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Is the impact of managed care on hospital prices decreasing?

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Received 26 January 2006; received in revised form 21 May 2007; accepted 21 May 2007

Available online 22 January 2008

Abstract

Prior studies find that the growth of managed care through the early 1990s introduced a strong positive relationship between price and concentration in hospital markets. We hypothesize that the relaxation of constraints on consumer choice in response to a “managed care backlash” has diminished the price sensitivity of demand facing hospitals, reducing or possibly reversing the price–concentration relationship. We test this hypothesis by studying the price/concentration relationship for hospitals in California and Florida for selected years between 1990 and 2003, while addressing the potential endogeneity of concentration. We find an increasingly positive price/concentration in the 1990s with a peak occurring by 2001. Between 2001 and 2003, the growth in this relationship halts and possibly reverses.

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JEL classification: I11; L11; D4

Keywords: Managed care; Competition; Hospitals

1. Introduction

For the better part of the 1990s, growth in managed care enrollments was accompanied by marked slowdown in the rate of growth of private health care spending. By the late 1990s and early 2000s, however, this period of relative calm had ended,¹ raising questions about the ability of managed care organizations (MCOs) to contain costs.² A key to cost containment may have been selective contracting, whereby MCOs extracted price discounts from providers.³ A necessary condition for this strategy to succeed is consumers’ willingness to accept restrictions on choice through the use of financial incentives by MCOs to “steer” them to “preferred providers.” A second necessary condition is competition among medical providers; the ability to “steer” patients serves little function if there is only a single provider in the market.

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¹ Levit et al. (2002) and Catlin et al. (2007).

² Lesser et al. (2003).

³ Cutler et al. (2000) and Glied (2000).

A range of studies confirm that by the early 1990s, selective contracting had, perhaps for the first time, generated a positive correlation between price and concentration in hospital markets.⁴ Yet recent marketplace changes – in particular the growing reluctance of patients to accept limitations on access – may be working to once again sever this relationship. In this paper, we test whether, in fact, the price/concentration relationship has begun to weaken, by documenting trends in the price/concentration relationship in California and Florida for the period 1990–2003.

Section 2 presents our conceptual framework. Section 3 discusses methods and data. We use data for inpatient services at urban hospitals in California and Florida for selected years between 1990 and 2003 and address the potential endogeneity of measures of market concentration. Section 4 presents our results and Section 5 discusses their implications. Consistent with the overall cost trends, we find an increasingly positive price/concentration relationship through the 1990s. But between 2001 and 2003, our findings suggest this pattern of growth came to a halt and possibly reversed, although we are cautious about concluding a major shift has occurred.

2. Conceptual framework

We draw on the literature on the industrial organization of health care to provide a conceptual framework for assessing the impact of managed care.⁵ In this literature, hospitals in urban markets are hypothesized to operate in an environment of monopolistic competition. The demand curve for care by privately insured patients (either expressed on their own, through the choices of referring physicians, or as intermediated by managed care) is downward sloping with respect to price. The price that a hospital can command for its services is hypothesized to be a function of its own characteristics and the degree of competition it faces from other hospitals. Specifically, under selective contracting, greater competition increases the elasticity of demand facing the hospital.

Consider the price of a standardized basket of routine inpatient services representing services offered by a majority of hospitals. Let $PRICE_{jt}$ be the price of this basket at hospital i in market j in time t . Following Lynk (1995), Dranove and Ludwick (1999) and Keeler et al. (1999), let C_{ijt} be a vector of predictors of the cost of providing these services based on patient characteristics and case-mix.

Let Z_{ijt} be a vector of hospital i 's characteristics that may influence the price it can charge for care. Examples include the degree to which the hospital offers access to specialized services in addition to routine care and the perceived quality of care. We also hypothesize that a hospital's price may be influenced by its payer mix.⁶ Finally, hospital location and characteristics of the local population may be important.

Turning to market conditions, we hypothesize that a hospital's ability to raise prices will depend on both supply and demand conditions. Let $CONCENTRATION_{ijt}$ be a measure of the level of concentration facing hospital i on the supply side of the market in period t . To the extent that concentration is inversely related to the elasticity of demand facing hospital i , we hypothesize that as concentration decreases, hospital i will find it optimal to reduce its price. Accordingly, we expect a positive (+) relationship between price and concentration. Note that when hospitals integrate into systems, they typically bargain as a unit. Thus, the measure of concentration must account for system membership.

We also hypothesize that the level of competition in the marketplace will reflect demand side conditions and the price sensitivity of shopping. We expect that the price SENSITIVITY of shopping will depend on the degree to which patients, their physicians and/or their MCO-agents base purchasing decisions on price versus other provider characteristics such as location or perceived quality. In particular, we expect that the price SENSITIVITY $_{ijt}$ of shopping will be a function of the presence of managed care in the marketplace. We specifically hypothesize that SENSITIVITY $_{ijt}$ will increase with the share of patients enrolled in MCOs and plan characteristics associated with greater restrictions on choice and more aggressive shopping.

We expect in general that prices will be lower the greater the level of price SENSITIVITY $_{ijt}$. However, we also expect that price sensitivity (the willingness to shop around) will be of greater consequence in low concentration markets where there are more opportunities for competition (i.e. the ability to shop around is greater). We hypothesize accordingly that there will be a negative (–) relationship between price and SENSITIVITY $_{ijt}$. But we also hypothesize that

⁴ Dranove et al. (1993), Keeler et al. (1999) and Zwanziger and Melnick (1988).

⁵ See Dranove et al. (1986) and Dranove and Satterthwaite (2000).

⁶ Patient mix may, for example, influence hospital "practice styles", affecting the prices they can charge. It is also possible that "cost shifting" may occur, although evidence is controversial.

the magnitude the effect of $SENSIVITY_{ijt}$ on price will be lower in more concentrated markets and that consequently, there will be a positive interaction (+) between $CONCENTRATION_{ijt}$ and $SENSIVITY_{ijt}$ as $CONCENTRATION_{ijt}$ increases. These hypotheses are captured by Eq. (1):

$$PRICE_{ijt} = P(Z_{ijt}, C_{ijt}, CONCENTRATION_{ijt}^{(+)}, SENSIVITY_{ijt}^{(-)}, CONCENTRATION_{ijt}^{(+)}) \times SENSIVITY_{ijt} \quad (1)$$

Estimating this model (1) poses several issues. First, estimating it over time requires consistent measures of the price sensitivity at the individual market level. Second, sensitivity may be endogenous to local market conditions. In cross-section analysis, this problem may be addressed by using an instrumental variables approach. However, finding suitable identifiers for estimates involving repeated observations over time poses significant difficulties.⁷

In our analysis we adopt two approaches. First, following earlier work by Zwanziger and Melnick (1988) and Dranove et al. (1993), we estimate a simple version of our model in which we examine the relation between price and concentration over time omitting any measure of sensitivity:

$$PRICE_{ijt} = P(Z_{ijt}, C_{ijt}, CONCENTRATION_{ijt}) \quad (2)$$

Because (2) does not contain any measure of $SENSIVITY_{ijt}$, direct inferences about the impact of changes in this variable are not possible. However, (2) can be used to make indirect inferences by examining the relation between price and concentration over time under changing market conditions. Second, we estimate a variant of our full model (1) in which we include HMO penetration at the metro level as a measure of sensitivity.

A central claim in the literature is that market reforms in the 1980s increased the price sensitivity of shopping by shifting the locus of control over purchasing decisions away from relatively price insensitive consumers and towards more price sensitive health plans empowered to aggressively shop for care using selective contracting.

Estimates employing variants of model (2) find a weak or negative relationship between price and concentration prior to the advent of managed care (e.g. Robinson and Luft, 1985). However, while the exact turning point varies between studies, the growth of managed care in the later 1980s and early 1990s is associated with the emergence of a strong positive relationship between price and concentration.⁸

This research draws on this general analytical framework to consider subsequent trends in the price–concentration relationship in urban hospital markets. We focus on changes in the price–concentration relationship over time rather than its level using a panel data approach. By examining changes over time, we effectively remove the impact of any unobservables that have a time invariant correlation with concentration and price. Such unobservables might include quality or patient severity, both of which could impart a negative bias to a single cross-section estimate of the price/concentration relationship.

We specifically consider hospital inpatient services because they make up a major component of healthcare expenditures and consistent price and volume data are available over long periods for our study states. We focus on urban hospitals (i.e. hospitals located in metro areas) because opportunities for MCOs to engage in competitive contracting typically are very limited outside metro areas. Accordingly, there is little reason to expect any change in the ability to extract price concessions over time. In addition, consistent data on local HMO penetration, which we use as a measure of sensitivity, are only available on a continuous basis for metro areas.

Recent observers have hypothesized that trends on both the supply and the demand side of the marketplace may be reducing the ability of MCOs to win price discounts. On the supply side of the market, downsizing and provider consolidation have led to increased market concentration. This may be enabling hospitals and other providers to exercise growing countervailing market power and makes it important to seek to control for changes in $CONCENTRATION$.

On the demand side of the market, consumer “backlash” may operate to reduce the price sensitivity of shopping in several ways. Through the growth of “managed care lite,” consumers have voted with their feet in the insurance

⁷ Standard identifiers used to examine determinates of MCO penetration on the demand side of the market include employment conditions and market level demographics, which both tend to have low levels of variation over time. On the supply side, analyses typically use lagged values of supply variables measuring conditions prior to significant MCO penetration to avoid problems with their potential endogeneity to managed care (see Dranove et al., 1998).

⁸ See for example Dranove et al. (1993), Keeler et al. (1999), Melnick et al. (2000) and Zwanziger and Melnick (1988).

marketplace. So even though overall enrollments in managed care continue to grow (between 1996 and 2003 the share of covered workers in conventional insurance plans fell from 27 to 5%), there has been a shift in enrollments towards less restrictive types of MCOs. Enrollments in HMOs, which historically have been associated with the tightest controls on choice and utilization, have declined, while the shares in Preferred Provider Organizations (PPOs) and Point of Service plans (POSs), which typically impose less restrictions on choice and are associated with lower discounts, have grown.⁹ Recent discussions also suggest that MCOs of all types, including HMOs, may have responded to market pressures by expanding network size and the menu of providers available to their enrollees. Finally, plans have reduced administrative controls on utilization and the use of incentive payment schemes such as capitation.¹⁰

We hypothesize that a shift in enrollments to less restrictive types of MCOs and increases in network size will reduce $SENSITIVITY_{ijt}$. While we are uncertain about the exact timing, the institutional facts laid out above suggest that these trends will appear in the data beginning in the latter part of the 1990s.

In this context, a potential countervailing force has been growth in managed care enrollment penetration. We expect that controlling for the mix of plans, higher overall MCO penetration will increase $SENSITIVITY_{ijt}$. While MCO enrollments grew throughout the 1990s, they appear to have plateaued by the end of the decade.¹¹ Accordingly, especially in our study states, which have been at the forefront of managed care, we expect any positive countervailing effects from MCO enrollment growth since the late 1990s to be negligible.

3. Overview of data and methods

3.1. Data

We use patient level discharge data and hospital financial data obtained from California Office of State Health Planning and Development (OSHPD) and Florida State Center for Health Statistics (SCHS) data files for 1990, 1995, 1999, 2001 and 2003. We select California and Florida for study because both states have a long history of managed care and consistent price and volume data are available over long periods.¹² We select 1990 to capture the initial impact of rapid growth in managed care enrollments in our study states and 1995 as an example of an “in-between” year prior to the emergence of significant “managed care backlash.” We select 1999, 2001 and 2003 to capture recent trends, where 2003 was the most recent year available to us at the time of our study.

We use data on hospital characteristics such as service offerings, size and system membership from the American Hospital Association’s Annual Survey of Hospitals. Data on HMO penetration are from Interstudy. In addition, we made use of data from the 1990 and 2000 U.S. Censuses to characterize socio-demographic conditions at the zip code level in two ways. First, data for patients’ zip codes of residence were used as instruments in a first-stage hospital choice model to predict $CONCENTRATION_{jt}$, which may be correlated with unobservable market characteristics that are themselves correlated with prices. Second, we include the weighted average of the patient’s zip code information in the second stage.

Zip code data were available at the zip code level in 2000 and at the block group level in 1990. For 1990 and 1995, we use block group data from the 1990 census and aggregate up to the zip code level using a population weighted average. For 1999, 2001 and 2003, we use zip code level data from the 2000 census. The census data are matched to the patient discharge data using the patient’s zip code. We imputed data that were missing in either the 1990 or 2000 census. Observations were missing mostly because of confidentiality requirements which precluded releasing data in zip codes with small populations. As a result we imputed data for 1.2–4.7% of patient observations in each year in Florida and 1.3–5.5% in each year in California.

⁹ For example, in 1996 the share of covered workers enrolled in HMOs was 31%, while 28% were enrolled in PPOs and 14% were in POSs. By 2003, the share of covered workers in HMOs had fallen to 24%, while 54% were enrolled in PPOs and 17% in POSs. Source: Kaiser Family Foundation (2006).

¹⁰ Devers et al. (2003), Draper et al. (2002), Lesser and Ginsburg (2001), Lesser et al. (2003), Kohn (2000) and Mays et al. (2003).

¹¹ See Kaiser Family Foundation (2006) and California Health Care Foundation (2005).

¹² For example AMARA (1995) estimates that in 1993 California ranked first and Florida ranked third among states in levels of both HMO and PPO penetration (estimated rates for HMO and PPO penetration were, respectively, 43 and 29% of the total insured population in California and 22 and 28% in Florida).

We imputed these missing values using a Hotdeck imputation.¹³ In doing so, we assume that the data are missing at random. However, this assumption may be violated because in several cases the data are not reported to prevent confidentiality violations in small zip codes. Regardless, because the majority of patients are in urban areas, the bias from imputing these data is likely to be small.

The specific zip code level variables employed in our analysis are Population Density; Median Household Income; Unemployment Rate; Percent (%) Self Employed; Percent Government Employed; Percent High School Graduates; Percent Baccalaureate degree; Percent Commuting 25 min or more; Percent New Residents; Percent Urban; Percent Age < 18; Percent Age > 65; Percent Female; Percent Black; Percent Hispanic.

3.2. Methods

We examine relationships between hospital prices and market concentration controlling for hospital characteristics using pooled data for California and Florida for 1990, 1995, 1999, 2001 and 2003. We begin by examining the basic price–concentration relation described in Eq. (2). Our basic empirical model (3) is

$$\begin{aligned} \text{PRICE}_{ijt} = & \alpha + \beta_Z Z_{ijt} + \beta_C C_{ijt} + \beta_{\text{CON}ij} \text{CONCENTRATION}_{ijt} + (\beta_{\text{TCON}ijt} \text{CONCENTRATION}_{ijt}) \\ & \times T_t + \beta_{T_t} T_t + \varepsilon_i \end{aligned} \quad (3)$$

As before, we define PRICE_{ijt} , as the price of this basket in hospital i in market j in time t , C_{ijt} as a vector of predictors of the hospital's cost of providing services, Z_{ijt} as a vector of characteristics which may influence the price a hospital can charge for care, including the socio-demographic characteristics for its local zip code, and $\text{CONCENTRATION}_{ijt}$ as a measure of the level market concentration faced by a hospital. We define T as a zero/one time dummy for our selected study years where our base year, 1990, is our omitted category. We interact T with $\text{CONCENTRATION}_{ijt}$ to capture shifts in the price–concentration relationship over time and include T as an independent variable to capture overall trend in price levels over time. We discuss our choice of variables and potential methodological issues in estimating this model below and in particular suggest a novel approach for addressing the possible endogeneity of measures of concentration based on patient flows.

Following (1), we then extend our analysis to consider the SENSITIVITY of shopping. Our full empirical model including a measure of SENSITIVITY (4) is

$$\begin{aligned} \text{PRICE}_{ijt} = & \alpha + \beta_Z Z_{ijt} + \beta_C C_{ijt} + \beta_{\text{CON}ij} \text{CONCENTRATION}_{ijt} + (\beta_{\text{TCON}ijt} \text{CONCENTRATION}_{ijt}) \times T_t \\ & + \beta_{\text{SEN}ij} \text{SENSITIVITY}_{ijt} + \beta_{\text{SEN}ij} (\text{SENSITIVITY}_{ijt} \times \text{CONCENTRATION}_{ijt}) \\ & + \beta_{\text{SEN}ijt} (\text{SENSITIVITY}_{ijt} \times \text{CONCENTRATION}) \times T_t + \beta_{T_t} T_t + \varepsilon_i \end{aligned} \quad (4)$$

We define SENSITIVITY_{ijt} as a measure of the price sensitivity of shopping in the hospital's local market. T is defined as before as a zero/one time dummy for our selected study years where 1990 is our omitted category. We interact SENSITIVITY_{ijt} with T to capture shifts over time. We interact SENSITIVITY_{ijt} with $\text{CONCENTRATION}_{ijt}$ and T to capture possible non-linearities in the relationship between concentration and price sensitive shopping over time.

4. Details about data and methods

4.1. Measuring PRICE

For the purposes of this study, we would like to measure the net discounted price paid by private insurers to a hospital for a standardized basket of routine services (i.e. the net revenue a hospital receives for a standardized basket of services after deducting any price discounts from the hospital's official "list" price or "charges" for these services). Following Keeler et al. (1999), we estimate PRICE_{ijt} as the weighted average of the net revenues received by hospital in period t for patients discharged in 10 common DRGs, while controlling for sex, whether the admission was routine,

¹³ Rubin and Schenker (1986).

whether the patient died, and the log of length of stay.¹⁴ We lack a direct measure of net revenues for use in our index. However, California and Florida data files allow us to calculate estimates of net revenues by combining information on “charges” for individual patient discharges with information on the average discount from charges for private payers as a group.

4.2. Individual hospital characteristics

We consider a range of hospital characteristics Z_{ijt} that may affect the price a hospital can command for its services. Virtually all hospitals offer routine services. We hypothesize that hospitals that also offer the option of access to more advanced services may be able to obtain a price premium.¹⁵ Following Spetz and Maiuro (2004), we calculated an index (TECH INDEX) of the availability of high-tech services designed to take into account that the services became less novel (or less high-tech) over time. For this index we use data from AHA hospital data files on whether a hospital offered the following services: a cardiac catheter Lab, CT Scan, diagnostic radioisotope, open heart surgery and transplant. These services were selected because the survey questions were asked each year over the entire study period.

We hypothesize that hospital size may make hospitals more attractive to patients. To capture this, we use AHA data files to include a dummy variable LARGE HOSPITAL for bed size (greater than 400 beds). Pricing policies for private patients may also be affected by the overall case-mix of patients and hospital payer mix. To control for this we include a measure of case-mix for the hospital (CASE-MIX) and variables for the share of hospital revenues from Medicare and Medicaid based on hospital financial data (% MEDICARE, % MEDICAID). In addition, demand for hospital services may reflect hospital location and the characteristics of the local population. Specifically, we include the following variables for the zip code in which a hospital is located: Population Density; Median Household Income; Unemployment Rate; % Self Employed; % Government Employed; % High School Graduates; % Baccalaureate degree; % Commute \geq 25 min; % New Residents; % Urban; % Age < 18; % Age > 65; % Female; % Black; and % Hispanic.

4.3. Market concentration

We base our measures of CONCENTRATION $_{ijt}$ on hospital-specific Herfindahl Hirschman Indices (HHIs). We draw on data from the American Hospital Association's Annual Survey of Hospitals and supplemental sources on system membership to adjust for integration following Madison (2004). Drawing on Zwanziger and Melnick (1988) and Keeler et al. (1999), we use zip code level patient flow data for individual hospitals and system membership information to directly compute system level HHIs. We designate this measure of concentration HHI $_{SYS}$. The exact formula used to compute HHI $_{SYS}$ is reported below.

Capps et al. (2003) and Gaynor and Vogt (2003) raise questions about using observed levels of concentration to measure opportunities for competition both because HHI is an ad hoc measure and because it may be endogenous to the presence of managed care. Neither paper offers a simple alternative metric for measuring market concentration, instead they focus on the ability of a hospital to translate its market power into higher prices. We have chosen to follow recent literature and use an HHI and control for potential endogeneity bias.¹⁶

4.4. Endogeneity of the HHI

Because HHI $_{SYS}$ yields a system level HHI reflective of actual patient flows, this measure may be endogenous to factors such as unobserved hospital quality, which can, in turn, affect pricing. A further issue is that system membership may also be endogenous.

We address the potential endogeneity of patient flows at the hospital level by computing HHIs for each hospital based on predicted rather than actual patient flows. We then combine these HHIs with information on actual system

¹⁴ The DRGs are 14, 89, 96, 127, 174, 182, 183, 243, 296, and 320. These DRGs are chosen because they are fairly common and, more importantly, there is little variation in severity and treatment intensity within the DRGs. We did not include age or race due to missing data in selected state/years. Otherwise the methodology for computing PRICE is identical to that in Keeler et al. (1999).

¹⁵ Capps et al. (2003).

¹⁶ For a discussion of alternative geographic definitions for HHIs see Lindrooth (2008).

membership to compute estimates of HHI_{SYS} which we employ as instruments in our analysis. We do not, however, attempt to control for the endogeneity of system membership.¹⁷

We designate our measure of concentration using predicted patient flow data HHI_{SYS}^{Pred} . We compute HHI_{SYS}^{Pred} employing a model of hospital choice that builds on the approach used by Kessler and McClellan (2000). We estimate the choice model separately for each state and year. In addition we estimate it separately for the following diagnoses: cardiac care; oncology; labor and delivery; transplants; HIV; orthopedics; pediatrics; and all other diagnoses. Thus we estimate 80 models (5 years \times 2 states \times 8 diagnosis groups). Consistent with Kessler and Geppert (2005) we eliminate hospitals that were more than 100 miles from the patients. We then estimate a grouped conditional logit model where patients are grouped by zip code following Guimarães et al. (2003).

Our model of patient choice utilizes the zip code level census demographic data described above interacted with two measures of distance: within 10 miles of a hospital and the number of miles from the hospital to the patient. We use these measures, rather than a simpler continuous measure, because we have a geographically dispersed choice set and thus sought to have a flexible specification where the effect of distance becomes greater as the patient move beyond 10 miles. We also include the individual hospital characteristics described above in our choice model. Like the demographic variables these are interacted with the distance measures.

The coefficients of the grouped conditional choice model are then used to predict the number of patients admitted to each hospital system by zip code and disease. Note that the choice set includes individual hospitals; the predicted number of patients is based on hospital systems, or groups of hospitals with common ownership. We compute predicted hospital system market shares for each zip code/disease, denoted $\hat{\alpha}_{i,zdt}$ and the predicted HHIs for zip code/disease combination:

$$HHI_{zdt}^{Pred} = \sum_{i=1}^I (\hat{\alpha}_{i,zdt})^2 \tag{5}$$

where i indexes hospital systems; z indexes zip codes; t indexes time and d indexes diseases. These zip code/disease level HHIs are aggregated to the hospital level using the predicted share of the zip code/disease in the hospital systems' total business, denoted $\hat{\beta}_{i,zdt}$, as a weight, where i is based on actual system membership:

$$HHI_{it}^{Pred} = \sum_{z=1}^Z \sum_{d=1}^D \hat{\beta}_{i,zdt} HHI_{zdt}^{Pred} \tag{6}$$

Estimates using HHI_{SYS}^{Pred} and hospital fixed effects are identified using variation in the geographic distribution hospitals and systems. We include zip code demographic characteristics aggregated to the hospital level in the second stage and thus control for changes in demographics over time. Changes in the estimates over time reflect changes in the geographic distribution of hospitals due to consolidation, entry and exit.¹⁸

Note that we compute HHI_{SYS} by calculating Eqs. (1) and (2) using the actual shares in place of the predicted shares. This method is also related to the Zwanziger and Melnick (1988) patient flow HHIs except that we use different disease definitions and use all zip codes served by the hospital.

4.5. Measurement of the price sensitivity of shopping

A variety of possible measures of the price sensitivity of shopping exist, but the only consistent measure available for the full study period is HMO penetration at the metro level. Specifically, we use Interstudy data on the percentage of privately insured enrollees in HMOs (Medicare and Medicaid HMO enrollments are excluded). As noted, HMO penetration and other MCO penetration may be endogenous to local market conditions. In cross-section analysis, this problem may be addressed by using an instrumental variables approach, but as discussed, finding suitable identifiers is difficult for estimates involving repeated observations over time. Reporting HMO penetration as a continuous variable is particularly problematic in this context. To address this issue we treat HMO penetration as a dichotomous variable

¹⁷ An interesting topic for future research is the development of a measure of predicted system membership.

¹⁸ See Dafny (2005) for a novel approach for dealing with potential endogeneity of integration. Unfortunately, this approach is of limited value to our application.

Table 1
Variable means and standard errors by state by year

Variable name	Year				
	1990	1995	1999	2001	2003
California					
Price	7.432 (0.283)	7.465 (0.420)	7.393 (0.568)	7.534 (0.698)	7.887 (0.588)
HHI _{SYS}	0.292 (0.120)	0.366 (0.106)	0.392 (0.121)	0.384 (0.114)	0.378 (0.119)
HHI _{SYS} ^{Pred}	0.168 (0.121)	0.194 (0.106)	0.239 (0.128)	0.234 (0.117)	0.233 (0.130)
LARGE HOSPITAL (≥400 beds)	0.088 (0.283)	0.074 (0.262)	0.092 (0.290)	0.112 (0.316)	0.107 (0.310)
Small Hospital (<200 beds)	0.602 (0.490)	0.618 (0.487)	0.590 (0.493)	0.578 (0.495)	0.562 (0.497)
Teaching Hospital	0.056 (0.229)	0.047 (0.213)	0.060 (0.238)	0.059 (0.237)	0.060 (0.238)
Specialty Hospital	0.044 (0.205)	0.056 (0.231)	0.067 (0.250)	0.063 (0.243)	0.080 (0.272)
For profit	0.289 (0.454)	0.281 (0.450)	0.286 (0.452)	0.274 (0.447)	0.294 (0.456)
Nonfederal Government	0.184 (0.388)	0.178 (0.383)	0.162 (0.369)	0.172 (0.378)	0.164 (0.371)
TECH INDEX	0.583 (0.359)	0.529 (0.357)	0.538 (0.369)	0.585 (0.376)	0.573 (0.391)
CASE-MIX	19.526 (28.232)	22.347 (49.983)	27.456 (69.028)	32.541 (124.920)	33.035 (124.682)
% Medicare Admissions	0.309 (0.168)	0.346 (0.181)	0.363 (0.173)	0.354 (0.173)	0.365 (0.175)
% Medicaid Admissions	0.204 (0.185)	0.268 (0.193)	0.242 (0.183)	0.250 (0.189)	0.259 (0.188)
HMO Penetration (share privately insured enrollees in hospital's metro area)	0.287 (0.122)	0.379 (0.131)	0.510 (0.129)	0.523 (0.136)	0.432 (0.205)
High HMO (1 if HMO Pen ≥ 0.308)	0.208 (0.406)	0.621 (0.486)	0.851 (0.357)	0.855 (0.353)	0.742 (0.438)
Number of Hospitals	342	338	315	303	299
% Hospitals in system	54.68	59.17	66.67	68.32	68.23
Number of Systems	208	180	148	142	142
Hospital Own Zip code Data					
Population Density	1963.087 (1709.493)	1935.782 (1731.509)	1940.261 (1719.686)	1955.604 (1730.210)	1939.846 (1731.879)
Median Income	38048.660 (8061.58)	48457.050 (11678.05)	48422.060 (11992.68)	48752.990 (12149.71)	49189.230 (11975.14)
Unemployment Rate	0.072 (0.025)	0.077 (0.031)	0.077 (0.032)	0.076 (0.030)	0.076 (0.029)
Self Employed	0.083 (0.022)	0.112 (0.028)	0.111 (0.029)	0.110 (0.029)	0.112 (0.029)
Government Employed	0.148 (0.044)	0.152 (0.038)	0.152 (0.039)	0.151 (0.040)	0.152 (0.040)
% High School Graduates	0.527 (0.066)	0.512 (0.071)	0.511 (0.075)	0.512 (0.074)	0.515 (0.073)
% Baccalaureate degree	0.207 (0.079)	0.237 (0.101)	0.235 (0.103)	0.235 (0.103)	0.240 (0.101)
Commute ≥ 25 min	0.405 (0.091)	0.442 (0.088)	0.442 (0.090)	0.443 (0.090)	0.443 (0.089)
New Residents	0.232 (0.063)	0.140 (0.057)	0.140 (0.059)	0.141 (0.059)	0.143 (0.057)
Urban	0.791 (0.309)	0.914 (0.105)	0.923 (0.104)	0.926 (0.104)	0.925 (0.102)
Aged 18 or less	0.279 (0.041)	0.287 (0.042)	0.289 (0.042)	0.290 (0.041)	0.288 (0.040)
Aged 65 or more	0.107 (0.028)	0.112 (0.028)	0.111 (0.029)	0.110 (0.030)	0.110 (0.029)
Female	0.501 (0.010)	0.502 (0.016)	0.502 (0.017)	0.503 (0.017)	0.503 (0.018)
Black	0.064 (0.064)	0.058 (0.054)	0.060 (0.059)	0.060 (0.059)	0.060 (0.058)
Hispanic	0.264 (0.144)	0.328 (0.160)	0.328 (0.166)	0.330 (0.164)	0.319 (0.158)
Florida					
Price	7.400 (0.189)	7.711 (0.227)	7.745 (0.248)	7.946 (0.279)	8.183 (0.248)
HHI _{SYS}	0.310 (0.119)	0.389 (0.070)	0.398 (0.075)	0.397 (0.073)	0.391 (0.084)
HHI _{SYS} ^{Pred}	0.216 (0.125)	0.273 (0.090)	0.281 (0.101)	0.304 (0.089)	0.294 (0.102)

Table 1 (Continued)

Variable name	Year				
	1990	1995	1999	2001	2003
LARGE HOSPITAL (≥ 400)	0.178 (0.383)	0.203 (0.404)	0.205 (0.405)	0.243 (0.431)	0.208 (0.407)
Small Hospital (<200 beds)	0.467 (0.500)	0.430 (0.497)	0.456 (0.500)	0.408 (0.493)	0.455 (0.500)
Teaching Hospital	0.033 (0.180)	0.047 (0.211)	0.053 (0.224)	0.059 (0.237)	0.065 (0.247)
Specialty Hospital	0.028 (0.165)	0.041 (0.198)	0.117 (0.322)	0.066 (0.249)	0.058 (0.235)
For profit	0.444 (0.498)	0.477 (0.501)	0.491 (0.501)	0.487 (0.501)	0.487 (0.501)
Nonfederal Government	0.133 (0.341)	0.122 (0.328)	0.111 (0.315)	0.105 (0.308)	0.104 (0.306)
TECH INDEX	0.649 (0.321)	0.632 (0.361)	0.567 (0.352)	0.663 (0.356)	0.651 (0.362)
CASE-MIX	17.553 (36.025)	19.584 (41.023)	17.954 (28.296)	19.086 (24.982)	17.838 (18.667)
% Medicare Admissions	0.408 (0.170)	0.425 (0.184)	0.384 (0.176)	0.390 (0.177)	0.402 (0.174)
% Medicaid Admissions	0.092 (0.107)	0.123 (0.090)	0.098 (0.082)	0.106 (0.086)	0.114 (0.090)
HMO Penetration (share privately insured enrollees in hospital's metro area)	0.118 (0.063)	0.223 (0.150)	0.343 (0.195)	0.320 (0.100)	0.258 (0.087)
High HMO (1 if HMO Pen ≥ 0.308)	0.000 (0.000)	0.169 (0.375)	0.497 (0.501)	0.289 (0.455)	0.143 (0.351)
Number of Hospitals	180	172	171	152	154
% Hospitals in system	63.89	75.00	77.19	80.26	82.47
Number of Systems	102	72	73	58	59
Hospital Own Zip code Level Data					
Population Density	998.455 (777.026)	1109.386 (914.386)	1142.259 (913.941)	1115.138 (914.261)	1068.664 (891.916)
Median Income	29626.120 (4342.005)	39317.400 (5241.567)	39796.490 (5265.340)	40094.340 (5496.159)	40270.960 (5600.282)
Unemployment Rate	0.060 (0.015)	0.058 (0.019)	0.056 (0.018)	0.055 (0.018)	0.055 (0.018)
Self Employed	0.068 (0.013)	0.113 (0.020)	0.114 (0.020)	0.114 (0.019)	0.113 (0.019)
Government Employed	0.141 (0.048)	0.139 (0.041)	0.135 (0.039)	0.135 (0.038)	0.136 (0.037)
% High School Graduates	0.562 (0.051)	0.576 (0.058)	0.578 (0.059)	0.579 (0.060)	0.580 (0.058)
% Baccalaureate degree	0.173 (0.046)	0.209 (0.053)	0.211 (0.052)	0.211 (0.053)	0.211 (0.053)
Commute ≥ 25	0.369 (0.068)	0.436 (0.068)	0.436 (0.070)	0.438 (0.070)	0.439 (0.068)
New Residents	0.284 (0.061)	0.201 (0.064)	0.201 (0.063)	0.203 (0.065)	0.207 (0.065)
Urban	0.761 (0.292)	0.886 (0.134)	0.894 (0.134)	0.891 (0.133)	0.885 (0.135)
Aged 18 or less	0.230 (0.039)	0.237 (0.036)	0.236 (0.035)	0.237 (0.034)	0.238 (0.034)
Aged 65 or more	0.195 (0.074)	0.185 (0.067)	0.186 (0.065)	0.186 (0.065)	0.186 (0.065)
Female	0.519 (0.009)	0.514 (0.010)	0.514 (0.009)	0.514 (0.010)	0.514 (0.009)
Black	0.125 (0.090)	0.148 (0.103)	0.139 (0.094)	0.132 (0.089)	0.135 (0.096)
Hispanic	0.113 (0.156)	0.163 (0.178)	0.167 (0.184)	0.169 (0.191)	0.162 (0.184)

HIGH HMO, which we set equal to one if penetration exceeds 38%, the median level of penetration in our sample for all years, and zero otherwise. We note that estimates of HMO MSA level penetration show considerable volatility, suggesting potential measurement error.¹⁹

5. Results

Table 1 reports variable means and standard errors separately for California and Florida for our dependent variable PRICE, our measures of CONCENTRATION (HHI_{SYS} and HHI_{SYS}^{Pred}), our control variables for hospital characteristics (LARGE HOSPITAL, TECH INDEX, CASE-MIX, % MEDICARE and % MEDICAID), our control for the SENSIVITY of shopping (HIGH HMO), and our zip code level control variables. The unit of observation is an individual hospital and the sample means reported in the table are unweighted for hospital size. Consequently, small hospitals receive disproportionate weight in relation to their overall share of patient discharges and changes in means over time should be interpreted with appropriate caution.

Highlighting trends relevant to our analysis, PRICE follows a general upward trend in both California and Florida over the study period. In both states there is a marked rise in HHI_{SYS} between 1990 and 1999, from 0.292 to 0.392 in California and from 0.310 to 0.398 in Florida, after which HHI_{SYS} plateaus or slightly declines. Values of our instrument HHI_{SYS}^{Pred} are lower, but follow similar patterns. The number of hospitals in the sample declines over time in both states, from 342 in 1990 to 299 in 2003 in California and from 180 to 154 in Florida, while the share of hospitals in systems increases and the number of systems involved declines in both states. In California the average percentage of private HMO penetration in individual study hospital's metro areas increases from 29 to 52% between 1990 and 2001 and then declines to 43% in 2003. In Florida, penetration is 9% in 1990 and rises to a peak of 34% in 1999, declining to 23% by 2003. The percentage of hospitals in HIGH HMO metro areas (penetration > 38%) follows a similar pattern. In California, the percentage of urban hospitals in HIGH HMO metro areas is 20% in 1990, rises to a peak of 85% in 1999/2001 and falls to 73% in 2003. In Florida, there were no urban hospitals in HIGH HMO metro areas in 1990, but by 1999, almost 50% of hospitals were in HIGH HMO metro areas, while this percentage falls to 14% by 2003.

Table 2 reports the results for estimates of our basic model of the price–concentration relationship (3) using our measure of market concentration HHI_{SYS} based on actual patient flows and our measure based on predicted patient flows HHI_{SYS}^{Pred} . Our focus is our instrumented estimates using HHI_{SYS}^{Pred} . However, OLS estimates using HHI_{SYS} are included as well for purposes of comparability. In both cases we estimate three variants of our model: without controls, with controls without time interactions, and with controls with time interactions. Results on the coefficients of interest for all three specifications of our model are similar in both cases.^{20,21}

Both OLS and instrumented results reported in Table 2 find a modest negative relationship between price and concentration in 1990.²² The price–concentration relationship becomes positive between 1990 and 1995 and continues to strengthen between 1995 and 2001. In both OLS and IV results, consistent with the hypothesis that recent demand side changes have diminished the price sensitivity of shopping, the coefficient for the interaction term between HHI and year

¹⁹ Interstudy penetration estimates at the MSA level are based on survey data on county level enrollments obtained from plans on a voluntary basis. Data for non-respondents in a given year are imputed from past survey responses and data available from state insurance regulators (Interstudy, 2004). Illustrative of the level of volatility in these data, there were 43 MSAs in our data in California and Florida for which we could compare penetration for both 1999 versus 2001 and 2001 versus 2003, a total of 86 market pairs. In about 20% of these 86 pairs, there is either a 50% or greater decrease in HMO penetration or an 80% or greater increase over a 2-year period. Further, when comparing changes over time for our 43 MSAs, in 6 (14%) there are increases of 25% or more in penetration between 1999 and 2001 followed by decreases of 25% or more between 2001 and 2003 or vice versa. We are unsure about the sources of this volatility, but it raises concerns.

²⁰ We do not include the coefficients for individual control variables in the results of second-stage estimates presented in the paper. Results including coefficients for individual control variables are available as a web appendix at <http://www.kellogg.northwestern.edu/faculty/dranove/htm/appendix/>.

²¹ We do not present the results of the first-stage estimation of the hospital-choice model. We estimated 80 separate choice models in order to calculate the predictions. In virtually all the cases the distance variables were highly significant and the demographic/disease interactions with the distance measures were also significant. Sample results from this analysis are available as a web appendix at <http://www.kellogg.northwestern.edu/faculty/dranove/htm/appendix/>.

²² Dranove and Ludwick (1999) suggest a similar finding by Lynk (1995) of a positive price–concentration relationship in California in 1989 may reflect greater intensity of services in large markets, as well as other unobserved factors which may bias results. In any case, as discussed, our focus is on changes in the price–concentration relations, rather than levels at a given point in time.

Table 2
Regressions of PRICE using pooled data for California and Florida hospitals 1990, 1995, 1999, 2001 and 2003

	OLS estimates with HHI _{SYS}			IV estimates with HHI _{SYS} ^{pred}		
	1	2	3	1	2	3
HHI	−0.268*** (0.091)	−0.041 (0.096)	−0.173 (0.137)	−0.330*** (0.084)	−0.110 (0.087)	−0.344** (0.135)
HHI × 1995	0.586*** (0.205)	0.286 (0.208)	0.223 (0.223)	0.598*** (0.153)	0.317** (0.155)	0.203 (0.185)
HHI × 1999	0.861*** (0.251)	0.695*** (0.246)	0.719*** (0.243)	0.670*** (0.198)	0.556*** (0.197)	0.605*** (0.221)
HHI × 2001	1.383*** (0.325)	1.126** (0.342)	1.033*** (0.328)	1.470*** (0.281)	1.198*** (0.256)	1.106*** (0.271)
HHI × 2003	1.024*** (0.242)	0.820*** (0.253)	0.802*** (0.244)	0.919*** (0.209)	0.716*** (0.189)	0.726*** (0.211)
1995	−0.071 (0.082)	0.060 (0.085)	0.169* (0.103)	0.007 (0.041)	0.092** (0.046)	0.209*** (0.065)
1999	−0.218** (0.105)	−0.166* (0.100)	−0.084 (0.108)	−0.051 (0.054)	−0.038 (0.055)	0.053 (0.074)
2001	−0.263* (0.135)	−0.177 (0.145)	−0.057 (0.146)	−0.104 (0.084)	−0.057 (0.084)	0.065 (0.096)
2003	0.198** (0.097)	0.265** (0.105)	0.338*** (0.115)	0.357*** (0.062)	0.382*** (0.070)	0.462*** (0.083)
Constant	7.501*** (0.030)	7.435*** (0.089)	7.609*** (0.648)	7.482*** (0.020)	7.423*** (0.089)	7.474*** (0.585)
Controls	None	Hospital	Hospital, demographics	None	Hospital	Hospital, demographics
R ²	0.165	0.253	0.297	0.165	0.253	0.296
N	2422	2422	2422	2422	2422	2422

*** Significant at 1% level.
 ** Significant at 5% level.
 * Significant at 10% level.

Table 3
 Regressions of PRICE using pooled data for California and Florida hospitals 1990, 1995, 1999, 2001 and 2003

	IV estimates HHI_{SYS}^{Pred} using fixed effects		
	1	2	3
HHI	−0.517** (0.204)	−0.429** (0.209)	−0.228 (0.215)
HHI × 1995	0.373** (0.172)	0.300* (0.181)	−0.005 (0.202)
HHI × 1999	0.812*** (0.214)	0.697*** (0.220)	0.439* (0.237)
HHI × 2001	1.261*** (0.258)	1.157*** (0.252)	0.837*** (0.261)
HHI × 2003	0.881*** (0.222)	0.775*** (0.209)	0.486** (0.224)
1995	0.067 (0.046)	0.130** (0.052)	0.185 (0.130)
1999	−0.084 (0.057)	−0.021 (0.065)	0.025 (0.137)
2001	−0.055 (0.078)	0.013 (0.083)	0.064 (0.150)
2003	0.349*** (0.063)	0.435*** (0.078)	0.462*** (0.146)
Constant	7.526*** (0.041)	7.714*** (0.113)	8.346*** (1.214)
Controls	None	Hospital	Hospital, demographics
R^2	0.237	0.250	0.280
N	2422	2422	2422

*** Significant at 1% level.
 ** Significant at 5% level.
 * Significant at 10% level.

falls substantially between 2001 and 2003, and in IV results, the differences between coefficients for $HHI_{SYS}^{Pred} \times 2001$ and $HHI_{SYS}^{Pred} \times 2003$ are statistically significant for cases 1 and 2.²³

We performed both Breusch-Pagan and Hausman specification tests to test if there was a hospital-specific fixed error component and whether random effects might be appropriate for our model using HHI_{SYS}^{Pred} . These tests implied that a fixed error component was present and that a hospital fixed effect specification would be appropriate.

Table 3 reports the results of estimates of our basic model (3) using hospital-level fixed effects and HHI_{SYS}^{Pred} . Standard errors are calculated using a bootstrap controlling for hospital-level clustering with 500 repetitions. These standard errors are consistent with those suggested by Bertrand et al. (2004) in a panel data framework.

Results in Table 3 also find a negative relationship between price and concentration in 1990 and the coefficient of concentration remains statistically significant. Again, the price–concentration relationship becomes positive between 1990 and 1995 and continues to strengthen between 1995 and 2001. However, in all three of our models, the magnitude of the interaction coefficient between time and concentration declines between 2001 and 2003 and the coefficients of $HHI_{SYS}^{Pred} \times 2001$ and $HHI_{SYS}^{Pred} \times 2003$ are significantly different in all three of our models.

Some hospitals in our sample report very high levels of price discounts. In addition, not all hospitals appear in every sample year, possibly resulting in attrition bias. To evaluate the robustness of our results, in unreported regressions we re-ran our fixed effect models separately including only hospitals with average discounts of 75% or less, only for hospitals that appear in every year, and for hospitals which satisfied both criteria. Our results tell a similar story: the relationship between price and concentration increased between 1990 and 2001 and then reached a plateau or declined between 2001 and 2003. Coefficients for $HHI_{SYS}^{Pred} \times 2001$ and $HHI_{SYS}^{Pred} \times 2003$ are significantly different for hospitals with discounts under 75% and those in the combined model.

We also examined the relationship between concentration and Medicare reimbursement to test whether our findings reflect unobserved market wide trends. There should be no relationship between reimbursement and market concentration for Medicare prices because they are administrative prices and not subject to market forces.²⁴

Table 4 reports results estimates of our full empirical model (4). In these estimates we used fixed effects and IV estimates of HHI_{SYS}^{Pred} and included HIGH HMO as an indicator of the price SENSITIVITY of shopping. Models

²³ We ran our IV model separately for California and Florida for the years 1990–2003. Although the magnitudes of coefficients vary and standard errors are higher for Florida than California, the general patterns are qualitatively similar to our pooled sample. In an earlier draft of this paper, we separately ran our OLS model for California using 1983–2001 data. Results are similar for OLS results for the 1990s. While there was a strong negative relation between price and concentration in 1983, our findings indicate that the magnitude of this negative relationship markedly diminished between 1983 and 1990 and became increasingly positive between 1990 and 1999.

²⁴ Results of these estimates are reported as a web appendix at <http://www.kellogg.northwestern.edu/faculty/dranove/htm/appendix/>.

Table 4

Regressions of PRICE using pooled data for California and Florida hospitals 1990, 1995, 1999, 2001 and 2003 including HIGH HMO

Variable name	IV estimates HHI_{SYS}^{Pred} using fixed effects			
	Without HMO year interactions		With HMO year interactions	
1995	0.206 (0.164)	0.242*** (0.049)	−0.002 (0.129)	0.043 (0.068)
1999	−0.001 (0.191)	0.079 (0.074)	0.018 (0.146)	0.107 (0.100)
2001	0.050 (0.180)	0.127 (0.090)	0.155 (0.148)	0.241** (0.108)
2003	0.415** (0.176)	0.515*** (0.095)	0.506*** (0.129)	0.622*** (0.095)
Pred. HHI	−0.250 (0.177)	−0.389 (0.238)	−0.253 (0.247)	−0.427* (0.175)
Pred. HHI × 1995	−0.072 (0.206)	0.015 (0.179)	0.512*** (0.176)	0.684*** (0.221)
Pred. HHI × 1999	0.442 (0.270)	0.421* (0.241)	0.316 (0.247)	0.368 (0.288)
Pred. HHI × 2001	0.838*** (0.257)	0.879*** (0.266)	0.469* (0.276)	0.585** (0.295)
Pred. HHI × 2003	0.489** (0.231)	0.503** (0.239)	0.158 (0.252)	0.231 (0.249)
Pred. HHI × High HMO	0.344 (0.568)	0.536 (0.459)	0.741 (1.223)	1.626 (1.333)
Pred. HHI × High HMO × 1995	−0.676 (0.414)	−0.527* (0.284)	−1.999 (1.251)	−2.639* (1.184)
Pred. HHI × High HMO × 1999	−0.326 (0.464)	−0.203 (0.301)	−0.551 (1.320)	−1.196 (1.427)
Pred. HHI × High HMO × 2001	−0.404 (0.439)	−0.290 (0.346)	−0.313 (1.385)	−0.963 (1.449)
Pred. HHI × High HMO × 2003	−0.121 (0.432)	−0.032 (0.331)	−0.003 (1.312)	−0.662 (1.374)
High HMO	0.007 (0.076)	−0.128* (0.068)	−0.077 (0.246)	−0.364 (0.266)
High HMO × 1995			0.329 (0.245)	0.506** (0.238)
High HMO × 1999			0.016 (0.282)	0.190 (0.291)
High HMO × 2001			−0.092 (0.294)	0.083 (0.297)
High HMO × 2003			−0.096 (0.274)	0.073 (0.276)
Constant	8.457*** (1.635)	7.716*** (0.138)	8.367*** (1.307)	7.711*** (0.142)
Controls	Hospital, demographics	Hospital	Hospital, demographics	Hospital
R^2	0.276	0.0248	0.281	0.253
N	2393	2393	2393	2393

*** Significant at 1% level.

** Significant at 5% level.

* Significant at 10% level.

are reported including and excluding HIGH HMO year interactions and controls for characteristics of hospitals' own zip codes. We again find an increasing positive relationship between price and concentration between 1990 and 2001 and decline in this relationship between 2001 and 2003. Differences between coefficients for HHI_{SYS}^{Pred} for 2001 and 2003 are statistically significant. However, while coefficients on HIGH HMO are negative as expected, they are not statistically significant at conventional levels. Nor are most coefficients for year interactions with HIGH HMO and or between HIGH HMO and HHI_{SYS}^{Pred} and years.

6. Discussion

Our results uniformly suggest that the hospital price/concentration relationship grew stronger during the 1990s, consistent with an increase in the price sensitivity of shopping due to managed care. Our findings also suggest that at a minimum, managed care experienced a loss of momentum after 2001. OLS estimates using HHI measures based on actual patient flows are consistent with a plateau in the price–concentration relationship, while our IV results indicate a decline after 2001.

These findings are less dramatic than might be anticipated based on claims regarding MCO responses to mounting “managed care backlash” since the mid-1990s. Although concentration has increased over time, as of 2003, it does not appear there has been a collapse in the price/concentration relationship. MCOs still appear to continue to be playing competitive hospitals off against each other to secure discounts, though with possibly less effectiveness than in the peak year of 2001.

There are a number of limitations to our analysis. We would like to directly measure changes in MCO price sensitivity. There is substantial anecdotal evidence that MCO enrollees have increasing demands for broader networks, which would necessarily limit MCO price sensitivity. Unfortunately, we have no way to directly measure this. Instead, we use HMO penetration as a proxy for price sensitivity. This is problematic for both theoretical and statistical reasons.

At the theoretical level, it is not clear whether HMOs are more price sensitive than PPOs, particularly when PPOs are much more reliant on selective contracting to contain costs. In addition, HMO penetration may be endogenously related to other factors associated with pricing and there may also be issues with measurement error in the data. Finally, we note that increases in concentration may have diluted managed care's effectiveness in ways that are not captured by examining year to year changes in concentration.

Acknowledgements

This research has been supported by Grant No. 051830 from the Robert Wood Johnson Foundation Changes in Health Care Financing and Organization (HCFO) Initiative. We would like to thank Kristin Madison and Sujoy Chakravarty for providing data on hospital system membership. We would also like to thank two anonymous referees and participants at presentations at meetings of the American Economics Association and the American Society of Health Economists for comments.

References

- AMCRA, 1995. 1994–1995 Managed Care Overview. AMCRA Foundation, Washington, DC.
- Bertrand, Duflo, Mullainathan, 2004. How much should we trust difference-in-differences estimates. *Quarterly Journal of Econometrics* 119 (1), 249–275.
- California Health Care Foundation, 2005. California Employer Health Benefits Survey.
- Capps, C., Dranove, D., Satterthwaite, M., 2003. Competition and market power in option demand markets. *RAND Journal of Economics* 34 (4), 737–763.
- Catlin, A., Cowan, C., Heffler, S., Washington, B., 2007. National health spending in 2005: the slowdown continues. *Health Affairs* 26 (1), 142–153.
- Cutler, D., McClellan, M., Newhouse, J., 2000. How does managed care do it? *RAND Journal of Economics* 31 (3), 526–548.
- Dafny, L., 2005. Estimation and identification of merger effects: an application to hospital mergers. NBER working paper 11673.
- Devers, K.J., Casalino, L.P., Rudell, L.S., Stoddard, J.J., Brewster, L.R., Lake, T.K., 2003. Hospitals' negotiating leverage with health plans: how and why has it changed? *Health Services Research* 38 (1 Part 2), 419–446.
- Dranove, D., Ludwick, R., 1999. Competition and pricing by nonprofit hospitals: a reassessment of Lynk's analysis. *Journal of Health Economics* 18 (1), 87–98.
- Dranove, D., Satterthwaite, M., 2000. The industrial organization of health care markets. In: Culyer, A.J., Newhouse, J.P. (Eds.), *Handbook of Health Economics*, vol. 1A. Elsevier, Amsterdam, pp. 1093–1135.
- Dranove, D., Satterthwaite, M., Sindelar, J., 1986. The effect of injecting price-competition into the hospital market—the case of preferred provider organizations. *Inquiry* 23 (4), 419–431.
- Dranove, D., Simon, C.J., White, W.D., 1998. Determinants of managed care penetration. *Journal of Health Economics* 17 (6), 729–745.
- Dranove, D., Shanley, M., White, W.D., 1993. Price and concentration in hospital markets: the switch from patient-driven to payor-driven competition. *Journal Law & Economics* 36 (1 Part 1), 179–204.
- Draper, D., Hurley, R., Lesser, C., Strunk, B., 2002. The changing face of managed care. *Health Affairs* 21 (1), 11–23.
- Gaynor, M., Vogt, W.B., 2003. Competition among hospitals. *RAND Journal of Economics* 34 (4), 764–785.
- Glied, S., 2000. Managed care. In: Culyer, A.J., Newhouse, J.P. (Eds.), *Handbook of Health Economics*, vol. 1A. Elsevier, Amsterdam, pp. 705–753.
- Guimarães, P., Figueiredo, O., Woodward, D., 2003. A tractable approach to the firm location decision problem. *Review of Economics and Statistics* 85 (1), 201–204.
- Interstudy, 2004. *Competitive Edge: Spring 2004*. HealthLeaders-Interstudy, Nashville, TN.
- Kaiser Family Foundation and Health Research & Educational Trust, 2006. *Employer Health Benefits 2006 Annual Survey*. Kaiser Family Foundation Publication #7315.
- Keeler, E.B., Melnick, G., Zwanziger, J., 1999. The changing effects of competition on non-profit and for-profit hospital pricing behavior. *Journal of Health Economics* 18 (1), 69–86.
- Kessler, D.P., Geppert, J.J., 2005. The effects of competition on variation in the quality and cost of medical care. *Journal of Economics and Management Strategy* 14 (3), 575–589.
- Kessler, D.P., McClellan, M.B., 2000. Is hospital competition socially wasteful? *Quarterly Journal of Economics* 115, 577–615.
- Kohn, L., 2000. Organizing and managing care in a changing health system. *Health Services Research* 35 (1 Part I), 37–52.
- Lesser, C., Ginsburg, P., February 2001. Back to the Future? New Cost and Challenges Emerge, Issue Brief No. 35. Center for Health Systems Change.
- Lesser, C., Ginsburg, P., Devers, K., 2003. The end of an era: what became of the “Managed Care Revolution”. *Health Services Research* 38 (1 Part II), 337–355.
- Levit, K., et al., 2002. Inflation spurs health spending in 2000. *Health Affairs* 21 (172), 172–181.
- Lindrooth, R.C., 2008. Research on the hospital market: Recent advances and continuing data needs. *Inquiry*, in press.
- Lynk, W.J., 1995. Nonprofit hospital mergers and the exercise of market power. *Journal of Law and Economics* 38 (2), 437–461.
- Madison, K., 2004. Multihospital system membership and patient treatments, expenditures and outcomes. *Health Services Research* 39 (4 Part 1), 749–769.

- Mays, G.P., Hurley, R.E., Grossman JM, 2003. An empty toolbox? Changes in health plans' approaches for managing costs and care. *Health Services Research* 38 (1 Part II), 375–393.
- Melnick, G.A., Zwanziger, J., Bamezai, A., 2000. The effect of selective contracting on hospital costs and revenues. *Health Services Research* 35 (4), 849–867.
- Robinson, J.C., Luft, H.S., 1985. The impact of hospital market-structure on patient volume, average length of stay, and the cost of care. *Journal of Health Economics* 4 (4), 333–356.
- Rubin, D., Schenker, N., 1986. Efficiently simulating the coverage properties of interval estimates. *Applied Statistics—Journal of the Royal Statistical Society Series c* 35 (2), 159–167.
- Spetz, J., Maiuro, L.S., 2004. Measuring levels of technology in hospitals. *The Quarterly Review of Economics and Finance* 44 (3), 430–447.
- Zwanziger, J., Melnick, G.A., 1988. The effects of hospital competition and the Medicare PPS Program on hospital behavior in California. *Journal of Health Economics* 7 (3), 301–320.