifying variation is given by the hospitals that changed organizational forms. As we shall see later, a significant number of hospitals changed organizational form over the sample period. Second, fixed-effects reduce the variation in the data and could give rise to statistically insignificant estimates. This is an empirical issue, which turns out not to be important in this paper. Third, fixed-effect regressions do not allow for the possibility of major events in the industry, and that hospitals may have heterogeneous responses to these events. The major event in the healthcare industry in the 1990s has certainly been the advent of managed care, which is controlled for with measures of managed care penetration at the county level. I also include year indicators, and their interactions with state indicators. Finally, the fixed-effect regressions only control for hospital specific effects that do not vary over time. If there are environmental changes that are not time invariant, then fixed effects are not enough. For example, the trends in investments made by the hospitals before the wave of organizational changes could be different for different organizational forms. To address this possibility, I consider a specification where a trend variable is added to the estimation. The trend variable is allowed to have a different effect by organizational form.

IV. THE DATA

Data are from the American Hospital Association (AHA) Annual Surveys 1994–1999; the Medicare Cost Reports, 1994–1999; and from the Inter-Study HMO census (1992). I also use data from the Area Resource File (ARF), a database containing demographic variables for each county in the United States. The unit of observation is a general short-term hospital.[10] General hospitals provide diagnostic and therapeutic services to patients for a variety of medical conditions, both surgical and non surgical. Non-general hospitals specialize in psychiatric, tubercolotic and other particular diseases. The analysis excludes hospitals outside the continental U.S., military and veteran hospitals. The final sample contains 20,810 hospital-year observations.[11]

[10] Long-term hospitals specialize in the provision of rehabilitation, skilled nursing and other long-term care.

[11] The number of observations used in the study depends on the variables used. In the regressions of the investment equations, all the observations for 1999 will drop out since investments are defined as the difference of technology in 1999 and in 1998. Thus investments in 1999 cannot be defined since data for 2000 is not available. In the regressions that include measures of managed care, some observations will drop out because data on managed care is not available for all counties. I imputed values for the variables *CASEMIX* and *HMOPEN* that were missing for one county or one hospital in an intermediate year in the dataset.

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IV(i). *Time Trends*

Organizational Forms. The first two rows of Table I report, respectively, the percentage of hospitals in each year that have joint venture agreements with physicians and the percentage of hospitals in each year that are vertically integrated with physicians. For example, 15.92 per cent of the 3,580 hospitals present in 1994 had adopted a joint venture; this percentage was almost unchanged in 1999, when 15.2 per cent of hospitals reported being part of a joint venture. The main point to be drawn from Table I is that the percentages of hospitals adopting these organizational forms have remained quite stable over the 1990s.[12]

Table II reports the transition matrix between organizational forms using hospital observations.[13] This matrix is useful in understanding the source of identification in the hospital fixed-effect regressions. The coefficients for the organizational forms are identified by hospitals that changed their organizational form over this time period. The entries in Table II indicate that many hospital-year observations are available for hospitals that changed organizational forms. For example, 70.33 per cent of the hospitals that had adopted vertical integration abandoned it later on. On the other hand, 24.24 per cent of the hospitals that initially were independent of their physician, later on vertically integrated. There is only limited change between joint ventures and vertical integration, suggesting either that hospitals choose the organizational form that best fits their characteristics, or that the costs of changing organizational forms too often outweigh the benefits.

Managed Care. The other three rows of Table I report, for each year in the sample, the percentage of county population covered by HMOs, the average percentage of county population covered by an HMO in a county, and the average percentage of county population covered by the largest HMO in each county.[14] Between 1994 and 1998, the percentage of individuals covered by managed care has doubled.

[12] I have excluded from the analysis hospitals that at least once during the 1990's had vertically integrated with some of their doctors and at the same time formed a joint venture with some other of their doctors. The problem with these hospitals is that it is impossible to identify the effect of adopting a joint venture from that of vertical integration.

[13] The matrix is different if the unit of observation is the hospital-year. Since a hospital generally changes organizational form only once, the number off-diagonal are much larger.

[14] This percentage is calculated over the whole population, thus including Medicare and Medicaid patients. Since on average Medicare and Medicaid patients are 40 per cent of the admitted patients at hospitals, the measure that I use underestimates managed care penetration. However, this is still the best measure of managed care penetration available. The ideal denominator should only include the total number of privately insured patients. For example, suppose that there are 180 individuals covered by managed care in a total population of 1,000. *HMOPEN* would be equal to 18.10%. However, if the number of individuals that have private insurance is 600, then *HMOPEN* should be 30%.

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TABLE I

TIME TRENDS

	1994	1995	1996	1997	1998	1999
Joint Venture (PHO)	15.92	17.94	17.77	18.09	17.48	15.22
Vertical Integration	15.75	18.00	18.26	17.04	17.20	17.70
% of county population covered by HMOs HMOPEN	10.89	12.44	15.16	17.45	18.16	...
Average % of county population covered by an HMO in a county HMONBR	1.98	2.07	2.39	2.51	2.83	...
Maximum value of the Average % of county population covered by an HMO in a county $MAX\{HMONBR_{counties}\}$	41.97	42.82	34.02	34.44	21.10	...
Number of Hospitals	3580	3606	3478	3427	3296	3423

The second variable is *HMONBR*, which is the average percentage of individuals covered by each HMO in the local market. This is a measure of the number of patients that an MCO can move among hospitals. It has increased only marginally over time. In 1994, this number could be as high as 41.97 per cent. By 1998, the maximum value of *HMONBR* was down to 21.10 per cent. Thus, over time it looks like the market for managed care coverage has become more competitive.[15] Table I shows that the total percentage of individuals covered by HMOs, *HMOPEN*, has increased from 10.89 per cent in 1994 to 18.16 per cent in 1997.

IV(ii). *Geographical Trends*

Regions of the United States differ in their regulatory treatment of hospital-physician affiliations. Moreover, in some states managed care has grown faster, presumably because the climate was more favorable to the new form of health care insurance, or because the demand for less expensive health care coverage was stronger.

Table III reports the distribution of the different organizational forms, and managed care penetration by regions of the United States. The first two columns show that joint ventures and vertical integration are chosen by 50 per cent of the hospitals in New England. In other regions, the large majority of the hospitals remain independent, particularly in the East South Central region.

[15] There is one shortcoming of *HMONBR* worth mentioning here: A market area with one dominant HMO plus many small ones would rate the same value of *HMONBR* as an area comprising many medium-sized HMOs. Unfortunately, data on individual managed care organizations are not available; therefore I cannot construct measures of managed care concentration (such as a Herfindahl-Hirschman Index).

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TABLE II

ORGANIZATIONAL FORMS - THE TRANSITION MATRIX

To From	Independent	Joint Venture	Vertical Integration	Total
Independent	1707	546	721	2974
Joint Venture	540	286	59	891
Vertical Integration	704	53	236	1001
Total	2951	885	1016	4852

Note: Hospital Observations. Double counting occurs if a hospital changes organizational form more than once. 45.36 per cent are hospital year observations for hospitals that remained independent over the time period. 22.55 per cent of the 4,852 hospital-year observations are for hospitals that changed organizational form once; 22.05 for hospitals that changed organizational form twice; 8.10 for hospitals that changed organizational forms three times. The remaining hospital year observations are for hospitals that changed organizational form more than 3 times. This table shows the number of hospitals changing organizational forms over the period. For example, 546 hospitals that were independent formed a Joint Venture.

Columns 3, 4 and 5 of Table III show that some regions are clearly lagging behind in terms of managed care penetration. In particular, most of the Central U.S.A. has seen a much slower entry of managed care. The East Coast and the Pacific region have experienced much faster growth of managed care.

In the regression analysis, I will use time indicators, and their interactions with state indicators, to control for state unobserved characteristics.

IV(iii). *Investments*

The dependent variable in the main empirical tests is the change in the range of services provided by the hospital over time, which I interpret as the hospital's investments. Hospitals provide several types of services, from outpatient surgery, which allows the patients to leave the hospital the same day, to transplant services, which require the patient to stay in for long periods of time.

In this paper I focus my attention on outpatient and diagnostic services, whose demand is determined mainly by primary care physicians. Managed care contracts, especially HMO contracts, provide that the patient must first visit a primary care physician to address her health concern. Primary care physicians have the patient go through a set of diagnostic procedures, and then try to solve the health problem in outpatient centers so that the MCO does not have to pay for an overnight stay at the hospital. The outpatient and diagnostic venues and services that I consider for this paper are: freestanding outpatient care centers, hospital based outpatient care centers, physical rehabilitation outpatient services, primary care departments, psychiatric outpatient services, alcoholism, drug abuse or dependency outpatient services, breast cancer screening services, diagnostic radioisotope facilities, magnetic resonance imaging, and single photon emission computerized

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TABLE III

ORGANIZATIONAL FORMS - GEOGRAPHICAL LOCATION

Region	Joint Venture	Vertical Integration	% of county population covered by HMOs	Average % of county population covered by an HMO in a county	Maximum % of county population covered by an HMO in a county	TOTAL NUMBER
New England	29.72	20.78	25.65	3.43	29.42	794
Mid Atlantic	25.38	15.88	26.59	4.8	42.82	1958
South Atlantic	18.40	14.09	11.69	1.4	34.02	3087
East North Central	15.41	22.78	16.04	2.33	19.97	2875
East South Central	16.36	10.00	7.76	1.52	14.89	1950
West North Central	10.65	23.93	7.44	2.27	27.74	3306
West South Central	22.26	10.49	8.24	1.04	12.15	3185
Mountain	15.74	20.29	12.72	2.96	21.43	1385
Pacific	9.25	19.30	30.32	3.27	23.56	2270
Number Observations	3552	3605	17336	16457	16457	

New England: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut. *Mid Atlantic*: New York, New Jersey, Pennsylvania. *South Atlantic*: Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida. *East North Central*: Ohio, Indiana, Illinois, Michigan, Wisconsin. *East South Central*: Kentucky, Tennessee, Alabama, Mississippi. *West North Central*: Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas. *West South Central*: Arkansas, Louisiana, Oklahoma, Texas. *Mountain*: Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada. *Pacific*: Washington, Oregon, California, Alaska, Hawaii.

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tomography.[16] The demand for other services, such as cardiac intensive care or angioplasty, is either related to emergency cases or is determined by specialists who must admit patients overnight.

The technology endowment of the hospital is measured as a count variable, *TECH*, which is equal to 1 if the hospital provides only one of the services listed above and is equal to 10 if the hospital provides all of the services. This way of constructing the measure of technology available to the hospital is standard in the health literature and follows Dranove *et al.* [1993], Conrad *et al.* [1996], and Cutler and Sheiner [1998]. I define the observable investments made by the hospital as:

$$INV_{it} \equiv TECH_{it+1} - TECH_{it}.$$

The variable *INV* can take any value between -10 and 10. Hospitals can decide to shut down facilities if there is insufficient demand.[17]

This measure of technology has two shortcomings. First, *TECH* measures only whether a hospital provides a service, but not how many units it has. For example, a hospital that has two MRI units will have the same value of *TECH* as a hospital that has one MRI unit, *ceteris paribus*. This unobservable difference could bias the estimates as large hospitals could encounter a different risk of opportunistic behavior than small hospitals. I control for the size of the hospital with the natural logarithm of beds. Second, *TECH* does not measure the intensity with which services are used, but only whether they are available. Hospitals with different rates of capacity utilization will face different incentives to add another service. I control for differences in capacity utilization with the ratio of inpatient days over the number of beds multiplied by 365.

IV(iv). *Control Variables*

The main concern in the estimation is that the organizational variables actually measure differences in concentration in the market of hospital and physician services and in the market of managed care. Hospitals that adopt one of the two new organizational forms could be those that dominate the market, and thus they could invest more to increase further their market power. Another possibility is that the organizational form variables are proxies for managed care concentration or for the market power of the

[16] The adoption of two other diagnostic services, positron emission tomography and ultrasound services, as well as the provision of outpatient surgery services, did not show enough variation in the data over time, thus I excluded them from the analysis.

[17] In the empirical section I estimate ordinary least squares regressions with hospital fixed effects, where the dependent variable is *INV*. *INV* is a count variable, and OLS regressions would be inappropriate if *INV* were strongly skewed to the right. In such a case, I should use some type of Poisson analysis. It turns out, however, that *INV* is normally distributed with zero mean. Moreover, *INV* takes on negative values. Thus OLS regressions are appropriate in this particular context.

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hospitals and the physicians. Gal-Or (1999) shows that physicians and hospitals increase their bargaining power by merging vertically depending on the degrees of competitiveness in the market for physicians and for hospitals. If the degrees of competitiveness are comparable, then both parties benefit from the vertical merger; if they differ, only the party that operates in the highly competitive market benefits, but the other sees its profits decline. By tying with a hospital that operates in a concentrated market, a physician who operates in a very competitive market can improve her own bargaining power versus an MCO. Thus, hospitals could be investing more to differentiate themselves from other hospitals in the market area and to reduce the degree of competition in the hospital market.

To control for the market power of each hospital in its county, I construct a Herfindahl-Hirschman Index of hospital admission. This is a market-specific variable that changes over time. I also construct, using the ARF dataset, a measure of the density of primary care physicians: the percentage of primary care physicians per 1,000 individuals in the market area. When the density of primary care physicians is large, the market of primary care physicians should be more competitive.

Hospitals provide care to different types of patients, some of whom are covered by Medicare and some of whom are covered by Medicaid. In the regressions, I include the percentage of annual admissions that involve Medicare patients and the percentage of admissions that involve Medicaid patients. Medicare often reimburses hospitals more than MCOs do, and thus hospitals with larger shares of Medicare patients should have more funds to invest in new technologies. The opposite is true for Medicaid patients.

V. EMPIRICAL ANALYSIS

V(i). *Descriptive Analysis*

Table IV presents the summary statistics for the variables used in this analysis. The first row of the table reports the average yearly investment by hospitals. Independent hospitals add on average one facility every 10 years. The means for the other organizational forms are not statistically different from those of independent hospitals. A large part of the variation in hospitals' investments is within hospital variation, which is important to identify the effect of organizational forms on investment decisions.[18] Similar conclusions can be drawn for other variables in the table. The differences across organizational forms are not statistically significant.

[18] A table of within and between variation in each variable is available from the author.

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V(ii). *Organizational Forms and Managed Care*

Before presenting the effect of organizational forms on investment decisions, I further investigate the relationship between managed care and the adoption of new organizational forms using a model of organization type transition, conditioning on prior organizational form, and on other variables such as managed care and hospital market concentration. This can be thought of as doing the multivariate version of the analysis presented in Table II.

Table V presents the results of a multinomial logit estimation where the dependent variable is the organizational form chosen by the hospital, and the independent variables include prior organizational form, and other variables such as managed care and hospital market concentration. The first two columns of Table V report the estimates of the multinomial logit. The third and fourth columns report the marginal effects for the baseline specification. The last two columns include state and year effects, and their interactions, to control for geographical and time differences across the United States.

The results are largely consistent over the two specifications.[19] The hospital's prior organizational forms, technology endowment, size, capacity utilization, case-mix, and percentage of outpatient and medicaid patients are all statistically significant. *HMONBR* is also statistically significant. There is also a very strong persistence in the data, as one would expect after the analysis of Table II. Column 3 shows that a hospital which at time $t-1$ had adopted a joint venture is 72 per cent more likely than an independent hospital to form a joint venture at time t.

The average percentage of managed care patients under each MCO (*HMONBR*) has a strong effect on the probability that a hospital vertical integrates with its physicians. A 10 per cent increase in *HMONBR* increases the probability that a hospital chooses vertical integration over being independent by 4 per cent.

The other critical determinant of vertical integration is the percentage of outpatient visits over inpatient admissions. A 10 per cent increase in the outpatient share increases the probability that a hospital chooses vertical integration by 2 per cent. This last finding is reassuring because it shows that the adoption of organizational forms is related to the use of outpatient services, which are counted to construct the measure of technology, *TECH*.

[19] The regressions fit the data quite well for the independent hospitals. For example, 93.27 per cent of the hospital-year observations that are predicted to be independent were indeed vertically independent. 50.48 per cent of the hospital-year observations that are predicted to be joint ventures were joint ventures. And 42.52 per cent of the hospital-year observations that are predicted to be vertically integrated were vertically integrated. The remaining hospital-year observations were wrongly predicted, with most of them being predicted to be independent when they were observed to be either joint ventures of vertically integrated. A matrix that compares the predicted organizational form with the actual organizational form is available from the author.

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TABLE IV

SUMMARY STATISTICS

Variable	Independent		Joint		Vertical		Changed Organiz. Form		All Hospitals	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Investments (INV)	0.10	1.11	0.09	1.05	0.07	0.99	0.10	1.13	0.09	1.08
Technology Endowments (TECH)	4.18	2.35	5.47	2.16	4.91	2.47	4.90	2.35	4.52	2.40
Average % of County Population covered by *each* HMOs (HMONBR)	0.02	0.03	0.02	0.03	0.03	0.03	0.02	0.03	0.02	0.03
% of County Population covered by *all* HMOs (HMOPEN)	0.14	0.15	0.16	0.15	0.15	0.16	0.15	0.15	0.15	0.15
HHI of hospital admission	0.67	0.34	0.62	0.33	0.66	0.34	0.67	0.33	0.66	0.34
% Primary Care physicians	0.06	0.10	0.06	0.10	0.06	0.10	0.06	0.10	0.06	0.10
Log(Beds)	4.55	0.94	4.94	0.83	4.63	1.03	4.71	0.95	4.63	0.95
Capacity Utilization	0.52	0.20	0.56	0.18	0.55	0.21	0.55	0.19	0.54	0.20
Outpatients/Inpatients	0.91	0.09	0.91	0.06	0.93	0.07	0.92	0.06	0.91	0.08
Medicare Share of Inpatients	0.44	0.16	0.41	0.14	0.42	0.16	0.43	0.15	0.43	0.15
Medicaid Share of Inpatients	0.14	0.11	0.14	0.09	0.14	0.12	0.14	0.11	0.14	0.11
Case-mix	1.23	0.50	1.32	0.23	1.26	0.49	1.28	0.44	1.25	0.46
Teaching Hospital	0.03	0.18	0.06	0.24	0.06	0.24	0.05	0.23	0.04	0.20
Government Hospital	0.31	0.46	0.18	0.39	0.32	0.47	0.26	0.44	0.29	0.45
For-Profit Hospital	0.13	0.34	0.18	0.39	0.05	0.33	0.10	0.31	0.10	0.31
Church-Owned Hospital	0.10	0.30	0.11	0.31	0.13	0.33	0.12	0.33	0.13	0.33

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TABLE V

A MODEL OF ORGANIZATION TYPE TRANSITION

	Baseline Coefficients (Standard Errors)		*Baseline Marginal Effects [Sample Means]*		State, Year, and their Interaction Fixed Effects Coefficients (S.E.)	
	$Joint_t$	$Vertical_t$	$Joint_t$	$Vertical_t$	$Joint_t$	$Vertical_t$
$Joint_{t-1}$	4.144***	0.626***	*0.72*	*−0.07*	4.354***	0.622***
	(0.075)	(0.150)	*[0.18]*	*[0.18]*	(0.084)	(0.154)
$Vertical_{t-1}$	0.499***	3.531***	*−0.06*	*0.63*	0.524***	3.722***
	(0.144)	(0.068)	*[0.17]*	*[0.17]*	(0.149)	(0.074)
HMONBR	**0.943**	**3.973*****	***0.04***	***0.40***	**−0.579**	**2.852***
	(1.604)	**(1.382)**	***[0.02]***	***[0.02]***	**(1.919)**	**(1.675)**
HMOPEN	−0.670*	−0.736**	*−0.06*	*−0.07*	0.259	−0.284
	(0.347)	(0.324)	*[0.16]*	*[0.16]*	(0.443)	(0.410)
HHI Hosp. Admission	0.193	−0.030	*0.02*	*−0.01*	0.276*	−0.072
	(0.132)	(0.126)	*[0.66]*	*[0.66]*	(0.151)	(0.143)
% Primary Care Phys.	0.058	0.489	*−0.00*	*0.05*	−0.678	0.367
	(0.366)	(0.353)	*[0.06]*	*[0.06]*	(0.412)	(0.414)
Technology Endowm.	0.130***	0.099***	*0.01*	*0.01*	0.125***	0.121***
	(0.021)	(0.019)	*[4.62]*	*[4.62]*	(0.023)	(0.021)
Log(Beds)	0.096	−0.145**	*0.01*	*−0.02*	0.066	−0.129**
	(0.065)	(0.059)	*[4.65]*	*[4.65]*	(0.071)	(0.064)
Capacity Utilization	0.126	0.611***	*0.00*	*0.06*	0.085	0.567***
	(0.224)	(0.193)	*[0.54]*	*[0.54]*	(0.247)	(0.212)
Outpatients/Inpatients	0.738	2.144***	*0.05*	*0.21*	0.850	2.292***
	(0.664)	(0.619)	*[0.92]*	*[0.92]*	(0.718)	(0.672)
Medicare Inpatients	−0.131	−0.267	*−0.01*	*−0.03*	−0.382	−0.034
	(0.300)	(0.275)	*[0.43]*	*[0.43]*	(0.337)	(0.311)
Medicaid Inpatients	0.334	0.704*	*0.02*	*0.07*	0.583	1.034**
	(0.421)	(0.371)	*[0.14]*	*[0.14]*	(0.466)	(0.419)
Case-mix	−0.039	−0.174**	*−0.00*	*−0.02*	−0.002	−0.183*
	(0.102)	(0.088)	*[1.27]*	*[1.27]*	(0.094)	(0.094)
Teaching	−0.229	0.163	*−0.02*	*0.02*	−0.312*	0.117

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TABLE V. (Contd.)

	Baseline Coefficients (Standard Errors)		*Baseline Marginal Effects [Sample Means]*		State, Year, and their Interaction Fixed Effects Coefficients (S.E.)	
	$Joint_t$	$Vertical_t$	$Joint_t$	$Vertical_t$	$Joint_t$	$Vertical_t$
	(0.167)	(0.156)	*[0.05]*	*[0.05]*	(0.174)	(0.164)
Government	− 0.180*	0.041	*− 0.02*	*0.01*	− 0.184*	0.027
	(0.093)	(0.079)	*[0.05]*	*[0.29]*	(0.104)	(0.088)
Church Owned	0.009	0.139	*− 0.00*	*0.01*	0.125	0.159
	(0.118)	(0.104)	*[0.11]*	*[0.11]*	(0.126)	(0.111)
For-Profit	− 0.075	− 0.569***	*− 0.00*	*− 0.05*	− 0.054	− 0.545***
	(0.110)	(0.139)	*[0.12]*	*[0.12]*	(0.124)	(0.150)
Constant	− 4.436***	− 4.367***			− 4.629***	− 4.953***
	(0.738)	(0.675)			(1.140)	(1.023)
Pseudo R^2	0.4303				0.4645	
Log-Likelihood	− 6384.643				− 6000.6189	
Observations	12438				12438	

Standard errors in parentheses *significant at 10%; **significant at 5%; ***significant at 1%

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V(iii). *Main Results*

In this section, I first investigate how the new organizational forms affect investment decisions. Then, I investigate the relationship between managed care, organizational forms, and investment decisions.

Organizational Forms and Investment Decisions. Table VI displays the estimation results without including variables related to managed care penetration. The first column presents the baseline regression with hospital fixed effects, but not controlling for geographical differences across the United States. The baseline regression, presented in the first column of Table VI, includes all hospitals. The second column presents the baseline regression with year indicators, and their interactions with state indicators. The third column presents the baseline regression without hospital fixed effects, and provides information on the self selectivity bias that I discussed in Section 3.4. The sample for the first three columns consists of all the hospitals.

The 1990's were turbulent years for the healthcare industry, and some hospitals could have been experimenting with different organizational forms. The investments that I am considering here take some time to be made, and some hospitals change organizational forms several times in few years.

To address this concern, I restricted the sample by excluding hospitals that changed organizational status more than once during the sample period. Thus, the sample for the regressions reported in columns 4, 5 and 6 of Table VI consists only of hospitals that either did not change organizational form or changed organization form once. The fourth column presents the baseline regression. The fifth column presents the baseline regression when the impact of integrating is allowed to differ from the impact of de-integrating. In particular, I define the variable *JointAdopt* to be equal to 1 in year t when a hospital participated in a joint venture with physicians in year t but was independent the year before. It remains equal to 1 thereafter since hospitals in the sample can change organizational form at most once. The variable *JointLeave* is equal to 1 in year t if the hospital is independent in that year but participated in a joint venture in the year before, and it remains equal to 1 for the remainder of the sample period. Thus, *JointAdopt* selects hospitals that change from independent to joint and *JointLeave* selects hospitals that change from joint to independent. The variables *VerticleAdopt* and *VerticleLeave* are defined similarly. The sixth column adds trend variables in the regression to account for the possibility that hospitals that adopted different organizational forms were investing at different rates already before the mid 1990's.

Column 1 of Table VI shows that hospitals that vertically integrated with their physicians add approximately one more service every ten years relative to the independent hospitals. Joint ventures, on the contrary, do not seem to behave differently from independent hospitals. The results change only

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TABLE VI

ORGANIZATIONAL FORMS AND INVESTMENTS

	Baseline Regression	State, Year, and their Interaction Fixed Effects	Baseline without Hospital Fixed-Effects	Baseline Regression with only Stable Hospitals(#)	Move From and To Organizational Forms(#)	Move From and To Organizational Forms (#)
	Investments	Investments	Investments	Investments	Investments	Investments
Joint	0.052	0.022	0.109***	0.085**		
	(0.035)	(0.035)	(0.022)	(0.043)		
Vertical	0.080***	0.064**	0.065***	0.169***		
	(0.031)	(0.031)	(0.022)	(0.040)		
JointAdopt					0.273***	0.096
					(0.062)	(0.084)
JointLeave					0.170**	0.031
					(0.068)	(0.078)
VerticalAdopt					0.300***	0.214**
					(0.059)	(0.088)
VerticalLeave					– 0.071	– 0.243***
					(0.060)	(0.071)
Trend						0.069***
						(0.007)
Trend*Joint						0.007
						(0.016)
Trend*Vertical						– 0.015
						(0.017)
HHI of Hospital Adm.	– 0.082	– 0.254**	– 0.034	– 0.071	– 0.114	– 0.234*
	(0.116)	(0.118)	(0.028)	(0.125)	(0.125)	(0.125)
% Primary Care Phys.	– 4.500	– 5.017	0.179**	– 1.888	– 1.847	– 2.599
	(3.555)	(3.530)	(0.084)	(3.672)	(3.666)	(3.648)
Technology Endowm.	– 0.834***	– 0.858***	– 0.189***	– 0.833***	– 0.837***	– 0.853***
	(0.009)	(0.009)	(0.005)	(0.010)	(0.010)	(0.010)
Log(Beds)	– 0.156***	– 0.059	0.287***	– 0.136**	– 0.112*	– 0.027
	(0.058)	(0.059)	(0.015)	(0.064)	(0.064)	(0.064)
Capacity Utilization	– 0.046	0.011	– 0.032	– 0.021	– 0.011	0.046
	(0.102)	(0.103)	(0.049)	(0.112)	(0.112)	(0.111)
Outpatients/Inpatients	– 0.153	– 0.588**	0.973***	– 0.236	– 0.277	– 0.489*
	(0.246)	(0.248)	(0.128)	(0.254)	(0.254)	(0.253)
Medicare Share Inpat.	0.314**	0.107	– 0.293***	0.246*	0.219	0.045

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TABLE VI. (Contd.)

	Baseline Regression	State, Year, and their Interaction Fixed Effects	Baseline without Hospital Fixed-Effects	Baseline Regression with only Stable Hospitals(#)	Move From and To Organizational Forms(#)	Move From and To Organizational Forms (#)
	Investments	Investments	Investments	Investments	Investments	Investments
	(0.134)	(0.135)	(0.067)	(0.143)	(0.143)	(0.143)
Medicaid Share Inpat.	−0.143	0.135	−0.301***	−0.220	−0.171	0.064
	(0.157)	(0.158)	(0.090)	(0.163)	(0.163)	(0.163)
Case-mix	−0.008	−0.028	0.039**	−0.011	−0.013	−0.025
	(0.019)	(0.019)	(0.017)	(0.019)	(0.019)	(0.019)
Constant	4.925***	5.008***	−1.156***	4.679***	4.673***	4.518***
	(0.442)	(0.443)	(0.143)	(0.470)	(0.469)	(0.467)
Observations	16145	16145	16145	13331	13331	13331
Number of Hospitals	3897	3897		3281	3281	3281
R^2 Within	0.425	0.448		0.425	0.427	0.434

Standard errors in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%
Only hospitals that did not change organizational forms more than once over the time period.

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slightly in Column 2 of Table VI, when I control for geographical differences across the United States.

Column 3 shows that hospital fixed effects are necessary to get unbiased estimates of the effects of organizational forms. Column 3 shows that joint ventures increase their service levels more than vertically integrated hospitals do. The fixed effects regressions in Columns 1 and 2 provide very different conclusions from ordinary least squares regression. Not surprisingly, a Hausman test rejects the hypothesis that difference in coefficients from the first column and the third column is not systematic at all significance levels. Hence, hospital fixed effects must be used to consistently estimate the effect of organizational forms on investment decisions.

Column 4 shows that the results become statistically and economically stronger when I exclude hospitals that changed organizational forms more than once over the time period. Now, vertically integrated hospitals add a new service every 6 years. Joint ventures also invest more than independent hospitals when I consider only stable hospitals. Hospitals in joint ventures add a new service every ten years.

Column 5 shows that the results for vertical integration are symmetric in sign but not in magnitude. When the hospital integrates, it add one service, every three years, but when it de-integrates, it decreases its investment by one service every ten years. The results for joint ventures are more puzzling. Hospitals that switch from independent to joint typically add one service every three years, but hospitals that switch from joint to independent also add one service, although over a longer period of time. One possible explanation for these results is that environmental changes are not time invariant for the different organizational forms.

Column 6 includes trend variables in the regression. The variable trend is equal to 1 in 1994, 2 in 1995, and 6 in 1999. The results now are striking. First, the results for vertical integration are exactly symmetric: when hospitals vertically integrate, they add one additional service every five years. When they vertically disintegrate, they shut down one service every five years. Second, the results for the joint venture hospitals are now much more similar to those in Columns 1 and 4, and they are statistically very weak. In general, hospitals are increasing their number of services over the years, though the rate of growth is not different across organizational forms.

Organizational Forms and Investment Decisions: A More Disaggregated Analysis. One limitation of the results provided in Table VI is related to the definition of investments that I use. Under this definition, hospitals that add a primary care department and physical rehabilitation services (count = 2) invest the same as hospitals that add a magnetic resonance imaging and breast cancer screening (also count = 2). Clearly, this approach can overlook the fact that the ten technologies used to construct the measure of investments are very different from each other.

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To address this limitation of the dependent variable, I construct ten new dependent variables. Each of the new variables is equal to the sum of the ten technologies minus one. The first that I consider is the sum of the ten services minus breast cancer screening. This new technology is defined in Table VII as $TECH(MAMM)$. Clearly, $TECH(MAMM)$ can take any value between 0 and 9, and $INV(MAMM)$ can take any value between -9 and 9. The other ten technologies, for example $INV(SPECT)$, are defined similarly.

Consider the possibility that the results are driven by changes in only one of the ten technologies. Then, dropping it from the analysis should drastically change the results. Table VII shows that this is not the case. The results change only slightly when I drop one technology at a time. In all regressions I find again that vertical integration is associated with an increase in the number of hospitals' services. Most importantly, I find that joint ventures now also have an effect on investment decisions once I exclude breast cancer screening services or psychiatric outpatient services from the construction of the *TECH* variable. The more disaggregated analysis shows that the change in investment behavior is not just limited to one or two technologies, but affects all the technologies that I have taken into consideration.

Organizational Forms, Investment Decisions, and Managed Care Concentration. There are two reasons why we should be interested in studying the role of managed care in a hospital's investment decisions. First, the basic idea of this paper is that hospitals adopt new organizational forms to reduce their investments' specificity to managed care contracts. Hence, I want to test whether the differences in investment behavior between independent and non-independent hospitals are larger where the managed care market is more concentrated. Second, I want to make sure that the organizational indicators are not proxy themselves for managed care concentration, and thus do not measure the effect of adopting new organizational forms.[20]

Table VIII reports the estimation results of several regressions, where the dependent variable is still the change in service levels over time. The first column reports the baseline regression, which is an ordinary least square regression with hospital fixed effects. The second column is the baseline regression with fixed effects for each year and state-year interactions. The third regression includes interaction terms between the organizational forms and measures of market concentration and market density of primary care physicians. The last two columns use the notion of successful and failed organizational changes discussed previously.

It is immediately clear that the results closely follow those presented in Table VI: vertical integration is strongly associated with increases in service

[20] A minor caveat to this part of the analysis is that the sample of analysis is smaller than the one used in Table 6. I do not observe managed care penetration in 1999.

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TABLE VII

A MORE DISAGGREGATED ANALYSIS

	INV (MAMM)	IN (DRAD)	INV (MRI)	INV (SPECT)	INV (OPCN)	INV (OPHO)	INV (RHBO)	INV (PCDE)	INV (PSYO)	INV (ALCO)
Joint	**0.059****	**0.052**	**0.035**	**0.038**	**0.043**	**0.044**	**0.045**	**0.045**	**0.055****	**0.052**
	(0.032)	**(0.032)**	**(0.032)**	**(0.032)**	**(0.032)**	**(0.031)**	**(0.031)**	**(0.032)**	**(0.033)**	**(0.033)**
Vertical	**0.104******	**0.083******	**0.074******	**0.077******	**0.068*****	**0.074******	**0.059*****	**0.053****	**0.065*****	**0.063*****
	(0.029)	**(0.028)**	**(0.028)**	**(0.029)**	**(0.029)**	**(0.028)**	**(0.028)**	**(0.028)**	**(0.029)**	**(0.030)**
Tech. Endowment*	−0.83***	−0.83***	−0.84***	−0.84***	−0.84***	−0.82***	−0.83***	−0.84***	−0.84***	−0.83***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Log(Beds)	−0.18***	−0.16***	−0.15***	−0.16***	−0.12**	−0.10*	−0.11**	−0.10*	−0.17**	−0.17***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)	(0.06)	(0.06)
Capacity Util.	−0.078	−0.043	−0.024	−0.020	−0.075	0.031	−0.030	−0.040	−0.072	−0.062
	(0.096)	(0.095)	(0.095)	(0.096)	(0.096)	(0.092)	(0.093)	(0.094)	(0.097)	(0.099)
Outpati./Inpat.	−0.050	−0.068	−0.216	−0.156	−0.167	−0.128	−0.136	−0.194	−0.182	−0.078
	(0.230)	(0.227)	(0.227)	(0.230)	(0.231)	(0.220)	(0.223)	(0.226)	(0.233)	(0.238)
Medicare	0.294**	0.275**	0.287**	0.282**	0.323**	0.252**	0.258**	0.253**	0.315**	0.283**
	(0.125)	(0.124)	(0.124)	(0.125)	(0.126)	(0.120)	(0.122)	(0.123)	(0.127)	(0.129)
Medicaid	−0.141	−0.155	−0.026	−0.162	−0.114	−0.111	−0.110	−0.160	−0.131	−0.178
	(0.146)	(0.145)	(0.145)	(0.147)	(0.147)	(0.140)	(0.142)	(0.144)	(0.148)	(0.151)
Case-mix	−0.007	−0.008	−0.005	−0.009	−0.007	−0.002	−0.010	−0.005	−0.010	−0.008
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.018)	(0.018)
Constant	4.245***	4.336***	4.666***	4.532***	4.560***	3.893***	4.081***	4.430***	4.841***	4.766***
	(0.413)	(0.408)	(0.409)	(0.414)	(0.415)	(0.396)	(0.402)	(0.407)	(0.419)	(0.427)
Observations	16145	16145	16145	16145	16145	16145	16145	16145	16145	16145
Number of Hospitals	3897	3897	3897	3897	3897	3897	3897	3897	3897	3897
R^2 Within	0.425	0.420	0.429	0.428	0.430	0.421	0.425	0.426	0.432	0.426

Standard errors in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%

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Table VIII

Organizational Forms, Managed Care, and Investments

	Baseline Regression Investments	Year Fixed Effects, and their Interaction with State Fixed Effects Investments	Baseline with Interactions of HHIA and Primary Investments	Failures Investments	Successes Investments
Joint*HMONBR	**0.961**	**0.919**	**0.633**	**1.713**	**2.019***
	(0.785)	**(0.790)**	**(0.899)**	**(1.201)**	**(1.080)**
Vertical*HMONBR	**1.662****	**1.618****	**1.111**	**0.375**	**2.052***
	(0.690)	**(0.691)**	**(0.787)**	**(1.094)**	**(1.118)**
HMONBR	−0.137	0.996	0.032	0.338	−1.055
	(0.599)	(0.656)	(0.610)	(0.794)	(0.683)
HMOPEN	0.467***	−0.310*	0.466***	0.258	0.620***
	(0.137)	(0.175)	(0.137)	(0.167)	(0.161)
HHI of Hospital Admission (HHIA)	−0.124	−0.265**	−0.134	−0.126	0.004
	(0.118)	(0.120)	(0.119)	(0.141)	(0.138)
% Primary Care Physicians (PRIMARY)	−4.688	−4.826	−4.918	−2.082	−2.013
	(3.569)	(3.544)	(3.576)	(3.716)	(3.606)
Joint*HHIA			−0.001		
			(0.060)		
Vertical*HHIA			0.054		
			(0.052)		
Joint*PRIMARY			0.424		
			(0.441)		
Vertical*PRIMARY			0.156		
			(0.318)		
Technology Endowment	−0.840***	−0.861***	−0.840***	−0.830***	−0.841***
	(0.009)	(0.009)	(0.009)	(0.011)	(0.011)
Log(Beds)	−0.154**	−0.076	−0.153**	−0.063	−0.152**
	(0.060)	(0.061)	(0.060)	(0.074)	(0.070)
Capacity Utilization	−0.049	0.002	−0.049	−0.011	−0.064
	(0.106)	(0.107)	(0.106)	(0.129)	(0.125)
Outpatients/Inpatients	−0.261	−0.617**	−0.250	−0.106	−0.387
	(0.251)	(0.253)	(0.251)	(0.294)	(0.266)

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TABLE VIII. (Contd.)

	Baseline Regression Investments	Year Fixed Effects, and their Interaction with State Fixed Effects Investments	Baseline with Interactions of HHIA and Primary Investments	Failures Investments	Successes Investments
Medicare Share of Inpatients	0.242*	0.056	0.243*	0.298*	0.273*
	(0.140)	(0.141)	(0.140)	(0.164)	(0.160)
Medicaid Share Inpatients	– 0.083	0.160	– 0.086	– 0.082	– 0.166
	(0.159)	(0.160)	(0.159)	(0.175)	(0.168)
Case-mix	-0.017	-0.039*	-0.017	-0.021	-0.018
	(0.021)	(0.021)	(0.021)	(0.023)	(0.024)
Constant	5.109***	5.234******	5.106***	4.207***	4.811***
	(0.450)	(0.452)	(0.451)	(0.530)	(0.496)
Observations	15563	15563	15563	10543	10702
Number of Hospitals	3743	3743	3743	2616	2632
R^2 Within	0.428	0.451	0.428	0.417	0.435

Standard errors in parentheses
*significant at 10%; **significant at 5%; ***significant at 1%

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levels, while joint ventures are associated with an increase in service levels only if we restrict attention to successful organizational changes. The coefficient is interpreted as follows. When the average percentage of county population covered by each HMO increases by 10 per cent, the vertically integrated hospital adds 1.6 more services every ten years than does an independent hospital. If the average percentage of county population covered by each HMO increases by 20 per cent, the vertically integrated hospital adds 3.2 more services every ten years than does an independent hospital. Clearly, the effect of organizational forms on investments is stronger where the average percentage of county population covered by each HMO is larger.

The results are stronger when the analysis is restricted to successful changes of organizations (column 5). Now, when the average percentage of county population covered by each HMO increases by 20 per cent, the vertically integrated hospital adds 4 more services every ten years than an independent hospital. This is a remarkable difference.

The third column shows that the coefficients are imprecisely estimated when I interact the organizational forms with the measures of market concentration and market density of primary care physicians. There are two explanations. The first one is that the measures of *HMONBR* and of market concentration and market density of primary care physicians are both market, not hospital, specific, and there might not be enough variation in the data to identify them separately. It may also be that these variables are all measuring the same thing. A closer look at the results can help in providing a reasonable explanation. The magnitude of the coefficient of $Vertical*HMONBR$ is still very large and very close in magnitude to the value estimated in the first two columns. Hence, I conclude that the data do not provide enough information to estimate precisely the effect of $Vertical*HMONBR$ when I also include $Vertical*HHI$ and $Vertical*PRIMARY$.

VI. CONCLUSIONS

The healthcare literature has debated whether hospitals and physicians have vertically consolidated in the 1990's to increase their bargaining power versus MCOs, or to provide better and more efficient care to their patients (Gaynor and Haas-Wilson [1999]).[21] A rich body of the specialized healthcare literature has thoroughly examined anecdotal evidence and case studies, and often reached opposite conclusions (Robinson and Casalino

[21] Hospitals and physicians could be vertically consolidating to increase their negotiating power versus the managed care organizations (Gal-Or [1999], Gaynor and Haas-Wilson [1999). By doing so, hospitals would not increase the total welfare, but they would appropriate some of the wealth of the managed care organizations. The evidence is mixed on whether hospitals increased prices when they vertically integrated or formed joint ventures with the physicians. See Cuellar and Gertler [2002] and Ciliberto and Dranove [2003] for more on this.

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[1996], Shortell *et al.* [1996). In the only previous work that uses a large dataset to test well-established theories, Cuellar and Gertler [2006] show that there are no significant differences in the costs of vertically consolidated versus independent hospitals.

In this paper I show that vertically integrated hospitals, and to some extent hospitals that form joint ventures, add new services at a faster pace than do independent hospitals. The evidence is particularly convincing when I restrict the analysis to organizational changes that were successful in the sense that after adopting a new organizational form, the hospitals did not subsequently abandon it. I conclude that vertical integration and joint ventures are efficiency enhancing, as they prevent hospitals' under-investment in new services.

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