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THE CHANGING EFFECT OF HMO MARKET STRUCTURE: AN ANALYSIS OF PENETRATION, CONCENTRATION, AND OWNERSHIP BETWEEN 1994-2005

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The Changing Effect of HMO Market Structure: An Analysis of Penetration, Concentration, and Ownership Between 1994-2005

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ABSTRACT

We analyze the role of three aspects of HMO market structure -- HMO penetration, HMO plan concentration, and HMO for-profit share on explaining hospital cost and revenue growth during the HMO expansion period (1994-1999) and backlash period (2000-2005). We find that HMO penetration effects differ over time: a 10 percentage point increase in HMO enrollment leads to 2.5 percent reduction in cost and revenues in the expansion period but only 0.4-1 percent reduction in the backlash period. Furthermore, this HMO backlash effect can be attributed to HMO dis-enrollment as well as the changing nature of HMO product. We find that revenue increases at a slower rate (by about 5 percent) in markets with relatively concentrated HMO markets power and more competitive hospital markets. Finally, increased for-profit HMO presence is associated with smaller cost and revenue growth, and the effect differs between low and high penetration markets.

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1. Introduction

With the introduction and growth of managed care, the intense growth in US health care spending since post-war has subsided for the first time in the 1990s. More recently, however, health care spending has accelerated again after a decade of moderate growth. The causes of this increase are not well understood. Some observers suggest that the significant structural changes that managed care has gone through could have an important effect on the overall spending. Over the last fifteen years, managed care industry, in particular, health maintenance organizations (HMO), has experienced an expansion, competition period throughout the 1990s, during when enrollment exploded and many new plans entered the market. It was followed by a contraction, consolidation period that started in the late 1990s and continues to date, when consumers are leaving HMOs and health plans merged or exited completely. The early competitive environment also cultivated for-profit ownership interest: enrollment in for-profit plans rose to dominate the HMO sector in the latter 1990s and continues to increase throughout the 2000s (Figure 1).

Despite the rapid restructuring in the managed care industry, empirical literature has not kept up with these recent changes. Most of the previous work centers on only one aspect of the HMO competition: the effect of HMO penetration (see Miller and Luft, 1994, 1997, 2002; Morrisey 2001; and Scanlon et al, 2006, for reviews). However, these studies either pre-dated the HMO backlash beginning around 1999, or did not differentiate HMO effects before and after the backlash. Moreover, despite the significant activities and the controversy surrounding them, empirical evidence on the effects of managed care backlash, consolidation, and for-profit health plans on the health care system is very limited.

Our study explores the impact of changing managed care market structure on hospital performance during this turbulent period. We focus on the dominant health plan type, HMO, because it is the only form of health plan with reliable data on different aspects of its market structure. This research extends the existing literature in two ways. First, unlike others that focused on one single characteristics of the HMO market, our study analyzes simultaneously three measures that characterize different aspects of the HMO market in one model. Second, this study examines whether and how these three effects differ in the *expansion, competition* period (henceforth expansion period) vs. the *contraction, consolidation* period (henceforth backlash period). Specifically, we address the following research questions:

1. Do different aspects of the HMO market (in particular, penetration, concentration, and for-profit share) have independent effects on hospital cost and revenue growth?
2. Do these HMO effects differ between the expansion period (1994-1999) and the backlash period (2000-2005)?
3. Does the magnitude of these HMO effects depend on the level of overall HMO penetration?

2. Conceptual Framework and Research Design

In this section, we develop a conceptual framework that incorporates the existing literature and the research design for studying three aspects of HMO markets – HMO penetration, HMO plan concentration and HMO for-profit share .

Effect of HMO Penetration: The growth of managed care plans can have numerous direct and indirect effects on hospital performance. Miller and Luft (1994) developed a framework for understanding the various effects of managed care growth, including: (1)

increased purchasing power on the demand side through selective contracting and concentrated buying power which can lead to lower prices and improved cost efficiency, (2) reimbursement through capitation which rewards providers for lower utilization, (3) delivery system consolidation which can lower costs through increased technical efficiency and economies of scale and scope, and (4) increased use of information technology which can improve both cost efficiency and quality. In addition, HMO penetration can affect the performance of non-HMO health plans and thus the overall performance of health insurance market. For example, HMOs compete with non-HMOs for enrollment, thus providing the opportunity for competitive pressure on non-HMO products and plans. Further, to the extent that HMO penetration reaches a sufficient level such that HMO penetration induces broad changes in providers to deliver care more efficiently, this efficiency gain may accrue to non-HMO health plans in the form of HMO spillover effects.

HMOs can reduce the level of health care spending by reducing both price and quantity relative to FFS plans (Chernew et al, 1998). As such, switching enrollees from fee-for-service (FFS) plans into HMOs may lower the level of spending whereby a c*hange* in HMO enrollment is related to *change* in costs or revenue. In addition, HMOs can affect the growth of spending by (1) slowing down the diffusion of new high-cost medical technologies (Cutler and Sheiner, 1998; Baker, 2001), (2) spillover effect of FFS plans adopting HMO's more conservative treatment practice to other patients (Baker 1997, 1999; Heidenreich et al, 2002; Bradford and Krumholz, 2003; Bundorf et al, 2004; Meara et al, 2004), or that (3) change of HMO enrollment may affect spending with a lag (Cuter and Sheiner, 1998). Therefore, a higher *level* of HMO enrollment will result in lower rate of growth in cost or revenue. Consequently, both the level and change in HMO penetration might influence the change in spending.

The empirical literature shows that the level of HMO penetration can affect different aspects of provider performance (Zawnziger and Melnick, 1988; Robinson 1991, 1996; Gaskin, Hadley, 1997; Baker, 1994, 1999; Santerre and Adams, 2002; Hadley and Mitchell, 2002; Meara et al, 2004; Mitchell and Schlesinger, 2005). A number of these studies rely on cross-sectional variation by comparing high and low HMO penetration areas and, as a result, may suffer from omitted variable bias, with the few exceptions that employed plausible instrumental variable(s). Other studies use longitudinal variation to identify the effect of change in HMO enrollment on the change of spending/behavioral outcomes (Baker and Shankarkumar, 1997; Connor et al 1998; Bamezai et al 1999; Currie and Fahr, 2004; Kaestner et al, 2005; Morrisey et al, 2003; Shen and Melnick 2004, 2007; Zwanziger and Mooney, 2005).

In this study, our research design follows the latter approach that employs a more robust hospital/market fixed effect using a 12-year panel of hospital data. However, to allow for an effect to be related to the level HMO penetration, we specify a log-linear relationship to take into account the initial level of penetration. In addition, we allow for differential HMO effects in high and low penetration markets by running separate regression in those markets. Our design also allows us to consider how the HMO penetration effect might differ between the expansion and the backlash periods. It is clear that the HMO backlash effect is not just the reverse of HMO penetration effect: consumers can respond to their dissatisfaction with a firm's performance by "voting with their feet" and switching out of managed care plans into other insurance products, or by "voicing" their preferences and pressuring plans to change (Hirschmann 1970).[1] Our design allows us to differentiate between the "dis-enrollment" and "product change" effects by categorizing markets by their decline or growth in enrollment during the backlash period (details

[1] Studies have documented that HMO plans today bear limited resemblance to those plans of the early 1990s (Lesser et al, 2003), and many are looking more like PPOs (Federman and Siu, 2004).

in the results section). We hypothesize that cost/revenue containment effects will be smaller in markets with substantial dis-enrollment (the backlash markets) than in markets that maintain their enrollment level (the stable markets), because the backlash markets suffer both "dis-enrollment" and "product change" effects, whereas the stable markets would only suffer from "product change" effects.

Effect of HMO Concentration. Market concentration is a well-grounded economic measure of market structure with differential effects depending on whether it is on the selling (monopoly power) or buying side (monopsony power) of the market. Pauly (1998) posits that health plans with more concentrated buying power can exert more power to force price discounts and/or restrict output and as such, more concentrated insurance markets may be better able to inject price competition into hospital markets, leading to reduced cost and revenue growth[2].

The empirical literature on HMO market concentration and hospital performance is limited. Studies reported no relationship between HMO market structure and hospital prices (Zwanziger and Mooney, 2005) or cost per adjusted admission (Younis et al, 2005). Mitchell and Schlesinger (2005) found that greater HMO competition leads gender disparity in coverage and access to care while others show that HMOs in more concentrated markets are less likely to contract with a safety-net hospitals (Zwanziger and Khan, 2006) and are more likely to increase the cost of treating non-HMO patients (Bradford and Krumholz, 2003).

Empirically we do not expect a simple HMO concentration effect on hospital cost/revenue for several reasons. For example, it may be important to consider the level of HMO penetration; there may need a critical mass of market share before the health plan can successfully exert its countervailing power. Further, it may be important to consider the

[2] However, HMO concentration may not be a very precise measure of managed care's bargaining power, as a payer's ability to direct patients to lower-priced hospitals (which increases hospitals' price elasticity of demand) is also critical in determining discounts (Dranove and Satterthwaite, 2000; Sorenson, 2003; Wu, 2005).

structure of hospital markets as well given the wave of hospital consolidations throughout the 1990s which may endow hospitals with countervailing bargaining power in concentrated insurance markets. Our design includes both HMO penetration and HMO concentration at the same time to allow for a scale effect of penetration on HMO market concentration (e.g., a very concentrated HMO market with only 5% HMO penetration may not have much influence). We expect HMO concentration effects cost/revenue growth to be either negative or small but not positive.

For-Profit Ownership. Under the classical microeconomic framework, a for-profit organization can achieve higher production efficiency than other forms of ownership, even when applied to health care. For example, to help meet cost and revenue targets, for-profit health plans offer managers profit-sharing and stock option plans based on performance leading for-profit health plan managers to be more motivated than nonprofit managers to obtain hospital price discounts. For-profit plans are also more likely to use hospital risk sharing strategy (Ahern and Molinari, 2004). These economic incentives are cited by opponents of for-profit health plan conversions who have argued that for-profit plans may be too aggressive in negotiating lower prices with providers to reduce health plans' operating costs. 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). Despite heated debate on the merits of for-profit health plans, there is little empirical evidence on the relative performance of for-profit HMOs. Schramm (2001) and Town et al (2004) both reported that conversion of HMO plans to for-profit status does not result in demonstrable economic efficiency in the health plans. Wholey et al (2006), in a descriptive analysis of HMO plans between 1985 and 2001, even found for-profit HMOs to be less productive than not-for-profit plans. Shen and Melnick (2004) directly tested

whether for-profit HMOs exert more financial pressure than not-for-profit plans on hospital cost and revenue growth between 1989 and 1998. They found that hospital cost and revenue grew at a slower rate with increasing share of FP HMO penetration in the area; and this evidence is stronger high HMO penetration areas. Given the retrenchment of overall HMO penetration in the 2000s, our current study will examine whether for-profit HMO effect changes in the backlash period.

In sum, our approach is designed to examine these behavioral issues over time. First, we analyze the HMO penetration effects by examining both changes and levels. Second, we further decompose the HMO backlash effect by examining dis-enrollment and product change effects in the backlash period. Third, we test the HMO concentration and ownership effects while taking into account the overall HMO penetration level. Of course, there are other market and organizational factors (such as hospital ownership, size, patient mix) that can influence hospitals' financial performance besides the health insurance markets. In the next section, we provide more details on these other factors that are controlled in the empirical models.

3. DATA AND METHODOLOGY

3.1 Overview

We examine hospital costs and revenues among all short-term, general, non-federal hospitals located in MSAs in the United States between 1994 and 2005. The year 1994 is the earliest year where for-profit health plan information is available to us, and the year 2005 is the latest available year of data. We focus on three types of HMO effects (overall penetration, concentration, and for-profit share) in two distinct periods: 1994-1999 and 2000-2005 which represent the expansion and backlash periods of overall HMO enrollment (Swartz 1999,

Robinson 2001, Marquis et al, 2004, Shen and Melnick 2007). We utilize all years of data to capture the effect of changes in HMO characteristics on changes in hospital cost and revenue for each period. The unit of observation is the hospital, and we include hospital and market (MSA) fixed-effects to remove bias that might result from time-invariant unobserved heterogeneity across hospitals and MSAs. Our main model includes all hospitals in the full sample. We then estimate the same model separately for hospitals located in low and high HMO penetration markets. This allows us to capture potential differential effects of for-profit HMO and HMO competition across different levels of HMO penetration.

3.2 Data

Data were drawn from a variety of sources. Hospital data are primarily from Medicare hospital cost reports and the American Hospital Association (AHA) Annual Surveys include detailed information on hospitals' financial performance, inpatient and outpatient utilization, and other characteristics such as teaching status, multi-hospital system membership. In addition, we obtained the edited multi-hospital system information from Drs. Kristin Madison and Sujoy Chakravarty. HMO data were obtained from two sources. The HMO penetration and concentration data were provided by Dr. Laurence Baker of Stanford University.[3] The HMO ownership data were obtained from Interstudy. We supplemented these with data from the Area Resource File and the County Business Patterns (MSA characteristics such as per capita income and population size) and the PPS Impact file (area wage index).[4]

[3] The underlying data sources are from Interstudy.
[4] Information from Area Resource File (population size and per capita income) were at the county levels. We aggregate these to MSA levels.

3.3 Empirical Methods

The dependent variables include 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. In our main analysis, we implement the following model:

$$LnE_{it} = \alpha_i + \gamma_t + \beta(\ln(O_{it}, P_{it}, I_{it})) + \beta(X_{it}, HMO\_P * B_t, HMO\_C * B_t, HMO\_FP * B_t, HOP\_C_{it} * B_t) + \varepsilon_{it} \quad (1)$$

Where

E=annual operating costs or net patient revenue

α_i =hospital/market fixed-effects for each hospital *i*

γ_t =year dummies

HMO_P_{it} =Overall HMO penetration rate in each year.

HMO_C_{it} =HMO Herfindahl index in each year.

HMO_FP_{it} =For-profit share of HMO enrollment in each year.

HOP_C_{it} =Herfindahl index of the hospital market based on patient flow (more in the next section).

B_t =Backlash period indicator for years 2000-2005.

O=hospital output (total inpatient discharges, casemix, total outpatient visits; all log transformed)

P=input prices (proxy by relative wage index, log transformed)

I=demand for hospital care (proxy by log per capita income)

X=hospital and market characteristics (hospital ownership, hospital system membership, financial pressure index from Medicaid and Medicare as defined below, percent for-profit

and government hospitals in a market).

The year dummies capture the average growth rates for hospitals over the entire period. The key variables of interest are the three HMO market measures and their interaction terms with the backlash period dummy. Take the HMO penetration variable for example. The main effect of HMO_P captures the effect of overall HMO penetration on hospital cost in the expansion period (1994-1999). The interaction term between the backlash period indicator and the HMO_P variable tests whether the effect of HMO penetration on hospital costs is different in backlash period (2000-2005) compared to the expansion period. Because the HMO variables are measured at the MSA level whereas our unit of analysis is hospital, we adjust the standard errors of our estimates to account for the clustering at the MSA level.

3.4 Variable Definition

Hospital Cost and Revenue. In our analysis we focus on annual total operating costs and total annual net patient revenue[5], because health plan policies have a more direct effect on operations than on non-operating activities such as income from investments.[6]

HMO Penetration, Concentration, and For-Profit Share. Building on the work of others (Baker 1999; Hymen and Kovacic, 2004; Shen and Melnick 2004, 2007) we capture the effects of HMO penetration (*HMO_P*) by calculating the share of MSA total population enrolled in HMOs in a given year. HMO concentration (*HMO_C*) is captured by a Herfindahl-Herfindahl index using the MSA as the geographic market and is constructed by summing all squared value

[5] 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.
[6] 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.

of individual HMO market shares in each MSA. In sensitivity analyses, we also tested other HMO competition measures such as 1-plan and 2-plan concentrations. For-profit share of HMO (*HMO_FP)* is measured as the ratio of HMO enrollees in for-profit plans over the total number of HMO enrollees in each MSA. We estimate model (1) on the full sample, as well as on hospitals in low and high HMO markets separately. To categorize HMO markets, we calculate the average HMO penetration for MSA over the entire time period, divide the hospitals into three equal samples based on this average and run separate regressions for hospitals in low HMO markets (<17% HMO penetration) and high HMO markets (>25% HMO penetration).

Hospital Competition. Using the 1994-2005 Medicare discharge data extracted from the MEDPAR file, we construct annual, hospital-specific Herfindahl-Hirschman indices (*Hosp_C*) that takes into account each hospital's geographic market and adjusts for hospitals that are part of multi-hospital systems with other members in the same geographic market. Individual hospital geographic markets are defined using actual zip code level patient flow data, following the detailed method described in Bamezai et al. (1999). We broadly outline the approach here. First, competing hospitals are identified on a zip code level as those facilities that draw at least one discharge of a zip code area's total discharges. If two hospitals belong to the same system within the same geographic market, they are treated as a single entity and not as competing entities. Next, an HHI is calculated for each zip code based on the share of total discharges among all competing hospitals in the zip code. Finally, the degree of competition facing each hospital is captured by estimating a weighted average of the zip code area's HHIs in its market, with the proportion of discharges it draws from each zip code area serving as the weight. Though this measure is based on Medicare patients only, previously, a comparative correlation analysis was done using data from several states with all payor data, and the two HHI measures were highly

correlated (Bamezai et al 1999).

Medicare and Medicaid Financial Pressure. The study covers periods in which Medicare underwent several major payment changes for general acute hospitals including, for example, the 1998-Balanced Budget Act (BBA) that included payment reductions for general acute hospitals. To capture the changes in financial pressure by Medicare on each hospital over time, ted by, we construct a hospital specific Medicare fiscal generosity variable based on previous studies including Staiger and Gaumer 1992, Cutler 1998, and Shen 2003. Conceptually, the Medicare fiscal generosity index is calculated as the difference between a hospital's actual payments compared to the payments that it would have received under the new reimbursement method if the hospital did not change its behavior at all in response to the changing reimbursement policies from Medicare. This measure is then weighted by a hospital's Medicare share of patients. Further details of the variable construction can be found in Shen (2003) and Wu (2005).

A Medicaid financial pressure variable was constructed using a measure the generosity of state's Medicaid program. We use the state-level Medicaid physician fee index from Norton and Zuckerman (2000) and the follow-up study by Lewin Group (2003) as the Medicaid financial pressure index. The index is the ratio between each state's physician fee schedule for primary care to the median physician fee of the nation. If a state has an index above 1, it is a more generous state compare to the rest of the nation. If a state's Medicaid financial pressure index is below 1, then it is a less generous state than the median state.[7] In addition, we include hospital's share of Medicaid patients to capture the Medicaid pressure for individual hospitals.

[7] Ideally, we would like to have a Medicaid hospital payment index instead of the physician fee index. However, such measure is not available. What we were able to establish is that state's per capita Medicaid spending on hospital care and on physician services are highly correlated (based on state health expenditure account, the correlation is about 0.6). Therefore the physician fee index should be a reasonable alternative to capture a state Medicaid program's generosity.

4. Results

4.1 Descriptive Statistics

Trend data describing the three HMO market measures are presented in Figure 1. HMO penetration (i.e, total HMO enrollment divided by MSA population), represented by the bars, grew continuously from about 21 percent in 1994 to a peak of 28 percent in 1999, followed by a steady decline to a low of 23 percent in 2005. FP share of HMO enrollment (the dashed line) grew throughout the period from 57 percent in 1994 to 68 percent in 2005. The HMO HHI weighted by population (the dotted line) is U-shaped. In 1994, it was 0.29 and then dropped to 0.21 in 1999 and by 2005 the HMO HHI climbed to 0.27.

Table 1 provides summary statistics of all variables in the empirical models for all years, and separately for the expansion and backlash periods. Panel 1 in Table 1describes changes in the HMO market structure variables. The 1994-1999 period can be characterized growing HMO enrollment and increased competition along with consolidation in the hospital market. During this period, ninety percent of HMO markets experienced positive enrollment growth while at the same time about 70 percent of HMO markets had increased competition as measured by HMO HHI. Most of the HMO markets had stable or increased for-profit presence in the 1994-1999 period and about two-thirds of MSAs had increases in their average hospital HHI values, indicating hospital consolidations in those markets. In contrast, between 2000 and 2005 over three-quarter of the MSAs experience substantial enrollment backlash (enrollment drops of more than 2.5 percent) while about 9 percent of HMO markets had stable enrollment and the remaining 13 percent of markets continue to attract enrollees into HMOs. At the same time, HMO consolidation increased for two-thirds of the MSAs. Growth of FP share grew at the same pace as was in the previous period and the wave of hospital consolidation in the 1994-1999

period did not continue in the 2000-2005 period, with only 10 percent of the market experience an increase in hospital HHI values.

4.2 Hospital Fixed-Effects Regression Results

Table 2 shows the hospital fixed-effects model estimates for cost and revenue measures on the three HMO market variables (complete results on the whole sample are included in the Appendix). The dependent variables are the log of operating cost and log of net patient revenue. The first column of Table 2 shows the coefficients and standard errors for model (1) estimated on the entire hospital sample. The next 2 columns are the results for model (1) estimated separately for low and high HMO penetration markets. All standard errors are adjusted to reflect the clustering of HMO measures at the MSA levels.

Results on HMO Penetration. The coefficient of -0.25 on HMO penetration in the first column (total sample) indicates that a 10 percentage point difference in HMO penetration is associated with a -2.5 percent difference in operating cost between 1994 and 1999. The positive coefficient on the interaction term between HMO penetration and the backlash indicator indicate a statistically significant weakening cost containment effect: during 2000-2005 a 10 percentage point difference in HMO penetration is associated with a smaller cost difference compared to the base period (-0.25+0.14=-.11). When we allow for the log-linear relationship to differ by the level of HMO penetration (columns two and three) the change in HMO penetration has no effect on the change in cost in the low HMO markets, while the cost containment effect is very strong in the high penetration area (-.47) throughout the 1994-2005 period. The same pattern of HMO penetration effect was observed in the revenue regressions (bottom panel of Table 2). In general, we find a modest effect of reducing net patient revenue with the growth of HMO penetration,

and this effect weakens substantially in the backlash period.

The observed -1.1 percent HMO penetration effect in the cost model in the backlash period is a combination of two potential effects: a weakening of the HMO cost containment effect (HMO effect) and the cost increase due to enrollees switching out of HMO plans to other more expensive plans (product change effect). To estimate these two different effects, we re-categorize HMO markets based on the enrollment changes between 2000 and 2005. MSAs that lost more than 2.5 percentage points of enrollment are labeled "backlash markets" while "stable markets" contain MSAs where enrollment has remained roughly constant (within ±2.5 percentage points), and the "growing markets" are areas whose HMO penetration continued to rise. We estimate model (1) separately on these three markets and the results are presented in Table 3[8]. We find that in the stable markets, the HMO cost containment effect weakened substantially in the backlash period, suggesting that even without dis-enrollment, the ability of HMOs to control costs is getting weaker. Among the backlash markets, the effect of losing HMO market share is not symmetric to the effect of gaining market share. Specifically, during the expansion period, every 10 percentage point increase in HMO penetration leads to a 2.8 percent drop in cost and revenue; whereas in the backlash period, every 10 percentage point drop in HMO penetration leads to only 1.2 percent increase (-0.28+0.16=-0.12) in cost. The growing markets only represent 8 percent of the hospital sample in 33 MSAs and we do not find any HMO effect, possibly due to the small number of markets.

Results on HMO Concentration. Controlling for HMO penetration, we did not find any association between HMO concentration and hospital cost or revenue (Table 2). Coefficients on the HMO HHI and its interactions with the backlash indicator are both small in magnitude and

[8] Complete results are available upon request.

insignificant statistically. We also experimented with other concentration measures such as 1-plan and 2-plan concentrations and have similar insignificant findings. Although we do not find average HMO concentration effect on hospital costs or revenues, we suspect that the relationship may not be linear. For example, the HMO concentration effect might only appear in markets where insurers have relatively stronger market power compared to the hospitals they are negotiating with. To investigate this possibility, we modified model (1) by introducing a "dominant HMO market" indicator variable. This indicator captures markets where HMO markets are highly concentrated and hospital markets are highly competitive: we assign a value of 1 to markets where the average HMO concentration across all years is high (HMO HHI is above 0.32, representing upper 50th percentile of HMO Herfindahl distribution) and the average hospital concentration is low (Hospital HHI is below 0.32, roughly lower quartile of hospital HHI distribution).[9] Using these criteria, 8 percent of the hospitals fall into this category. We augment model (1) by adding this indicator as well as its interaction with overall HMO penetration and backlash dummy. Results on the key variables are presented in Table 4. We find that in the backlash period location of a hospital in dominant HMO market matters.[10] In particular, hospital cost and revenue growth is slower in dominant HMO markets than in other markets by 4-7 percent.

Results on HMO For-Profit Share. The regressions on the overall sample suggest that, on average, increase in the share of for-profit HMO does not affect the change in hospital cost or revenue (first column, Table 2). However, there is differential FP effect by levels of HMO penetration. In the low HMO penetration markets, there is no statistically significant relationship in the expansion period. However, in the backlash period, an increase in for-profit share of

[9] Note, on average the hospital market is more concentrated than the HMO market.
[10] Notice that because the dominant market indicator is time-invariant, the main effects drop out of the model.

HMO by 0.1 (i.e., 10 percentage points) leads to 0.5 percent reduction in cost or revenue holding all else equal (second column, Table 2). By contrast, in high HMO penetration markets, the effect of for-profit HMO persists throughout the entire 1994-2005 period. Specifically, a 10 percentage point increase in for-profit share of HMO plans leads to a reduction in cost by about 0.9 percent and a reduction in revenue by 1.1 percent (these effects are significant at the 0.05 level).

Study limitations. One concern with this type of analysis is that the relationship between HMO market characteristics and hospital costs and revenues performance might be endogenously related. That is, HMO plans might selectively enter markets where they see the biggest bargaining advantage (for example, high-cost provider markets). Previous studies used labor market characteristics as instruments for cross-sectional variations in HMO penetration (Baker 1997, Shen and Melnick 2007). In this study we use fixed-effects models to remove potential bias from time-invariant unobserved heterogeneity across MSA and hospital markets. In previous work, we found that the fixed-effects approach produced similar results as the instrumental-variable approach for the coefficients on managed care penetration. However, there are currently no published instruments for HMO concentration and for-profit shares beyond what's available to instrument for overall HMO penetration rates, and it is possible that time-varying omitted changes in concentration and FP shares can be endogenous to cost and revenue growth.

Another potential limitation to this study is that the panel data do not include measures for PPOs and as such we analyze HMO markets instead of the more general managed care markets. Given that HMO is known to have the most aggressive bargaining practices, our estimates of the for-profit and penetration effects can be viewed as the upper bound of their

effects on hospital.

5. Discussions and Conclusions

In this study, we examine the effects of three aspects of HMO market structure (HMO penetration, HMO concentration, and for-profit HMO ownership) on hospital costs and revenues between the HMO expansion and backlash periods. We find that all three dimensions have independent effects on hospital cost and revenue growth. Among the three measures, HMO penetration has the strongest effect on hospital costs and revenue. We find that both the change and the level of HMO enrollment matter. In the HMO expansion period, a 10 percentage point increase in HMO enrollment lead to an approximate 2.5 percent decrease in cost and revenue. In the backlash period where enrollment declined, a 10 percentage point HMO loss in enrollment led to a smaller, 1.1 percent increase in cost and 0.4 percent in revenue. The results are consistent with previous work (Gaskin and Hadley 1997, Shen and Melnick 2007).

Furthermore, we provide some evidence that the weakening cost and revenue containment effect in the backlash period can be attributed to both dis-enrollment from HMOs to other, possibly more expensive products, and a weakening of the HMO cost containment effect as a result of HMO product changes. The fact that hospitals in HMO markets that maintain stable enrollment in the backlash period still rebounded their cost and revenue growth suggest that HMOs are loosening their cost containment strategies. In the backlash market, enrollees switching out of HMO plans have contributed to the observed cost increase in the 2000-2005 period. However, this effect is smaller than the reverse HMO enrollment expansion effect in earlier years. This finding is consistent with the possibilities that (1) FFS plans are also adopting

some cost containment strategies these days, so that switching back to FFS means less cost growth; or that (2) there is still some spill-over effect across different types of health plans.

The rise and decline in HMO concentration is not directly associated with hospital cost and revenue performance and is consistent with previous literature (Younis, et al 2005). We probed the possibility that there might be a threshold effect of HMO concentration and found that hospitals in more competitive hospital markets located in highly concentrated HMO markets experienced slower cost and revenue growth than hospitals in other markets. This finding suggests that health plans that have a critical mass of concentration and face a less competitive provider markets may exert greater leverage over providers.

We find evidence that for-profit plans are still more aggressive in pursuing cost saving strategies relative to not-for-profit plans, especially in markets with high overall HMO penetration. The economic magnitude, however, is relatively small compared to the effect of HMO penetration. In addition, the for-profit effect did not materialize until backlash period for low penetration markets. We suspect that the for-profit HMO effect might be entangled with the changing landscape in hospital market competition. After 2000, hospitals in low HMO markets experience a small but noticeable decline in market power (the average HHI is still higher than that in high HMO markets). As a result, for-profit health plans in low HMO markets might be able to take advantage of the more competitive hospital markets in the backlash period.

Since 2000, health care spending has accelerated again after a decade of moderate growth. Can we still rely on HMO, and more generally the managed care industry, to keep spending under control? It is clear that HMOs has played a significant role in slowing down health care spending growth during its expansion period, and has lost its grip in the backlash period due to dis-enrollment and changes in their approach to control cost. Such change in

managed care industry might be welcome if it is accompanied by higher patient satisfaction and quality of care. There is no evidence to suggest either way. A natural extension of this work would be to examine other aspects of patient care to provide a more comprehensive picture. However, without reversing their product nature back to the expansion period, we would need to look for other ways to achieve the cost control. We also establish that the managed care's countervailing power and ownership are important and future work examining such bargaining needs to focus on the interactions between health plan and provider market structures. Given that health insurance market consolidations and changing ownership are still occurring, more work is needed to understand the consequences of such market re-structuring on other aspects of the provider markets.

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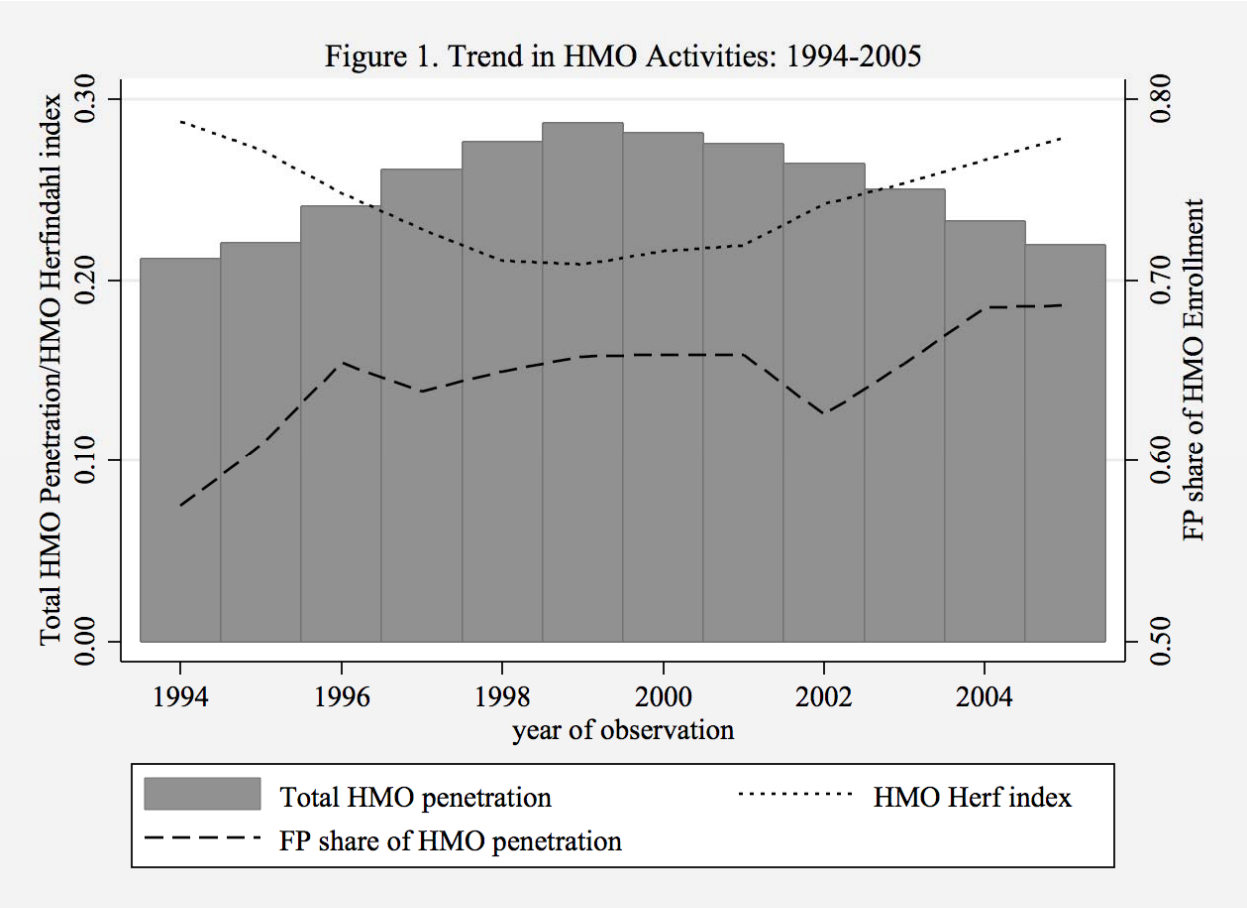
Figure 1. Trend in HMO Activities: 1994-2005
Total HMO Penetration/HMO Herfindahl index
0.00
0.10
0.20
0.30
FP share of HMO Enrollment
0.50
0.60
0.70
0.80
1994
1996
1998
2000
2002
2004
year of observation
Total HMO penetration
HMO Herf index
FP share of HMO penetration

Table 1. Descriptive Statistics of Hospital and Market Characteristics

(standard deviations in parentheses)	All Hospitals All years	All Hospitals By Expansion/Backlash 1994-1999	2000-2005
HMO and Hospital Market Characteristics			
HMO penetration	0.23		
	(0.13)		
Percent with <-2.5% growth		2%	78%
Percent with (-2.5%,2.5%) growth		7%	9%
Percent with >2.5% growth		90%	13%
HMO Herfindahl index	0.27		
	(0.17)		
Percent with <-2.5% growth		70%	28%
Percent with (-2.5%,2.5%) growth		9%	8%
Percent with >2.5% growth		21%	64%
HMO for-profit share	0.68		
	(0.34)		
Percent with <-2.5% growth		16%	29%
Percent with (-2.5%,2.5%) growth		31%	38%
Percent with >2.5% growth		52%	33%
Hospital Herfindahl index	0.34		
	(0.10)		
Percent with <-2.5% growth		6%	45%
Percent with (-2.5%,2.5%) growth		26%	45%
Percent with >2.5% growth		68%	10%
Dependent Variables			
Operating cost (in millions of dollars)	118.99	91.80	150.31
	(114.34)	(83.56)	(134.36)
Patient revenue (in millions of dollars)	116.08	89.70	146.38
	(109.06)	(79.88)	(127.72)
Other Hospital Characteristics			
Not-for-profit ownership	68%	68%	67%
	(47%)	(47%)	(47%)
For-profit ownership	19%	18%	20%
	(39%)	(39%)	(40%)
Government ownership	13%	14%	13%
	(34%)	(34%)	(33%)
Member of a system	64%	62%	68%
	(48%)	(49%)	(47%)
Medicare casemix index	1.38	1.37	1.40
	(0.23)	(0.23)	(0.23)
Total inpatient discharges	10654	10169	11120.66
	(104972)	(137096)	(8617.06)
Total outpatient visits	142149	120523	169147.7
	(149947)	(121701)	(174658.5)
Wage index	1.01	1.01	1.02
	(0.15)	(0.15)	(0.15)
Percent Medicare discharges	39%	39%	38%
	(14%)	(14%)	(13%)
Percent Medicaid discharges	15%	15%	15%
	(13%)	(13%)	(12%)
Medicaid financial pressure index	0.68	0.66	0.70
	(0.18)	(0.21)	(0.15)
Medicare financial pressure index	1.00	1.00	1.00
	(0.08)	(0.10)	(0.04)
Other Area Characteristics			
Per capita income	28143	25361	31635.5
	(8324)	(6865)	(8651.09)
Percent for-profit hospitals within 15-mile radius	14% (20%)	14% (19%)	15% (20%)
Percent government hospitals within 15-mile radius	8% (13%)	8% (13%)	8% (13%)
Number of hospitals	2742	2628	2311
Number of observations	25489	13669	11820

Table 2. Fixed-Effects Regression Results:
Coefficients on HMO and Hopital Market Characteristics

	Whole Sample	Hospitals by Levels of HMO Penetration	
(Standard errors in parentheses)		Low HMO Markets	High HMO Markets
Dependent Variable: Log(Operating Cost)			
Overall HMO penetration	-0.25**	-0.23	-0.47**
	(0.07)	(0.15)	(0.12)
X Backlash period (2000-2005)	0.14**	0.20+	0.03
	(0.04)	(0.12)	(0.10)
HMO Herfindahl index	0.01	0.02	-0.02
	(0.02)	(0.02)	(0.08)
X Backlash period	0.01	-0.01	-0.01
	(0.03)	(0.03)	(0.08)
HMO for-profit share	-0.01	0.00	-0.09*
	(0.01)	(0.01)	(0.04)
X Backlash period	-0.01	-0.05**	0.05
	(0.02)	(0.02)	(0.03)
Dependent Variable: Log(Patient Revenue)			
Overall HMO penetration	-0.23**	-0.04	-0.38**
	(0.07)	(0.16)	(0.12)
X Backlash period	0.19**	0.11	0.02
	(0.05)	(0.13)	(0.10)
HMO Herfindahl index	0.01	0.04	-0.00
	(0.02)	(0.02)	(0.08)
X Backlash period	-0.01	-0.04	0.05
	(0.02)	(0.03)	(0.08)
HMO for-profit share	-0.02	-0.00	-0.11**
	(0.01)	(0.01)	(0.04)
X Backlash period	-0.01	-0.05**	0.05
	(0.02)	(0.02)	(0.03)
Observations	25489	8567	8287

Notes:
Robust standard errors in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%
Complete regression results on the whole sample is presented in the Appendix.
Low HMO markets include hospitals in the lower 1/3 of HMO penetration based on average penetration rate between 1994 and 2005
High HMO markets include hospitals in the lower 1/3 of HMO penetration based on average penetration rate between 1994 and 2005

Table 3. Backlash Market Analysis: Coefficients on HMO Penetration by Type of Growth in HMO Markets

	Backlash Markets	Stable Markets	Growing Markets
Dependent Variable: Log(Operating Cost)			
Overall HMO penetration effect in 1994-1999	-0.28**	-0.65**	0.09
	(0.08)	(0.14)	(0.29)
X Backlash period (2000-2005)	0.16**	0.14	0.17
	(0.04)	(0.10)	(0.20)
	Backlash Markets	Stable Markets	Growing Markets
Dependent Variable: Log(Patient Revenue)			
Overall HMO penetration effect in 1994-1999	-0.27**	-0.69**	-0.12
	(0.09)	(0.15)	(0.27)
X Backlash period (2000-2005)	0.19**	0.27*	0.37
	(0.05)	(0.11)	(0.23)
Observations	19379	4102	2008

Notes:
Robust standard errors in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%
Model specification is identical to Table 2

Table 4. Dominant Market Analysis:
Coefficients on HMO Dominant Indicators and HMO Penetration

	Whole Sample	**Hospitals by Levels of HMO Penetration**	
		Low HMO Markets	High HMO Markets
Dependent Variable: Log(Operating Cost)			
HMO dominant markets			
X HMO penetration	-0.15	0.02	-0.06
	(0.16)	(0.19)	(0.22)
X Backlash period	-0.03	-0.04**	-0.06+
	(0.02)	(0.01)	(0.04)
Dependent Variable: Log(Patient Revenue)			
Overall HMO penetration			
X HMO penetration	-0.31	0.04	-0.33
	(0.21)	(0.28)	(0.20)
X Backlash period	-0.05**	-0.06**	-0.07*
	(0.02)	(0.02)	(0.03)
Observations	25489	8567	8287

Notes:
Robust standard errors in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%
HMO dominant markets are markets with high HMO Herf (above 50th percentile of HMO Herfindhal index distribution) and low hospital Herf (below 25th percentile)

APPENDIX. Hospital Fixed-Effects Regression Results on Whole Sample

(Standard errors in parentheses)	Log(Operating Cost)	Log(Patient Revenue)
Overall HMO penetration	-0.25**	-0.23**
	(0.07)	(0.07)
X Backlash period (2000-2005)	0.14**	0.19**
	(0.04)	(0.05)
HMO Herfindahl index	0.01	0.01
	(0.02)	(0.02)
X Backlash period	0.01	-0.01
	(0.03)	(0.02)
HMO for-profit share	-0.01	-0.02
	(0.01)	(0.01)
X Backlash period	-0.01	-0.01
	(0.02)	(0.02)
Hospital Herfindahl index	-0.07	-0.08
	(0.06)	(0.07)
X Backlash period	0.27**	0.37**
	(0.05)	(0.05)
Log(Medicare case mix index)	0.29**	0.25**
	(0.05)	(0.05)
Log(Total inpatient discharges)	0.44**	0.51**
	(0.04)	(0.04)
Log(Total outpatient visits)	0.06**	0.06**
	(0.00)	(0.01)
Wage index	0.16**	0.15**
	(0.05)	(0.06)
Percent Medicare discharges	0.60**	0.74**
	(0.06)	(0.07)
Percent Medicaid discharges	0.08**	0.11**
	(0.03)	(0.03)
Medicaid financial pressure index	-0.01	-0.03
	(0.03)	(0.03)
Medicare financial generosity index	0.06**	0.08**
	(0.02)	(0.02)
For-profit hospital	-0.02	-0.00
	(0.02)	(0.02)
Government hospital	-0.02+	-0.04**
	(0.01)	(0.02)
Member of a system	-0.01	0.00
	(0.01)	(0.01)
Log(per capita income)	0.05	0.04
	(0.04)	(0.05)
Percent for-profit hospitals within 15-mile radius	0.02	0.07*
	(0.02)	(0.03)
Percent government hospitals within 15-mile radius	-0.06*	-0.06
	(0.03)	(0.04)
Constant	12.46**	11.89**
	(0.54)	(0.65)
Observations	25489	25395

Note:
Robust standard errors in parentheses
+ significant at 10%; * significant at 5%; ** significant at 1%
Year dummies are included