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Yu-Chu Shen
Glenn Melnick

The Effects of HMO Ownership on Hospital Costs and Revenues: Is There a Difference Between For-Profit and Nonprofit Plans?

We conducted multivariate analyses to examine whether high health maintenance organization (HMO) penetration and large share of for-profit health plans in a market reduced hospital cost and revenue growth rates between 1989 and 1998. We found that hospitals in high HMO areas experienced revenue and cost growth rates that were 21 and 18 percentage points, respectively, below hospitals in low HMO areas. We also found that, conditional on overall HMO penetration level, hospitals in areas with high for-profit HMO penetration experienced revenue and cost growth rates that were 10 percentage points below hospitals in areas with low for-profit penetration areas; the difference was especially evident within high HMO penetration areas.

The U.S. health care system has undergone significant structural changes over the past decade, including changes in hospital ownership, the formation of large hospital systems and large medical groups, and an overall increased concentration in the hospital and managed care industries. However, perhaps no change has been as rapid and contentious as the conversion of the health maintenance organization (HMO) industry from a primarily not-for-profit industry (usually not-for-profit Blue Cross plans) to one where for-profit organizations dominate the market. Through a combination of conversions by nonprofit health plans to for-profit status, acquisitions of nonprofits by for-profit companies, and internal growth, the share of total HMO enrollment in for-profit health plans is now over 75% in many parts of the United States.[1] A similar pattern also has been observed in preferred provider organization (PPO) enrollment in many Metropolitan Statistical Areas (MSA).

Despite the significant growth of for-profit HMOs and the controversy surrounding it, empirical evidence on the effects of for-profit health plans on the health care system has been scarce. The need for a better understanding of the effects of health plan ownership on the health care system is critical as the restructuring continues and regulators, such as state insurance commissioners and legislators, are called upon to evaluate both the entry of for-profit plans and/or for-profit conversions of health plans in their states.

Yu-Chu Shen, Ph.D., *is an assistant professor at the Naval Postgraduate School, and a faculty research associate at the National Bureau of Economic Research.* ***Glenn Melnick, Ph.D.,*** *is the Blue Cross of California Professor of Health Care Finance at the University of Southern California, and a resident consultant at RAND.* *This research was conducted when Dr. Shen was with the Health Policy Center at the Urban Institute. Support for this research came from the University of Southern California Center for Health Financing, Policy and Management.* *Address correspondence to Dr. Shen at Code GB, Naval Postgraduate School, 555 Dyer Road, Monterey, CA 93943. Email: yshen@nps.edu* ***Editor's Note:*** *This paper by Yu-Chu Shen and Glenn Melnick has been through INQUIRY's usual peer review process for research papers.*

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Recent actions in Maryland and Kansas provide examples of the contentiousness of these issues as well as the need for better information about how ownership status affects health plans in the United States. The proceedings in these two states to convert Blue Cross/Blue Shield HMO plans to for-profit ownership underscore the controversy and lack of empirical information surrounding the effects of for-profit health plans on the health care system. Both transactions were rejected by regulators in those states.

While there is extensive literature comparing the performance of managed care plans with traditional fee-for-service (FFS) plans (see comprehensive reviews in Miller and Luft 1997; 2002), and some studies documenting the effect of overall HMO penetration on hospital cost inflation (Gaskin and Hadley 1997; Zwanziger, Melnick, and Bamezai 2000), there have been few empirical studies examining how for-profit plans differ from nonprofit plans in terms of their economic effects on health care providers. In this paper, we explore the effect of for-profit expansion in the HMO industry on hospital cost and revenue growth during the period 1989–1998. We present results from a time-series cross-sectional analysis of trends in hospital costs and revenues in the United States. We compare hospitals' financial performance in MSAs where for-profits have gained a large share of the HMO market to MSAs where nonprofit plans retain a substantial share of HMO enrollment. We seek to inform policymakers about how the increasing presence of for-profit health plans affects hospitals' cost and revenue growth and their overall financial status.

Using a hospital fixed-effects model, we found that hospitals in MSAs with high HMO penetration experienced revenue and cost growth rates that were, respectively, 21 and 18 percentage points below hospitals in MSAs with low HMO penetration, a finding that is consistent with prior literature. More importantly, we also found that, conditional on overall HMO penetration level, hospitals in MSAs with high for-profit penetration experienced revenue and cost growth rates that were 10 percentage points below hospitals in MSAs with low for-profit penetration, and the difference was especially evident within MSAs of high HMO penetration. These findings suggest that for-profit HMOs were responsible for reducing hospitals' revenue growth by a substantial amount. At the same time, hospitals appear to have been able to constrain their cost growth to counterbalance their reduced revenue.

Background Literature

Effect of Managed Care on Hospital Behavior

While this study focuses on the effect of for-profit expansions in the HMO industry on the financial state of hospitals, it is useful to first discuss the relationship between the managed care industry as a whole and the hospital industry. The rise of the managed care industry has been credited for slowing down the cost escalation in the health care industry at least during the 1990s (Congressional Budget Office 1995; Miller and Luft 1997, 2002; Glied 2000). Most of the studies focusing on the effect of plan types on utilization and costs within the health plans found that HMO plans have 30% to 40% lower expenditures than FFS plans (Newhouse 1993; Cutler, McClellan, and Newhouse 2000). One way that health plans can lower operating costs is to stimulate price competition among providers in order to negotiate lower prices as part of the selective contracting process. Such a process results in reduced revenue for hospitals, but at the same time encourages efficiency as hospitals are forced to operate at reduced cost. Previous literature found that selective contracting by health plans and price competition indeed lead to lower hospital costs and increased health system efficiency (Zwanziger and Melnick 1988; Bamezai et al. 1999; Zwanziger, Melnick, and Bamezai 2000).

The Role of For-Profit Health Plans on Hospital Behavior

While there is little empirical evidence on the effect of for-profit health plans on provider behavior, the classical microeconomic framework generally hypothesizes that a for-profit organization can achieve higher production efficiency than other forms of ownership. Thus one argument in favor of allowing for-profit conversions is that for-profit plans are able to achieve higher levels of efficiency compared to nonprofit plans (Marsteller, Bovbjerg, and Nichols 1998; Accenture Group 2001). For example, to help meet profit targets, for-profit health plan executives often will offer managers generous profit-sharing and stock option plans in order to help the organization achieve profits. Thus, for-profit health plan managers would be even more

aggressive than nonprofit health plan managers in working to obtain price discounts with hospitals since the hospital services often represent the largest single expense for a health plan. In a competitive market, this would result in lower health insurance premiums and higher levels of insured populations.

However, some have argued that for-profit health plans are no more effective than nonprofit plans at improving health system efficiency (see discussion in Weisbrod 1988). For example, one recent study reported that "conversion of Blue plans to for-profit status does not result in demonstrable economic efficiencies" (Schramm 2001). Moreover, opponents of for-profit conversions of health plans generally have argued that for-profit plans may be too aggressive in negotiating lower prices with providers to reduce health plans' operating costs. They argue that to report profits to shareholders, for-profit plans must negotiate lower prices with providers. This has led to concern that in attempting to maximize profits, for-profit plans may push prices below the point where hospitals can cut their costs without compromising their quality of care, and thus undermine the financial capability of health care providers. Despite heated debates on the merit of for-profit health plans (most apparent in recent media coverage of Wellpoint's failed attempt to convert Blue Cross/Blue Shield nonprofit health plans in Kansas and Maryland), there is little empirical evidence on whether type of ownership in the HMO industry matters in constraining the cost growth in hospitals. Further, there is no empirical evidence on the role of for-profit HMO expansion on hospital financial state.

In summary, the microeconomic framework suggests that hospitals in markets with a high concentration of for-profit health plans face lower revenue growth than hospitals in other markets. It is not clear, however, whether these hospitals' cost growth can be contained at the same rate as their revenue growth. It is also important to keep in mind that the extent to which managed care and its ownership distribution affect hospitals' cost and revenue growth will depend on other hospital and market factors as well, such as hospitals' ownership status, competition among hospitals in a market, and demand for health care among the population. As described in the next section, we capture these hospital and market characteristics in our empirical model.

Model Specification and Empirical Strategy

We examine changes in costs and revenues at the hospital level among all short-term, general, nonfederal hospitals located in MSAs in the United States between 1989 and 1998. We first establish the effect of overall HMO penetration on hospital costs and revenue by comparing costs and revenue growth over time among hospitals in MSAs with low, medium, and high HMO penetration. We then compare changes in hospital cost and revenue over time under different levels of for-profit HMO penetration (low, medium, and high), conditional on their overall HMO penetration level. The unit of observation is the hospital, and we use a hospital fixed-effects model to remove bias that might result from time-invariant unobserved heterogeneity across hospital markets.

For both sets of analysis (overall and for-profit HMO penetration), our empirical strategy consists of two steps. First, we estimate a translog model of hospital cost and revenue to test whether the growth rates of hospital cost and revenue are statistically different between high and low HMO penetration MSAs (in the first analysis), and between high and low for-profit HMO penetration MSAs conditional on the level of overall HMO penetration (in the second analysis). Second, we generate regression-adjusted growth rates to measure the magnitude of growth rate differences that can be attributed solely to differences in overall HMO penetration level and in for-profit HMO penetration levels.

Translog Cost and Revenue Model

The dependent variable is the logarithm of total operating cost for the cost regression and the logarithm of net patient revenue for the revenue regression. We use the standard translog function to account for the highly skewed distributions of cost and revenue. The equation for the first analysis is as follows:

$$Ln\,E_{it} = \alpha_i + \gamma_t + \beta(\ln(O_{it}, P_{it}, I_{it})) + \beta(X_{it}, H^*\gamma_t) + \varepsilon_{it} \quad (1)$$

where

$E =$ annual operating costs or net patient revenue;

$\alpha_i =$ hospital fixed-effects for each hospital i;

γ_t = year dummies for each of four years, t, between and including 1989–1998;
O = hospital output (total inpatient discharges, case mix, total outpatient visits);
P = input prices (proxy by a relative wage index);
I = demand for hospital care (proxy by per capita income);
X = hospital and market characteristics[2] (hospital ownership, teaching status, percent for-profit hospitals in a market, percent government hospitals in a market, and Herfindahl-Hirschman index in a market);
H = indicators for low, medium, and high overall HMO level (medium level is the omitted group), based on penetration rate in 1998 (more details in the next section).

We also include square and interaction terms of hospital input prices and output in our model to capture possible nonlinear relationships between these variables and costs and revenues. The year dummies effectively capture the annual growth rates for hospitals in MSAs with medium HMO penetration level. The key variables of interest are the interaction terms between year dummies and the indicator of HMO penetration levels. The growth rates for hospitals in low and high HMO MSAs are captured by these interaction terms. We perform a joint F-test on the interaction terms' coefficients to test whether the growth rate differences between hospitals in low and high HMO MSAs are statistically significant. Note that the main effect of H is dropped from the fixed-effects model because it is time-invariant.

For the second analysis, we run separate models for hospitals in low and in high HMO MSAs, so we do not constrain hospitals in both types of MSAs to behave the same way. We modify equation 1 by replacing H with F, indicators for hospitals located in low, medium, and high for-profit HMO penetration MSAs in 1998, where hospitals in the medium for-profit HMO penetration MSAs serve as the reference group. Note that the interaction terms of year dummies and H are dropped, because we limit the sample to hospitals in areas with the same level of overall HMO penetration.

For both analyses, we weight the regressions by hospital bed size to avoid the possibility that the experience of small hospitals may dominate the estimation results. To test the robustness of our findings, we also perform unweighted regression analyses. Results are not sensitive to this change.

Estimating Regression-Adjusted Growth Rates

After we estimate the translog models, we generate regression-adjusted growth rates using the following method. We first generate predicted operating cost assuming that all hospitals are in markets with the same level of HMO penetration. We then compute the growth rate using this regression-adjusted cost. To predict the hospital operating costs in the low HMO category, for example, we assume all hospitals in the sample are in low HMO markets (i.e., the indicator of low HMO penetration is turned to 1 and the indicator of high HMO penetration is turned to 0 for the entire sample), while the rest of the variables take on the value of the sample average. In other words, we ask the question, "What would the operating cost in each year be if all hospitals were in low HMO MSAs?" We then apply the smearing retransformation (Duan 1982) to generate consistent predictions of the log-transformed dependent variables. We repeat the same calculation for hospital costs in the high HMO category. We compute the growth rates using these predicted operating costs and net patient revenues and compare the difference in the growth rates between the two HMO categories. Using this method, the difference in regression-adjusted growth rates between low and high HMO categories can be attributed solely to the different levels of HMO penetration since all other observed characteristics are held constant.

For the second analysis, we apply the same method to compare the growth rates between hospitals in low and high for-profit HMO penetration MSAs, conditional on the overall HMO penetration level. Specifically, for all hospitals in low HMO penetration MSAs, we compute the predicted costs assuming all hospitals have the same level of for-profit HMO penetration. We then compare the growth rates between the low and high for-profit HMO categories within low HMO MSAs. We repeat the same process for all hospitals in high overall HMO penetration MSAs.

Issues in Empirical Strategy

There are several empirical issues in estimating the relationship between hospital cost/revenue

and HMO penetration. One concern is that HMO penetration is measured with errors (Baker 1999). Another concern is that the relationship is endogenous: HMO plans might choose selectively to enter a particular provider market structure that would give them the best market advantages. We address these problems by using a hospital fixed-effects model and using 1998 HMO penetration rates to classify the hospitals into MSAs with low, medium, and high HMO penetration levels. This fixed-effects translog model has been used extensively in previous studies (Granneman, Brown, and Pauly 1986; Bamezai et al. 1999; Zwanziger, Melnick, and Bamezai 2000). To the extent that the unobserved characteristics in the provider market remain stable over time, the hospital fixed-effects model would eliminate this potential selection bias. Using 1998 penetration rates to classify MSAs reduces bias that might result from the measurement errors (Greene 1997). The 1998 penetration rates also serve as an exogenous proxy for the actual growth rate during this period (Buerhaus, Staiger, and Auerbach 2000; Dranove, Simon, and White 2002). In a sense, one can think of the end-year HMO and for-profit HMO categories we use as instruments for the actual growth rates in the HMO industry and the rate of its for-profit expansion.

However, if the unobserved bias changed over time, there would be a need to instrument for overall HMO penetration rates (Dranove, Simon, and White 2002), as well as for for-profit HMO penetration rates. We further test the potential endogeneity of overall HMO penetration rates in our first analysis following the Dranove, Simon, and White (2002) approach; the instrumental variable method (IV) produces results that are very similar to those from our standard model.[3] There are no credible instruments for HMO ownership penetration beyond the instruments that can be used for overall HMO penetration rates. Therefore, we cannot directly test the potential endogeneity of HMO ownership for the second analysis. However, we show in the results section that, conditional on overall HMO penetration, hospitals in low and high for-profit HMO MSAs have similar historical growth rates in costs and revenue, as well as similar hospital and market characteristics in the baseline. This indicates that for-profit HMOs do not appear to selectively enter MSAs where there is slow hospital costs and revenue growth; therefore results from our standard model should remain valid.

Data and Variable Construction

Our sample of hospitals consists of all general, short-term, acute hospitals in MSAs between 1989 and 1998. Our analysis focuses on the following years—1989, 1992, 1995, and 1998—because some information is not available to us for the interim years. Since we are concerned with the growth rates in this study, we believe the 3-year gap provides us sufficient information to carry out the analysis. We limit the sample to hospitals in MSAs because the majority of HMO enrollment occurred in MSAs during this period, and hospitals in rural areas behave differently from those in urban areas.

Data were drawn from a variety of sources. Hospital data primarily came from the Medicare hospital cost reports and the American Hospital Association (AHA) Annual Surveys. Together, they provide detailed information on hospitals' financial, inpatient, and outpatient characteristics. The plan-level HMO enrollment data were obtained from SMG Marketing, Inc., for 1989 and 1992, and from Interstudy for 1995 and 1998.[4] The enrollment data collects detailed information about enrollment levels, ownership of each plan, and geographic areas served by the plan. The enrollment data were aggregated to the MSA level, so that we obtain both the overall HMO penetration rates and the percentage of HMO enrollment in for-profit plans.[5] We further supplement this data set with other MSA characteristics such as per capita income, population size, and area wage index using the Area Resource File and the PPS Impact file.[6]

Dependent Variables: Hospital Cost and Revenue

In our analysis we focus on annual total operating costs and net patient revenue[7] because health plans will have a more direct effect on operations than on nonoperating activities such as income from investments.[8]

Overall and For-Profit HMO Penetration

We capture the effects of HMO penetration rates and the extent of for-profit HMO ownership on hospital cost and revenue by categorizing hospitals according to whether they operated in

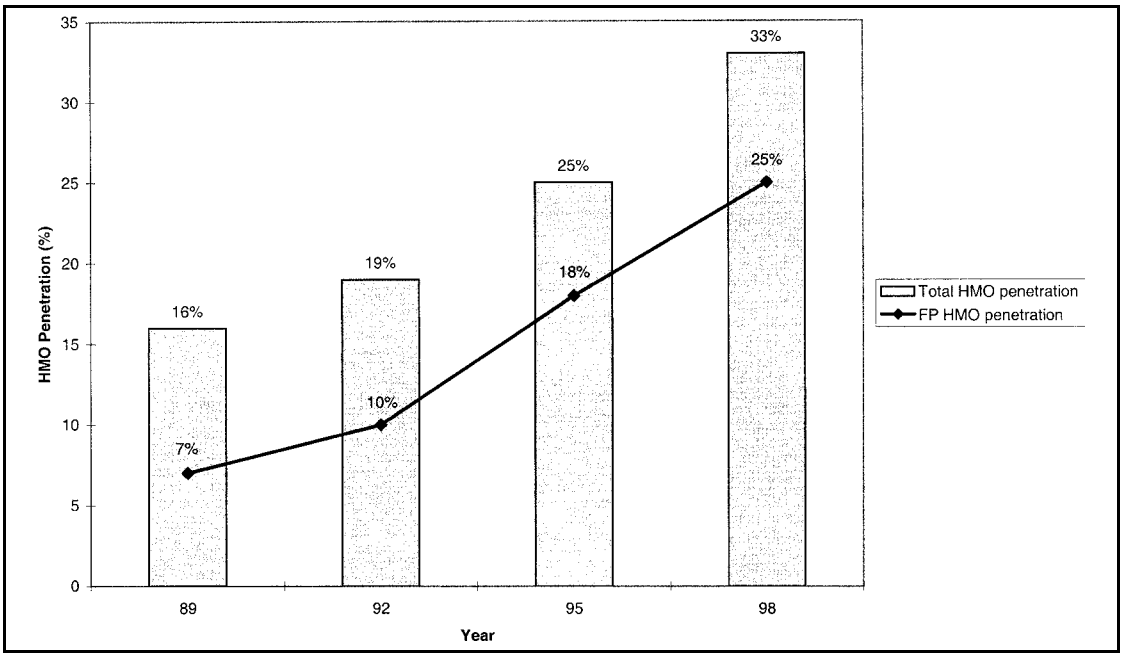

Figure 1. Trend in HMO penetration: 1989–1998 (FP = for-profit)

MSAs with low, medium, and high levels of HMO penetration, and whether they operated in MSAs with low, medium, and high levels of for-profit HMO penetration. We define overall HMO penetration as total HMO enrollment divided by the total population in an individual MSA. Percent for-profit penetration is the number of enrollees in for-profit plans divided by total HMO enrollment in an MSA. We then classify the MSAs into low, medium, and high HMO penetration categories, as well as low, medium, and high for-profit HMO categories. Specifically, we divide MSAs into quintiles based on the 1998 overall HMO penetration rate across all MSAs. High (low) HMO penetration areas are those MSAs whose HMO penetration rates were in the two top (bottom) quintiles in 1998.[9] Medium HMO penetration MSAs are those MSAs in the middle quintile. Likewise, to classify MSAs as high or low for-profit areas, we divide MSAs into quintiles based on the percentage of HMO enrollment in for-profit plans in 1998. An MSA is considered in a high for-profit category if its for-profit enrollment is in the top two quintiles.[10]

We use 1998 HMO penetration rates to classify MSAs for two reasons. First, using levels of penetration instead of the actual penetration rates reduces bias that may result from measurement errors (Greene 1997). Second, the end year's penetration level tends to reflect the level of growth rate during this period (Buerhaus, Staiger, and Auerbach 2000; Dranove, Simon, and White 2002), but is less prone to the endogenous trapping of using growth rates between 1989 and 1998 (i.e., the growth might be the result of changing hospital behavior instead of the other way around).

Study Results

Figure 1 illustrates the trend of overall and for-profit HMO penetration rates between 1989 and 1998. Overall HMO penetration in MSAs increased from 16% to 33%. The fastest growth in HMO penetration occurred between 1992 and 1995. The for-profit HMO penetration rose from 7% to 25%. This represents an increase in for-profit share of total HMO enrollment from 44% to 76% over the study period.

Table 1 summarizes the dependent variables used in our model in 1989 and 1998 and the percentage of hospitals that fall into each of the HMO and for-profit HMO penetration categories. The average hospital operating cost went from $50.8 million in 1989 to $97.1 million in 1998 (in nominal dollars). The average net patient rev-

Table 1. Descriptive statistics of key variables in 1989 and 1998

	1989		1998	
	Mean	S.D.	Mean	S.D.
Dependent variables				
Operating cost ($ millions)	50.8	43.4	97.1	89.6
Net patient revenue ($ millions)	49.6	41.7	92.9	83.5
HMO penetration indicators (%)				
Low HMO penetration indicator	17	37	—	—
Low FP penetration indicator	23	42	—	—
High FP penetration indicator	59	49	—	—
High HMO penetration indicator	61	49	—	—
Low FP penetration indicator	37	48	—	—
High FP penetration indicator	24	42	—	—
Number of hospitals		2,259		
Number of MSAs		318		

Note: FP = for-profit; S.D. = standard deviation.

enue grew from $49.6 million in 1989 to $92.9 million in 1998. Using the 1998 HMO penetration information to classify MSAs, 17% of all hospitals in the sample were located in low HMO MSAs, and 61% were located in high HMO MSAs. Among all hospitals in low HMO MSAs, 23% and 59% of hospitals were located in low for-profit HMO and high for-profit HMO MSAs, respectively. On the other hand, among all hospitals in high HMO MSAs, 37% of them were in low for-profit MSAs and 24% were in high for-profit MSAs.

In Table 2, we compare hospital and market characteristics in 1989 between hospitals in low and high for-profit HMO MSAs, looking separately at low and high overall HMO MSAs. If for-profit managed care plans indeed selectively entered a particular provider market structure that would give them the best market advantages, we would expect for-profit HMOs to enter markets where there was slower growth in hospital cost and revenue. The first two rows of each panel in Table 2 indicate that such is not the case—the historical growth rates in operating cost and net patient revenue were similar between hospitals in low and in high for-profit HMO MSAs, regardless of their overall HMO penetration levels. Within the low HMO category, hospitals in low and high for-profit HMO MSAs were similar in most aspects except that there were more for-profit and government hospitals in high for-profit HMO MSAs. Within the high HMO category, hospitals in high for-profit HMO MSAs tended to be smaller, and more were under for-profit or government ownership than those in low for-profit HMO MSAs. These two groups of hospitals were similar in other observed characteristics. We control for these output and market characteristics in the estimation models that follow.

The Effect of Overall HMO Penetration

The results pertaining to the effects of overall HMO penetration on hospital costs and revenues are presented in Tables 3 and 4. Table 3 presents the fixed-effects results and Table 4 presents the difference in regression-adjusted growth rates between hospitals in high HMO MSAs and those in low HMO MSAs. The interaction terms in the second panel of Table 3 show that relative to the medium HMO category, the operating cost and net patient revenue growth rates of hospitals in low HMO areas were consistently higher than those in the medium HMO category in the entire period. In contrast, hospitals in high HMO areas experienced cost and net revenue growth rates that were consistently lower.

Turning to Table 4, our results suggest that hospitals located in high HMO penetration MSAs experienced significantly reduced growth in both costs and revenues when compared to hospitals located in low HMO areas, a result consistent with previous findings (Gaskin and Hadley 1997). Hospital cost growth in high HMO areas was consistently slower throughout the study period. Between 1989 and 1992, the regression-adjusted difference in cost growth between hospitals in high and low HMO MSAs was six

Table 2. Hospital and market characteristics in 1989: by HMO/FP penetration levels

	Hospitals in low FP areas		Hospitals in high FP areas	
	Mean	S.D.	Mean	S.D.
Hospitals in low HMO areas				
Historical growth rate in operating cost between 1986 and 1987 (%)	9	(8)	10	(12)
Historical growth rate in net patient revenue between 1986 and 1987 (%)	12	(28)	11	(15)
Total outpatient visits	58,078	(49,094.54)	59,651	(61,088.48)
Total hospital discharge	7,423	(5,256.61)	7,928	(6,187.27)
Wage index	1.04	(.11)	1.06	(.12)
Case-mix index	1.30	(.19)	1.27	(.16)
Teaching status	.01	(.10)	.02	(.15)
Indicator for ownership conversion	.07	(.26)	.05	(.21)
Per capita income ($)	14,645	(1,373.93)	14,661	(2,759.24)
FP hospital in a market (%)	9	(17)	15	(19)
GOV hospital in a market (%)	8	(16)	13	(19)
Number of hospitals		101		264
Number of MSAs		34		69
Hospitals in high HMO areas				
Historical growth rate in operating cost between 1986 and 1987 (%)	8	(11)	8	(27)
Historical growth rate in net patient revenue between 1986 and 1987 (%)	10	(41)	8	(40)
Total outpatient visits	106,435	(142,125.00)	55,358	(79,641.54)
Total hospital discharge	9,449	(8,012.61)	5,891	(6,401.88)
Wage index	1.26	(.16)	1.19	(.13)
Case-mix index	1.27	(.17)	1.26	(.19)
Teaching status	.16	(.37)	.07	(.26)
Indicator for ownership conversion	.02	(.15)	.03	(.17)
Per capita income ($)	19,340	(4,913.51)	17,808	(3,440.09)
FP hospital in a market (%)	6	(10)	15	(20)
GOV hospital in a market (%)	8	(11)	10	(13)
Number of hospitals		593		635
Number of MSAs		56		54

Note: Reference group (hospitals in medium HMO penetration areas) is included in the estimation model but omitted from the table presentation. FP = for-profit; GOV = government; S.D. = standard deviation.

percentage points. This difference gap increased to 11 percentage points by 1995, and widened to 18 percentage points by 1998.[11] Hospital net patient revenue growth appears to have been constrained slightly more than costs in MSAs of high HMO penetration: the gap in net patient revenue growth started at eight percentage points in the first three-year period, and widened to 21 percentage points over the entire period (compared to an 18 percentage-point difference in growth rate for hospital costs). In all three periods, the differences between high and low HMO MSAs were statistically significant at the .01 level. These results add to the very limited evidence to date regarding the relationship between high HMO penetration and reduced hospital revenue growth.

The Effect of For-Profit HMO Penetration

The results pertaining to the effects of for-profit HMO penetration on hospital costs and revenues are presented in Tables 5 and 6. Table 5 presents separately the fixed-effects results for hospitals in low and high overall HMO penetration MSAs. Similar to the first analysis, the year dummies capture the growth rates for the omitted (medium) for-profit category. The interaction terms between for-profit HMO indicators and year dummies in the first two columns indicate that among hospitals in low overall HMO penetration MSAs, there were no statistically significant differences in growth rates among hospitals under different levels of for-profit HMO penetrations. Among hospitals in high

Table 3. Estimated coefficients from fixed-effects models, all hospitals

	Dependent variables			
	Log (operating cost)		Log (net patient revenue)	
	Coefficient	S.E.	Coefficient	S.E.
Year 1992	.268**	.009	.288**	.011
Year 1995	.375**	.014	.427**	.017
Year 1998	.491**	.015	.508**	.018
Low HMO × 1992	.012	.013	.012	.016
Low HMO × 1995	.042**	.013	.036**	.016
Low HMO × 1998	.073**	.013	.067**	.016
High HMO × 1992	−.035**	.010	−.045**	.012
High HMO × 1995	−.027**	.010	−.055**	.012
High HMO × 1998	−.027**	.010	−.046**	.013
Other control variables:				
Log(case-mix index)	.459**	.233	.780**	.285
Log(total hospital discharge)	.056	.061	.175**	.074
Log(outpatient visits)	.090**	.038	.175**	.046
Log(wage index)	.068	.199	.295	.242
Log(Herfindahl index)	−.054**	.016	−.071**	.020
Log(outpatient visits^2)	.013**	.002	.015**	.003
Log(total discharge^2)	.038**	.002	.045**	.003
Log(wage index^2)	.281**	.067	.303**	.081
Log(visit)*log(discharge)	−.035**	.005	−.048**	.006
Log(CMI)*log(discharge)	−.025	.027	−.052	.032
Log(visit)*log(wage index)	−.024	.022	−.011	.026
Log(discharge)*log(wage index)	.016	.023	−.018	.028
Teaching status	.015	.021	.098**	.025
MSA per capita income	1.7E-06*	1.0E-06	7.9E-07	1.2E-06
% FP hospital in a market	.051	.031	.009	.038
% GOV hospital in a market	−.053*	.031	−.041	.038
Indicator for hospital ownership conversion	−.025**	.012	−.008	.015
Constant term	14.628**	.386	13.207	.470
Number of hospitals	2,683		2,678	
Number of observations	8,641		8,615	
Goodness-of-fit measure	$F(26, 5932) = 773.57$		$F(26, 5911) = 536.82$	

Notes: FP = for-profit; GOV = government; CMI = case-mix index; S.E. = standard error.
** Significant at 5% level.
* Significant at 10% level.

HMO MSAs, there was also little difference in growth rates between 1989 and 1992. But by 1995, hospitals in low for-profit HMO penetration MSAs consistently had higher growth rates in both operating cost and net patient revenue than hospitals in high for-profit HMO penetration MSAs.

To assess the magnitude of growth rate difference between hospitals in low and high for-profit HMO MSAs, we calculate the regression-adjusted differences in hospital cost and revenue growth rates separately for high and low for-profit areas within high and low overall HMO penetration MSAs; we compare their growth rates in Table 6. Columns 1 and 3 show that for hospitals in low overall HMO penetration MSAs, there was little difference in growth rates between hospitals in low and high for-profit HMO MSAs. Between 1989 and 1998, the growth rate differences in operating cost were four percentage points and were not statistically significant. The growth rate difference in net patient revenue was also small between 1989 and 1995. But by 1998, the gap grew to 10 percentage points and was statistically significant at the .10 level.

For hospitals in high overall HMO penetration MSAs, the effects of for-profit HMOs appear to have strengthened over time. Between 1989 and 1992, the presence of for-profit plans had no ef-

Table 4. Cumulative difference in regression-adjusted growth rates from 1989 (hospitals in high HMO area − hospitals in low HMO area)

	Operating cost	Net patient revenue
1989 to 1992	−.06**	−.08**
1989 to 1995	−.11**	−.15**
1989 to 1998	−.18**	−.21**

** Difference between high and low HMO areas is statistically significant at .01 level.

fect on hospital cost or revenue growth in high overall HMO MSAs. By 1995, hospitals in high for-profit HMO MSAs had experienced an increase in operating cost that was seven percentage points lower than hospitals located in low for-profit HMO MSAs. The difference widened in 1998 to 10 percentage points. A joint *F*-test on the coefficients shows that these differences in operating cost growth rate were statistically significant at the .01 level. The last column of Table 6 indicates that between 1989 and 1995, hospitals in high HMO MSAs with high levels of for-profit enrollment experienced a patient revenue growth rate that was eight percentage points lower than hospitals located in MSAs with a low level of for-profit enrollment. Similar to costs, the difference also widened with time to 10 percentage points by 1998. Again, a joint *F*-test on the coefficients shows that these differences in the growth rate were statistically significant at the .01 level.

Discussion and Conclusions

During the 1990s HMO penetration of the health insurance market grew from 16% to nearly 35%. Contained within this trend was a significant restructuring of the health insurance sector with for-profit health plans becoming the dominant type of HMO coverage in the United States. In a competitive marketplace, new organizational forms overtake existing ones based on economic fundamentals. In this paper, we tested whether the growth in for-profit HMOs was driven in part by improvements in the cost containment effects associated with the for-profit ownership.

First, we conducted multivariate analyses to explore the relationship between hospital revenue and cost growth and the degree of overall HMO penetration. Our results confirm previous findings that hospital cost and revenue growth rates during the 1990s were lower in MSAs with high HMO penetration compared to MSAs with low HMO penetration. In the second part of our analysis, we tested whether cost or revenues grew at different rates depending on whether for-profit or nonprofit plans were the dominant type of plan in the market (conditional on overall HMO penetration levels). Our results show that there was a statistically significant relationship between cost and revenue growth rates and the levels of for-profit HMO penetration. Hospitals in high and low for-profit HMO MSAs within the high overall HMO penetration category started out in 1992 at more or less the same growth rates for both revenues and costs. But by 1995, hospitals in such MSAs with a high level of for-profit HMO enrollment experienced a rate of increase in revenues (cost) that was eight (seven) percentage points lower than hospitals located in MSAs with a low level of for-profit enrollment. By 1998, the gap in both revenue and cost growth between high and low for-profit HMO penetration MSAs within high overall HMO MSAs widened to 10 percentage points.

The classical microeconomic framework hypothesizes that for-profit organizations, because of the importance of profit maximization to shareholders, can achieve higher production efficiency than other forms of ownership. One way of achieving this goal is through aggressive cost management. Since payments to health providers are the largest expense in health insurance operating budgets, they provide the area for greatest potential cost savings. Our results provide evidence of greater cost savings by for-profit plans. However, our findings also suggest that other market factors, such as the overall HMO penetration, can affect the magnitude of savings that for-profit HMOs can generate from hospitals. While we find substantial differences in cost and revenue growth between hospitals in low and high for-profit HMO markets within high HMO MSAs, we find little difference in cost and revenue growth among hospitals within the low HMO areas between 1989 and 1995. Perhaps the small market share of HMOs in a MSA prevents for-profit HMOs from exercising aggressive bargaining strategy compared to those in highly competitive HMO markets. However, the gap in patient revenue growth between hospitals in low and high for-profit markets within the low HMO

Table 5. Estimated coefficients from fixed-effects models, hospitals in low and high HMO penetration MSAs

	Hospitals in low HMO MSA				Hospitals in high HMO MSA			
	Log (operating cost)		Log (net patient revenue)		Log (operating cost)		Log (net patient revenue)	
	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Year 1992	.310**	.023	.326**	.028	.229**	.010	.241**	.012
Year 1995	.440**	.034	.535**	.040	.302**	.015	.310**	.018
Year 1998	.596**	.034	.642**	.041	.397**	.016	.383**	.019
Low FP × 1992	−.033	.028	−.010	.034	.012	.013	.001	.015
Low FP × 1995	−.018	.028	−.004	.033	.055**	.013	.064**	.015
Low FP × 1998	−.012	.028	.019	.034	.099**	.013	.093**	.016
High FP × 1992	−.039	.024	−.021	.029	.000	.015	.000	.018
High FP × 1995	−.020	.024	−.015	.029	.011	.015	.009	.019
High FP × 1998	−.041*	.025	−.031	.030	.043**	.017	.035*	.021
Other control variables:								
Log(case-mix index)	−.597	.562	−.555	.680	.923**	.302	1.316**	.368
Log(total hospital discharge)	−.010	.157	.205	.196	.026	.083	.120	.101
Log(outpatient visits)	−.140	.104	.020	.133	.171**	.048	.248**	.058
Log(wage index)	−.891*	.461	−.218	.559	.397	.276	.250	.335
Log(Herfindahl index)	−.017	.031	−.031	.038	−.053**	.024	−.067**	.029
Log(outpatient visits^2)	.016**	.008	.018*	.010	.012**	.002	.013**	.003
Log(total discharge^2)	.037**	.004	.047**	.005	.046**	.003	.052**	.004
Log(wage index^2)	.664**	.192	.756**	.232	.373**	.094	.487**	.113
Log(visit)*log(discharge)	−.018	.015	−.042**	.019	−.042**	.007	−.054**	.008
Log(CMI)*log(discharge)	.085	.066	.099	.079	−.079**	.034	−.111**	.042
Log(visit)*log(wage index)	−.013	.057	−.085	.070	−.006	.030	.022	.036
Log(discharge)*log(wage index)	.127**	.061	.163**	.074	−.057*	.032	−.077**	.038
Teaching status	.009	.061	.024	.073	.032	.026	.164**	.032
MSA per capita income	5.0E-06*	3.0E-06	.000	.000	3.3E-06**	1.3E-06	2.4E-06	1.6E-06
% FP hospital in a market	−2.83E-03	.054	−.005	.064	.078	.052	.031	.063
% GOV hospital in a market	−.010	.053	−.043	.063	−.058	.050	.002	.061
Indicator for hospital ownership conversion	.032	.024	.044	.029	−.049**	.018	−.032	.022
Constant term	15.733	.841	13.425	1.012	14.232	.536	13.013	.651
Number of hospitals	442		443		1,638		1,633	
Number of observations	1,510		1,507		5,057		5,039	
Goodness-of-fit measure	$F(26, 1042) = 249.04$		$F(26, 1038) = 183.24$		$F(26, 3393) = 365.62$		$F(26, 3380) = 246.55$	

Notes: FP = for-profit; GOV = government; CMI = case-mix index; S.E. = standard error.
** Significant at 5% level.
* Significant at 10% level.

areas grew to 10 percentage points and became statistically significant by 1998, which is the same percentage-point difference we observe in the high HMO MSAs, albeit with a slightly larger standard error due to smaller sample size.

One concern raised by critics of for-profit HMO expansion is that reduced payments to providers will weaken their financial status (Schramm 2001). Our results suggest that this concern may be misplaced. While our results do indicate that hospitals in high for-profit HMO MSAs had slower revenue growth, they also had slower cost growth. Thus, it appears that hospitals facing slower revenue growth were able to cut their operating budgets. It is important to note that we were not able to explore in our analysis whether the cost reduction affected patient care.

Our findings provide an initial estimate of the independent effects of for-profit health plans on hospital cost and revenue growth. This analysis

Table 6. Cumulative difference in regression-adjusted growth rates from 1989 (hospitals in high FP area − hospitals in low FP area)

	Operating cost		Net patient revenue	
	Low HMO area	High HMO area	Low HMO area	High HMO area
1989 to 1992	−.01	−.01	−.02	−.002
1989 to 1995	−.002	−.07**	−.02	−.08**
1989 to 1998	−.06	−.10**	−.10*	−.10**

* Difference between high and low FP areas is statistically significant at .10 level.
** Difference between high and low FP areas is statistically significant at .01 level.

has several limitations. First, for-profit health plan expansion has not occurred randomly throughout the United States, thereby raising the possibility of selection bias. However, we believe combining a hospital fixed-effects model and classification of hospitals into different categories of MSAs by HMO/for-profit HMO penetration levels limits the potential for selection bias. In addition, we re-estimated our first model using an IV method developed by Dranove, Simon, and White (2002) and found that our results were not sensitive to the HMO penetration measure. Our descriptive results also show that historical growth in cost and revenue, and hospital and market characteristics appear to be similar between hospitals in low and high for-profit HMO areas within the same level of overall HMO penetration rate. These provide additional confirmation of the validity of results from our fixed-effects model. Second, our data currently cannot differentiate whether the for-profit expansion was the result of an increase in for-profit plan enrollment or ownership conversion of nonprofit health plans. These two activities might have differential effects on providers. Finally, due to data limitations, we restricted our analysis to HMOs to test for the effects of managed care. While it would be desirable to have data on PPOs, HMOs have been found to generate the largest reduction in health care utilization and expenditures (Thorpe, Seiber, and Florence 2001; Bamezai et al. 1999).

With these limitations in mind, taken together our findings indicate that for-profit HMO expansion has led to significantly reduced growth rates of hospital revenues and costs in MSAs with high overall HMO penetration. One natural question resulting from this analysis is: In what service areas or ways did hospitals cut their operating costs to respond to the for-profit HMO expansion? Furthermore, did those changes in hospital operation affect patient welfare? Several previous studies have documented that the increase in overall managed care has reduced hospital days per capita, lowered use of costly procedures (Miller and Luft 1997; Glied 2000), and reduced the probability of technology adoption in a market (Cutler and McClellan 1996). Perhaps the expansion of for-profit HMOs further pushes hospitals to move along these cost-saving measures. Moreover, the extent to which reduced hospital payments by for-profit health plans are reflected in lower health insurance premiums depends on a number of factors, including the level of competition in health insurance markets.

A complete evaluation of the effects of for-profit health plans necessarily involves examination of many different aspects of the health care system, including differences in costs and prices, quality, availability and coverage for health insurance products offered by for-profit and nonprofit plans. Additional research is needed to provide a more complete picture of the overall effects of the expansion of for-profit health plans on the health care system. The debate on the merits of for-profit ownership status in health care, including that of health plans, is likely to continue.

Notes

1 Tabulation from Interstudy enrollment data.
2 Market is defined as an area within a 15-mile radius from the given hospital's zip code location (Luft and Maerki 1984; Phibbs and Robinson 1993).
3 Results are available upon request to the author.
4 Comparative analysis of HMO penetration measures from these sources for several overlapping years showed that they were highly correlated (personal communication with Jack Zwanziger).
5 MSA-level HMO data were provided by Jack Zwanziger. Detailed construction of the HMO en-

rollment data is described in Bamezai et al. (1999).

6 Information from the Area Resource File (population size and per capita income) were at the county levels. We aggregate these to MSA levels.

7 Net patient revenue is total patient revenue minus contractual allowances and discounts on patients' accounts. Both net and total patient revenues are reported in the Medicare hospital cost reports.

8 Using total cost and total revenue yield very similar results since operating cost and patient revenue are the major components of total cost and revenue.

9 The lower two quintiles include all MSAs whose penetration rate is less than .18; the high HMO category includes all MSAs whose HMO penetration rate is greater than .27.

10 Based on the quintile distribution, the low for-profit category includes all MSAs whose percent of for-profit enrollment is less than 79%; the high for-profit category includes all MSAs whose percent of for-profit enrollment is greater than 97%.

11 As described in the methods section, the regression-adjusted growth rates were computed from predicted operating costs assuming that all hospitals are in markets with the same level of HMO penetration. Thus the difference between low and high HMO MSAs can be attributed solely to the different levels of HMO penetration since all other observed characteristics were held constant.

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