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HOSPITALS, MANAGED CARE, AND THE CHARITY CASELOAD IN CALIFORNIA

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ABSTRACT

Many observers have blamed HMOs for increasing financial pressures on private hospitals and causing them to cut back on the provision of charity care. We examine this issue using data on all hospital discharges in California between 1988 and 1996. We find that public hospitals in counties with higher HMO penetration do take on a larger share of the county's charity caseload. However, these public hospitals also take on larger shares of most other types of patients. At the hospital level, we find little evidence that either for-profit or non-profit private hospitals respond to HMO penetration by turning away uninsured and Medicaid patients. On the contrary, in the for-profit sector higher HMO penetration is linked to reductions in the share of privately insured patients in the caseload, and corresponding increases in the share of Medicare patients and Medicaid births. Since HMO penetration reduces the price paid by privately insured patients they may be less attractive to for-profit hospitals relative to the publicly insured.

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I. Introduction

Despite large expansions in public health insurance programs over the 1990s, the fraction of Americans without health insurance has hovered between 14 and 16%. For many years, the provision of hospital services to this population has been cross-subsidized by the privately insured (Aaron, 1991). For example, the American Hospital Association (1986) estimated that there was a "hidden tax" of 10.6% on the average paying hospital patient, which was used to subsidize charity care.

Managed care organizations may threaten this arrangement by squeezing hospital profits that are used to finance charity care. The rise of managed care organizations, and a resulting loss of hospital market power to health plans and insurers, have been identified by some analysts as "primary forces" affecting hospital revenues (c.f. Duke, 1996), and the ability to finance charity care (Lipson and Naierman, 1996). It is argued that in response to these pressures private hospitals will reduce their provision of charity care, which in turn will increase the burden on public hospitals (Reinhardt, 1986; Lewin and Lewin, 1987).

These developments have not gone unnoticed by the press. The Los Angeles Times reports that in Los Angeles County the share of charity care provided by public hospitals increased from 67% to 75% between 1993 and 1995, and says that "to a substantial degree, this unwelcome change can be blamed on the growth of managed care companies, whose compensation policies for private hospitals have greatly diminished the resources that hospitals can provide for indigent care" (Tranquada, July 5, 1999).

This paper examines the hypothesis that managed care has resulted in the shifting of

charity cases away from private hospitals and towards public hospitals. In order to test this hypothesis, we use data on all hospital discharges within California between 1988 and 1996, to examine changes in the share of each county's charity caseload being treated at public hospitals, as well as changes in individual hospitals' shares of charity discharges in their caseloads.

We consider several different types of charity patients, including the uninsured, Medicaid births and other Medicaid patients. Medicaid typically reimburses hospitals at about half the rate of private insurers, and the uninsured are unlikely to reimburse hospitals for the full cost of their care. However, Medicaid patients are clearly more lucrative (or at least, less expensive) than similar patients without health insurance. And within the Medicaid-eligible population, women admitted to deliver may be more profitable than other patients. Thus, even if hospitals do not reduce their overall share of charity patients, they may take steps to alter the composition of their charity caseloads.

We find that public hospitals in counties with higher HMO penetration do take on a larger share of the county's charity caseload. However, public hospitals in these markets also take on larger shares of most other types of patients, including the privately insured. This observation suggests that HMO penetration is linked to the exit of private hospitals from the market, rather than to attempts to reduce the fraction of charity patients in the caseloads of individual hospitals.

We also examine a panel of hospitals that were in existence throughout the sample period, and find little evidence that either for-profit or non-profit private hospitals in this sample responded to HMO penetration by turning away uninsured and Medicaid patients. On the contrary, in the for-profit sector higher HMO penetration is linked to reductions in the share of

private patients in the caseload, and corresponding increases in the share of Medicare patients and Medicaid births. Our interpretation of this result is that HMO penetration reduces the price paid by privately insured patients, making them less attractive to for-profit hospitals. These hospitals respond by turning away from these patients towards the next most lucrative groups, Medicare patients and Medicaid moms.

When we examine data on hospital revenues and costs, we find some evidence that increasing HMO penetration is associated with a reduction in revenues per discharge in public hospitals, which is not offset by a corresponding reduction in costs. Private hospitals are able to avoid these changes, perhaps by choosing healthier patients within each group.

The rest of the paper is laid out as follows. Section II provides background on the growth of managed care, how hospitals can act to alter their caseloads, and previous evidence regarding the relationship between the competitiveness of hospital markets and the provision of charity care. Section III outlines a model of the provision of charity care. The data is described in Section IV, and Section V delineates the empirical strategy and specification issues. Section VI lays out the results, and Section VII discusses the results and conclusions.

II. Background

a) The Rise of Managed Care

Between 1987 and 1997 the fraction of the privately insured who were enrolled in Health Maintenance Organizations (HMOs), the most restrictive form of managed care, increased from 16 to 48% nationally. Over the same period, the fraction enrolled in Preferred Provider Organizations (PPOs) increased from 11 to over 25% (Cutler and Sheiner, 1997).

The tremendous growth of managed care over the 1990s has had important effects on the health care market. Many analysts have attributed a slow down in the growth of costs of medical care to MCOs (c.f. Cutler and Sheiner, 1997). In addition to the strong emphasis on cost containment within plans, managed care organizations create competitive pressures on other providers to reduce costs (Baker, 1995, 1999; Baker and Shankarkumar, 1997; Noether, 1988). These pressures may in turn lead to a reduction in the provision of charity care by hospitals and other providers.

Table 1 shows trends in HMO enrollments for each county in California. It is evident that there is a great deal of variation in enrollment rates both within and between counties. Table 1 also illustrates the large increase in HMO penetration that took place in California over our sample period. The fraction of the population enrolled in HMOs rose from 28% in 1988 to 43.6% in 1996.

b) How Do Hospitals Affect Their Caseloads?

It is one thing to argue that hospitals wish to alter their patient mix, and another thing to show that they can actually do so. Hospitals are subject to federal laws which prohibit them from turning away women in labor if they accept any Medicare funds, and they are prohibited from turning away emergency patients in an unstable condition. The latter practice is called "patient dumping". A recent report by the consumer group Public Citizen finds that these illegal practices are in fact remarkably common (Public Citizen, 2001). Of the 500 hospitals that had confirmed violations of anti-dumping laws in 1997, 1998 and 1999, only 85 had been fined as of April 2001. The report also notes that up to a third of emergency room registration staff ask for

insurance information before a screening is provided and/or contact health plans for authorization of screening exams. These practices are also illegal if they result in delayed treatment. Unsurprisingly, uninsured patients and patients whose HMOs did not include the violating hospital in their networks were most likely to be dumped.

In one recent case, an 18 month old Los Angeles girl died of an infection that could have easily been treated with antibiotics. The girl belonged to an HMO, but was taken by ambulance to a hospital outside her network. The hospital consulted with the HMO which said she should be transferred to a network hospital, even though she was suffering a fever of 106 and was extremely ill. The girl was eventually transferred to the HMO hospital, where she died. The first hospital was found guilty of "dumping" the little girl, since they refused to treat her without a guarantee that they would be reimbursed by the HMO.

Perhaps the most interesting aspect of this case for our purposes is that the California Supreme Court ruled that hospitals that refuse to treat medically unstable patients are protected by a state cap on jury awards of $250,000 even if they violate federal laws against patient dumping. The lawyer representing the girl's mother commented that this cap renders the federal anti-dumping statutes "moot" in California, since hospitals can dump patients without the risk of incurring large financial penalties (Dolan, March 26, 1999).

A less extreme tactic than dumping is to deny indigent patients certain services. A class action lawsuit was recently filed against a Los Angeles County hospital which required Medi-Cal patients in labor to pay $400 cash on-the-spot for epidurals.[1] State officials have termed these

[1] The lawsuit argues that the hospital violated California consumer protection laws.

actions "improper" since it is illegal to charge extra fees to Medi-Cal patients. However, it does not appear that the hospital has faced any regulatory action from state or federal agencies, and in response to the scandal the state legislature found it necessary to enact a statute specifically outlawing this practice (of charging for epidurals) (Bernstein, June 17, 1999). It seems safe to assume that pregnant women who knew that they would be denied anesthesia would avoid this hospital if at all possible.

Similarly, hospitals are free to specialize in services that are attractive to desirable patients, and to eliminate services that attract less desirable patients. For example, hospitals can upgrade the quality of their obstetrical services, open special clinics catering to elderly patients, or close down their trauma units. Increasingly, hospitals that maintain trauma units are "closing" them to incoming ambulances when they are overcrowded, thus avoiding severely ill patients. Hospitals can choose what type of translation services to make available, and how to advertize these and other services. One large hospital in the Los Angeles area recently ran a bill-board promotion that advertised free carseats with each delivery. Anecdotes of this type indicate that hospitals go to considerable lengths to influence the composition of their caseloads.

c) Previous Evidence re: Hospital Competition and Charity Care

The idea that competition will squeeze private hospital revenues and result in the provision of less charity care predates the recent rise in managed care. Using data from private, non-profit hospitals in New York, Thorpe and Phelps (1988) construct a county Herfindahl index and find that hospitals operating in more competitive markets provide significantly less uncompensated care. Hadley and Feder (1985) report on a survey conducted by the American

Hospital Association and the Urban Institute. They find that many hospitals reported adopting explicit limits on charity care when they faced revenue constraints.

Frank, Salkever and Mitchell (1990) examine a sample of private non-profit Florida hospitals and find evidence of a strong "income effect" in the provision of charity care. This result implies that factors that squeeze hospital profit margins may reduce the provision of charity care. They contrast this result with Frank and Salkever (1991), who find negligible income effects in a sample of Maryland private non-profit hospitals. They speculate that the differing results may be due to differences in the regulatory environments in the two states--hospitals in states like Maryland, where rates are strongly regulated, may have less latitude to increase charity care when incomes rise. These results suggest that there are advantages to looking within a large state such as California over time, since changes in the regulatory environment that affect all hospitals can be controlled for using year effects.

Sloan, Morrisey and Valvona (1988) estimate models of the percentage of hospital discharges that were "self-pay" patients where the independent variables included the percent of the local population that was enrolled in HMOs, as well as characteristics of the county population, and measures of each hospital's structure (size, ownership, and teaching status). They found little evidence that HMO enrollments mattered, but their regression models pool public and private hospitals, so that they do not examine the question of whether the charity caseload is shifted from one type of hospital to another.

Finally, Gruber (1994) examines the effects of managed care on the provision of uncompensated care by hospitals in California. Since he has no direct information about

variations in managed care penetration across hospital markets, he relies on a model in which the effects of managed care penetration are larger in less concentrated hospital markets. The study has a difference-in-differences design in which the provision of uncompensated care in more competitive and less competitive markets is examined before and after legislation allowing payers to negotiate prices with hospitals took effect.[2] The results are consistent with the hypothesis that managed care reduces charity care since the provision of charity care fell by more in the competitive hospital markets than in the uncompetitive ones between 1984 and 1988.

In summary, the previous literature suggests that increased competition is usually associated with reductions in the extent of charity care provided by private non-profits. However, it provides little evidence regarding the effects of HMOs on public hospitals per se, and most studies predate the recent large increases in HMO penetration. Our study differs from most previous ones by examining all types of hospitals (public, private for-profit, and private non-profit), and by estimating both county-level and hospital-level models which include hospital specific fixed effects. As we argue below, the latter innovation allows us to control for a broad range of hospital characteristics in our analysis.

III. A Model of the Provision of Charity Care

a) Private Hospitals

Why do private hospitals supply charity care? Several models have been advanced in the literature. A purely altruistic hospital provides charity care because its owners or trustees derive utility from doing so. If the amount of utility depends on the degree of unmet need, then altruists

[2] The legislation was introduced in late 1983, and Gruber's data starts in 1984. However, he argues that you would expect the effects of the legislation to be stronger at the end of his sample period (1988) than at the beginning.

will respond to reductions in the amount of charity care provided by other hospitals by increasing their own supply (Frank and Salkever, 1991). For example, if non-profit hospitals are the "altruists" then non-profits may increase the provision of charity care if for-profits cut back. If the "warm glow" derived from providing charity care is a normal good, then the provision of such care should also increase with hospital income.

On the other hand, Frank and Salkever (1991) and Frank, Salkever, and Mitchell (1990) point out that even for-profit hospitals have an incentive to provide charity care. For example, being seen to provide such care may have an important impact the hospital's relationship with regulatory agencies. An attractive feature of this model of a self-interested hospital is that it can be applied to both for-profit and non-profit private hospitals.

Our model builds on this insight, as well as Hadley and Feder's finding that hospitals reported adopting explicit limits on charity care *when they faced revenue constraints*. We also allow for altruism as a motive for providing charity care. As we show below, the way that hospitals react to an HMO-induced reduction in the price paid by their privately insured patients can have a positive or a negative effect on the amount of charity care provided, depending on whether current period revenue constraints are binding.

Let Q be the total number of patients cared for, and $R=Q_c/(Q_p+Q_c)$ be the fraction of charity patients. The subscript c denotes "charity" and the subscript p denotes a privately insured customer. We assume that any benefits the hospital derives from treating charity patients accrue in the future. These benefits f(R) have the property that $f'(R)>0$ and $f''(R)<0$. The benefits accruing from charity care can include the warm glow of altruism, as long as this glow occurs

sometime after the patient is actually treated.

The hospital's maximand is given by

(1) $(1-R)PQ + RP_cQ - C(Q) + f(R)$,

where P is the price paid by a privately insured patient, P_c is the payment received for treating a charity patient, and C(Q) is the hospital's cost function. Note that P_c could be equal to zero, as long as $P>P_c$. We also assume that $C'(Q)>0$ and $C''(Q) >0$. The hospital must choose Q and R.

We further assume that hospitals are subject to a revenue constraint that must be satisfied in each period. Thus, the hospital's problem is to maximize (1) subject to:

(2) $[(1-R)P + RP_c]Q - C(Q) >= \pi^0$,

where π^0 is the minimum revenue the hospital requires.

Since Q does not affect f(R), the firm chooses Q in order to maximize profits and we can define:

(3) $\pi(R,P) = \max_Q [(1-R)P + RP_c]Q - C(Q)$ for all P.

Since $P>P_c$ and C is convex, then $\pi_P > 0$ and $\pi_R< 0$, for all R between 0 and 1. Hence, the hospital's problem is to choose R to maximize $\pi(R,P) + f(R)$ subject to $\pi(R,P) >= \pi^0$.

In this model, HMOs are assumed to act by reducing P, the price paid by privately insured patients. The key question then is what happens to R as P falls, that is, what is the sign of $\delta R/\delta P$? The hospital will find itself in one of three possible cases. In the first case $\pi(0,P) < \pi^0$ and there is no solution to the problem (the firm goes bankrupt).

Alternatively, let R^* be the value that maximizes $\pi(R,P) + f(R)$ and suppose that R* is between 0 and 1. Then $\pi_R(R^*,P) + f'(R^*) = 0$. Since we assume an interior solution, the second

order conditions are also satisfied. Hence:

(4) $\pi_{RR}(R^*,P) + f''(R^*) < 0$ and

(5) $[\pi_{RR}(R^*,P) + f''(R^*)] (\delta R/\delta P) + \pi_{RP} = 0$.

Rearranging terms, $\delta R/\delta P = -\pi_{RP} /[\pi_{RR}(R^*,P) + f''(R^*)]$. Here, the denominator is less than zero and the numerator can be signed by noting that $\pi_R = (P_c - P)Q$ so that:

(6) $\pi_{RP} = -Q + (P_c - P)\delta Q/\delta P$,

which is less than zero. Hence if revenue constraints do not bind, $\delta R/\delta P < 0$ and hospitals will substitute towards charity care when the price paid by privately insured patients falls.

In the third case, $\pi(R^*,P) + f(R^*) < \pi^0$ and $\pi(0,P) > \pi^0$ so that the current period revenue constraint is binding. In this case, the hospital will choose R to set $\pi(R,P) = \pi^0$ and $\delta R/\delta P = - \pi_P /\pi_R > 0$ since $\pi_R < 0$ and $\pi_P > 0$. Thus, as Hadley and Feder suggest, it is only when current revenue constraints are binding that the hospital will decrease the fraction of charity patients in its caseload in response to a reduction in the price paid by the privately insured customers. Hospitals that are able to borrow from a parent corporation, for example, may be able to take a longer-term view.

This model can easily be extended to situations in which there is more than one class of charity (or paying) patients. For example, below we will consider uninsured patients, Medicaid mothers and their babies, and other Medicaid patients as charity patients. We also include Medicare patients as a separate class of "paying customers". The average P_c's, costs, and longer-term benefits (f(R)) associated with these different classes of patients are all expected to vary. Without additional information about the rankings of these parameters over the different groups,

it is difficult to make firm predictions about which groups hospitals switching away from the privately insured will move to, for example. Medicaid mothers may be more profitable than the other two classes of charity patients. But it is possible that hospitals receive more longer-term benefits from treating the uninsured than they do from delivering Medicaid mothers. In what follows, we treat the relative desirability of different classes of charity and paying patients as an empirical question.

Much of the previous work on charity care has drawn a sharp distinction between for-profit and non-profit hospitals. For example, as discussed above, many analysts only examine non-profits, implicitly assuming that for-profits do not supply charity care. However, Pauly (1987, page 262) argues that "ownership differences turn out to be much less important than they might seem...nominal ownership structure seems to matter much less than fundamental economic incentives". Moreover, Norton and Staiger (1994) find that while for-profit hospitals tend to treat fewer uninsured patients than private not-for profit hospitals, this is largely because they tend to locate in areas with fewer uninsured. These important locational effects will be incorporated in our empirical models by using hospital fixed effects.

In terms of our model, an important potential difference between for-profits and non-profits is whether they are affected differently by current revenue constraints, on average. If for example, non-profits have a fiduciary responsibility to balance the books each year, while for-profits are able to take a longer-term view, then it may be non-profits rather than for-profits that reduce indigent care in response to pressures imposed by HMO penetration. For-profits and non-profits may also differ in terms of f(R), with non-profits perhaps placing greater weight on

altruism as a motive for providing charity care. In what follows, we allow the effects of HMO penetration to vary between for profits and non profits.

b) Public Hospitals

Public hospitals are intended to provide a "safety-net" for patients who cannot get care elsewhere. Thus, if patients are denied necessary care in private institutions, we expect them to receive it in public ones. Moreover, the financial incentives for public hospitals are muted by their reliance on government subsidies. Public hospitals that run a deficit receive "bailouts", while those that improve their financial performance are likely to see their subsidies reduced. This discussion suggests that public hospitals can be viewed as passively accepting the residual caseload that remains after private hospitals have chosen their markets.

This portrait may be overly simplistic, however. Even if public hospitals have little control over the composition of their potential clientele, they still have some discretion about whether or not someone should actually be admitted rather than being served in another setting. It is possible that by changing the mix of services provided, the number of hospital admissions could be reduced. In fact, the Los Angeles County-University of Southern California hospital is currently under considerable political pressure to adopt reforms intended to accomplish this goal by providing more preventive and outpatient care.

Still, even if public hospitals act very aggressively to change their admitting practices, they are still likely to be affected by changes in private hospital caseloads. If private hospitals respond to increasing HMO penetration by reducing their charity caseloads, some fraction of these patients are likely to turn up in public hospitals "of last resort".

IV. Data

a) County-Level HMO Enrollments

We make use of two sources of data about HMO enrollments, the Group Health Association of America (GHAA, 1988-1991) and Interstudy (1992-1996). The unit of observation in both data sets is the HMO, and total enrollments are reported for the entire HMO service area, which may include several counties. Following Baker and Shankarkumar (1997), county-level data on HMO penetration rates are constructed by allocating the enrollments of each HMO to the counties in its service area using the county's population, summing over all the HMOs in the county, and dividing by the county's population.[3]

We use GHAA data from 1988 to 1991, and Interstudy data for 1992 to 1996. GHAA reports HMO service areas for the entire period, while Interstudy reports them only from 1992 onwards. However, the GHAA's description of service areas appears to become less precise over time. GHAA enrollment numbers refer to December of the relevant year. In order to maximize comparability with the Interstudy data, which is reported bi-annually, we use the enrollment numbers from January of the following year. For example, the Interstudy number for 1992 is actually taken from January 1993. Table 1 indicates that there may be some discontinuities between the GHAA and the Interstudy data, however.

Errors may also be introduced by our procedure of allocating HMO enrollments to counties based on county populations. Random measurement errors would lead us to to under-

[3] Data on county populations comes from the Census bureau.

estimate the effects of HMO penetration. However, the Baker and Shankarkumar procedure we follow may also introduce non-random measurement error that will tend to attenuate the estimated effects of HMOs. In particular, suppose that an HMO's caseload tends to be concentrated in the county in which it is head quartered, rather than evenly distributed over all of the counties that it serves, and that counties with HMO head quarters tend generally to have higher penetration rates (because they are more urban, for example) . Then the procedure we use will tend to understate the amount of variation in HMO penetration rates (by understating the rate in high penetration areas and overstating it in low penetration areas). Baker and Shankarkumar test for this possibility by constructing an alternative measure of penetration rates that takes head quarter locations into account. However, they report that the two measures of HMO penetration are highly correlated and yield very similar estimation results.

b) Hospital-Level Data

Information about California's hospitals is available annually from the Office of Statewide Healthcare Planning and Development (OSHPD). The California Hospital Disclosure Data gives detailed information about each hospital's ownership and financial status. The California Hospital Discharge Data has information about every hospital discharge (approximately 3.65 million per year), including the patient's primary expected payer and basic demographic information (such as race and age). We also use information about the diagnosis to identify women admitted for childbirth and their infants, since this is the single largest category of Medicaid recipients. We use the data on primary expected payer to identify the fraction of each hospital's admits that are attributable to Medicaid or uninsured. This latter category

includes "self-pay", charity, no charge, and county indigent patients.[4]

Our measures of the fraction of care provided to charity patients (R) include the fraction of discharges represented by: either Medicaid or uninsured patients; uninsured patients only; Medicaid patients only; Medicaid mothers and infants; and other Medicaid. In addition to these measures, we examine the fraction of discharges accounted for by Medicare patients, and the fraction accounted for by the privately insured.

Our analysis proceeds at two levels. First, we examine data at the county level to see whether the fraction of the county's charity caseload that is cared for in public hospitals increases with HMO penetration. These analyses make use of the entire available sample of discharge data, with two exclusions. First, we exclude one small county that did not have both a public and a private hospital. Second, we include only discharges from general acute-care hospitals, and exclude institutions such as psychiatric hospitals and chronic care facilities.

An examination at the county level is perhaps the most natural way to address the question of whether HMO penetration is increasing the charity care burden on public hospitals. However, it is possible, that despite controls that are described further below, county-level regressions do not capture what is going on at the individual hospital level. For example, suppose that HMO penetration causes changes in practice style which result in fewer hospitalizations at private hospitals overall, while public hospitals retain more conservative practices that result in a higher rate of hospitalization. Then the share of charity patients treated

[4] Although the patient's primary expected payer may be a somewhat noisy measure of the actual payer, these data will be used to calculate our outcome measures and hence measurement error in these data should not bias our estimates.

at public hospitals would rise, but this might not be because any patients were actually shifted from private to public hospitals. Alternatively, if private hospitals exited the market at a faster rate than public hospitals over the sample period, then this could cause the charity caseload at public facilities to rise, even if the caseload mix at the remaining private hospitals showed little change over time. Moreover, it is difficult in county-level models to control adequately for factors such as the Disproportionate Share Program (discussed further below) which may have caused a shifting of patients between public and private hospitals within counties.

Hence, we supplement our analysis of the county-level data with an analysis of the behavior of individual hospitals that is based on a fixed panel of the hospitals that existed in each year of our data. This sample includes data on 3528 hospital years, or 392 hospitals per year.

Table 2 shows changes over time in the charity caseload at the county level by type of hospital ownership. These figures demonstrate that although the share of charity patients treated by private hospitals is small relative to the share of other patients, private hospitals still treat the majority of these patients. Moreover, private for-profit hospitals treat a significant share of uninsured and Medicaid patients. In 1996, 15% of such patients were treated in these hospitals, which illustrates the importance of including both for profit and non-profit hospitals in our sample.

Looking at shifts over time, Table 2 confirms that there is an increase in the fraction of uninsured patients treated at county hospitals between 1988 and 1996, but this is offset by a large reduction in the share of Medicaid patients treated at public facilities. The largest shift over time is in Medicaid births, with private hospitals taking a much greater share of these cases in 1996

than they did in 1988 (as Duggan, 2000 notes) but private hospitals also take a growing share of other Medicaid patients over time. Finally, public hospitals see reductions in their Medicare caseloads, but increases in the privately-insured category.

Table 2 also shows that there was some turnover in the hospital market over our sample period. Between 1988 and 1996, the number of hospitals shrank from 472 to 441. These losses were distributed over hospital types as follows: The number of private for-profit hospitals shrank from 135 to 116, the number of private non-profits fell from 243 to 240, and the number of public hospitals fell from 94 to 85. Thus, the largest percentage reduction in the number of hospitals occurred in the private for-profit sector.

Table 3 illustrates the large differences in the caseload mix of public and private hospitals. The table is divided into two parts, one corresponding to the entire available sample of hospitals whether or not they existed in each year, and the other corresponding to our fixed panel of hospitals. As Table 3 indicates, this smaller sample includes 823 observations on private for-profit facilities, 1966 on private non-profit hospitals, and 739 observations on public hospitals. The patterns of discharges are very similar between these two samples, however. Thus, in what follows we describe the patterns in the full sample.

Table 3 shows that on average, 58.9% of public hospital discharges were Medicaid and uninsured patients compared to 28.1% and 24.6% in private for-profit and non-profit hospitals respectively. Private for-profit hospitals have higher shares of Medicaid births than private non-profits--in the former, 13.7% of discharges are Medicaid births compared to 10.9% in the latter. However, somewhat surprisingly, the private for-profit hospitals also have somewhat higher

shares of uninsured though they have slightly lower shares of "other Medicaid" patients.[5]

Finally, Table 3 shows that private for-profit hospitals take on the lowest revenue, lowest cost patients on average, while public hospitals take the highest revenue, highest cost patients. In the for-profit sector, revenues tend to outweigh costs by a couple of hundred dollars per discharge, while in the public sector, costs outweigh revenues, on average.

V. The Empirical Model and Specification Issues

a) County-Level Analysis

This paper is motivated by the widespread perception that by squeezing private hospital profits, the rise of managed care has resulted in a shifting of charity patients from private to public hospitals. We saw above that an increasing fraction of each county's uninsured population is being treated at public hospitals, but it is not clear that this shift has been caused by HMOs.

In order to try to isolate the effect of HMOs we estimate a model of the following form:

$$(7)\ PCHARITY_{ct} = a_c + a_1 HMO_{ct} + a_2 PROJMED_{ct} + a_3 PROJUN_{ct} + a_4 COUNTY_{ct} + a_5 YEAR_t + e_{ct},$$

where $PCHARITY_{ct}$ is the share of a county's given type of charity care that is provided by public hospitals, a_c is a county fixed effect, HMO_{ct} is a measure of HMO penetration, $COUNTY_{ct}$ is a

[5] The fraction of the privately-insured caseload that is enrolled in managed care is higher in private non-profit hospitals (59.6) than in for-profit hospitals (54.3). But at 37.3%, it is much lower in public hospitals than in either type of private hospital. Thus, although the privately insured caseload is a smaller percentage of the total at public hospitals, it is composed of a larger fraction of fee-for-service patients.

vector of time-varying variables measuring the industrial composition of county employment, the distribution of firm sizes, and average wages, $PROJMED_{ct}$ and $PROJUN_{ct}$ are the projected shares of the county's caseload of Medicaid and uninsured hospital patients, respectively, $YEAR_t$ is a vector of year effects, and e_{ct} is an error term that is assumed to be uncorrelated with the included exogenous variables. The reasons for the inclusion of these variables, as well as further details about their construction, are given below.

The characteristics of the county may be expected to influence the amount of charity care provided. The Frank and Salkever (1991) model shows, for example, that the private provision of charity care will respond positively to perceived need, other things being equal. To the extent that characteristics such as the fraction of the local population that is poor and minority are relatively constant over time, these characteristics will be captured by the inclusion of county fixed effects. The structure of the hospital market at the start of the sample period will also be captured by the county fixed effect.

The time-varying variables that are most important to control for are those which are likely to be correlated both with our measures of HMO penetration, and with the private provision of charity care in the county. Three candidates come to mind. The first is the number of Medicaid patients in the county. The generosity of Medi-Cal was rising rapidly over our sample period, as was HMO penetration. Although the income cutoffs for Medi-Cal were established state-wide, and can be captured by year effects, the impact of changes in these cutoffs is likely to have varied greatly from one area of the state to another, depending on the income distribution in each area.

In order to capture these effects, we include PROJMED. This measure is intended to capture the way that changes in the generosity of the Medicaid program would have been expected to affect each county's 1988 hospital caseload. To construct this measure, we use a 20 percent sample of our individual-level data (approximately 700,000 observations per year) and estimate linear probability models of the probability of Medicaid coverage in each year of our data. These models included dummy variables for age, race, sex, and each individual's 4-digit home zip code as control variables.[6] We use zip codes, since information about income is not available. Because the generosity of Medicaid coverage was expanding rapidly over this period, the probability that a person with particular characteristics was covered will be much higher in 1996 than it was in 1988. Estimating separate regressions for each year generates coefficients that capture these effects.

We then apply the estimated coefficients obtained from each year's models to the county's 1988 hospital discharges, in order to obtain the share of this fixed patient population that would be predicted to have Medicaid coverage in each year. The use of a fixed sample of patients insures that PROJMED is independent of changes in the composition of discharges that might themselves be caused by increasing HMO penetration. That is, a county that had many "working poor" families might have been expected to increase its share of Medicaid-covered patients over time, solely because the probability that local residents became covered increased over time. Our measure captures this effect.

[6] The regressions included a dummy variable for each year of age between 0 and 19, and then dummies for each 4 year interval thereafter (e.g. 20-24, 25-29,...) up to a dummy for age >=85. The reason for entering single year of age dummies for children is that Medicaid eligibility rules can vary between single years of age.

Second, increases in Medicaid coverage were accompanied by decreases in private health insurance coverage and increases in the uninsured population. While some of the decline in private health insurance coverage can no doubt be attributed to the crowding-out of private insurance by public insurance, declines in private health insurance coverage predate recent expansions in public insurance coverage (Cutler and Gruber, 1996, Currie and Yelowitz, 2000).

Reductions in the rate of private health insurance coverage and increases in the uninsured population could be expected to put pressure on the ability of hospitals to provide charity care, even in the absence of managed care penetration. And private health insurance coverage could well have been falling more rapidly in some counties than in others. County-level data on the prevalence of private health insurance coverage and the size of the uninsured population are not available. However, the same algorithm that is used to create PROJMED, is used to create PROJUN.

In addition, we control for factors underlying changes in the provision of private health insurance by including annual, county-level measures of the distribution of firm sizes and of the industrial composition of employment (since some types of jobs are more likely to have health insurance than others) in COUNTY. These data are taken from County Business Patterns data (U.S. Census Bureau, 2000). Hoynes (1996) suggests that these data provide more reliable measures of labor force at the county level than small area unemployment statistics.

Third, increases in costs could also be expected to squeeze revenues, leading to possible reductions in charity care. Since the largest component of hospital costs is labor, COUNTY includes a measure of average payroll/employment, also derived from the County Business

Patterns data. We calculate this wage measure at the health service area (HSA) level. HSAs are conglomerations of counties that define regional health care markets. There are 26 HSAs compared to 58 California counties.[7]

Lastly, the introduction of the Disproportionate Share Program (DSH) in 1990 may be expected to affect the distribution of charity caseloads across hospitals by giving private hospitals an added incentive to treat charity patients. Under DSH, hospitals in which the percent of total revenues attributed to Medicaid and uninsured patients exceeded 25% received payments which rose non-linearly with the fraction of low-income patients. Duggan (2000) shows that private hospitals responded to DSH by increasing their share of indigent patients, but that they did this primarily by targeting Medicaid births rather than other types of Medicaid or uninsured patients. It is also noteworthy that Duggan does not find any significant difference in the responses of private for-profit and non-profit hospitals to DSH.

Given hospitals' ability to alter their caseloads endogenously in response to DSH, it is not desirable to include the hospital's DSH number in each year of the data. Instead, Duggan controls for the effect of the DSH program by including each hospital's "low income number" (i.e., the amount of revenue derived from charity patients) measured at a fixed point in time at the beginning of his sample period. Since DSH is expected to alter the distribution of indigent patients across hospitals within counties, county fixed effects are an imperfect control for the effects of DSH. The statewide introduction of the program and average changes in its effects over time will be captured by the inclusion of time dummies, but the fact remains that the effects

[7] All but one of these HSAs have more than one hospital.

of DSH may not be well controlled in county-level models, since DSH had very different effects on different hospitals within the same county.

b) Hospital-Level Analysis

When we turn to hospital-level data, we estimate a model very similar to (7), which takes the form:

(8) $CHARITY_{ht} = b_h + b_1 HMO_{ct} + b_2 HMO_{ct}*PRIVATE_{ht} + b_3 PRIVATE_{ht} + b_4 COUNTY_{ct} + b_5 PROJMED_{ht} + b_6 PROJUN_{ht} + b_7 YEAR_t + b_8 PRIVATE_{ht}*YEAR_t + v_{ht}$,

where $CHARITY_{ht}$ is a measure of the fraction of the hospital's caseload devoted to a particular type of charity care, b_h is a hospital fixed effect, HMO_{ct} is a measure of managed care penetration in the county, $PRIVATE_{ht}$ is an indicator equal to one if the hospital is privately owned, $COUNTY_{ct}$ is the vector of county employment, firm size, and wage measures that was described above, $PROJMED_{ht}$ and $PROJUN_{ht}$ are the projected shares of the hospital's caseload of Medicaid and uninsured patients, respectively, $YEAR_t$ is a vector of year dummies, and v_{ht} is an error term that is assumed to be uncorrelated with the included exogenous variables. Note that in (8) we allow the year dummies to differ depending on whether the hospital is publicly or privately owned. These year effects will capture factors such as differential rates of change in admitting practices between the private and public sectors. The standard errors are also corrected (using the "cluster" command in stata) to allow for correlations within counties and years.

The hospital fixed effects control for many important factors that could be measured as of the beginning of the sample period. These include the hospital's low income number prior to the

start of the DSH program (i.e. Duggan's measure of the effect of DSH), as well as the hospital's size and caseload mix, and the range of services the hospital offered.

The algorithm used to calculate the projected hospital level shares of Medicaid and uninsured caseloads, $PROJMED_{ht}$ and $PROJUN_{ht}$, follows that used in calculating projected county shares. Instead of using the county's 1988 sample of discharges, we use each hospital's 1988 sample of discharges, and use the estimated coefficients to calculate the fraction of that fixed sample of discharges that we would expect to be covered by Medicaid or uninsured in each subsequent year. The use of a fixed sample of discharges in this case means that PROJMED and PROJUN will not capture changes in hospital caseloads that are themselves caused by increasing HMO penetration.

We also estimate models which allow the effects of HMO penetration to differ depending on whether or not private hospitals are for-profit or non-profit. These models take the following form:

$$(9)\ CHARITY_{ht} = d_c + d_1HMO_{ct} + d_2HMO_{ct}*PRIVATE_{hct} + d_3HMO_{ct}*PRIVATE_{ht}*NONPROF_{ht} + d_4PRIVATE_{ht} + d_5PRIVATE_{ht}*NONPROF_{ht} + d_6COUNTY_{ct} + d_7PROJMED_{ht} + d_8PROJUN_{ht} + d_9YEAR_t*PRIVATE_{ht} + d_{10}YEAR_t + u_{ht}.$$

In this specification, the effects of HMO penetration on public, private for-profit, and private non-profit hospitals are given by d_1, d_1+d_2, and $d_1+d_2+d_3$, respectively.

All of these models may be subject to several sources of bias. First, we have information

about HMO penetration, but not about other forms of managed care. However, if HMO penetration and PPO penetration in California move together, as they do in the national data, then variation in our measure will capture movements in overall managed care penetration. Moreover, since HMOs are the most restrictive form of managed care, it is of interest to study their effects. A second problem is that our estimates of the effects of HMO penetration may be biased towards zero by measurement error, as discussed above.

Finally, it is important that our exogenous variables adequately control for factors that influence both caseloads and HMO penetration. As a specification test, we have estimated all our models excluding the measures in the vector COUNTY. This change in specification had little effect on the estimated effects of HMO. We attribute this result to the fact that much of the variation in county characteristics is already accounted for by the inclusion of hospital fixed effects.

IV. Results

a) County-level Models

Table 4 shows estimates of equation (5), where the dependent variables are the county shares of various types of charity and non-charity patients who are served at public hospitals. To ease interpretation of the estimated coefficients, the means of the independent variables are shown in the final column. Table 4 shows that HMO penetration increases the share of a county's charity caseload that is served at public hospitals. In particular, public hospitals in areas with higher HMO penetration appear to be serving a greater share of the uninsured and other Medicaid patients. However, public hospitals in these markets are also serving a larger share of the county's privately

insured and Medicare caseloads. In fact, increases in HMO penetration have approximately the same estimated effect on all four of these shares. A 50% increase in HMO penetration is estimated to increase each share by approximately 10 percentage points.

Table 4 also shows that in counties with higher predicted Medicaid caseloads, a larger fraction of uninsured patients, and a smaller fraction of Medicaid patients (and especially Medicaid births) is served at public hospitals. Counties with higher predicted uninsured caseloads also see a smaller proportion of Medicaid patients being served at public hospitals. The other county-level control variables for industrial composition, employer size, and wages are sometimes significant in the models of the share of Medicaid, private payer, and Medicare patients treated in public hospitals. In general, variables associated with a higher fraction of the county's Medicaid births occurring in public hospitals, are associated with a lower share of private and Medicare patients being treated in these hospitals.

In summary, while it is true that the fraction of charity cases served by public hospitals has increased with HMO penetration (as the LA Times article quoted in the introduction observed), it is not clear that this is due to a reduction in the share of charity patients served within individual private hospitals. These county-level estimates may reflect a combination of two factors. First, there may have been a more rapid reduction in the number of private relative to public hospital beds in some markets such as Los Angeles that had rapidly growing HMO penetration. We will return to this possibility in the discussion section below. Second, the combination of county-level fixed effects and year dummies may not adequately control for the effects of DSH, which is expected to cause the share of Medicaid births in private hospitals to increase within counties. This factor may explain the fact

that the share of county Medicaid births served in public hospitals is not increasing.

We conducted one further experiment using the county level data. We interacted our measure of HMO penetration with the fraction of beds in the county that were private in 1988. The idea was to see whether the impact of HMO penetration was different in markets that were more or less well served by public hospitals at the beginning of the period. We choose to use data from the beginning of the period in this analysis because HMO penetration could affect the fraction of beds that were private. These results were suggestive since the coefficient on the interaction was generally negative and of similar magnitude to the positive coefficient on HMO penetration. However, it was never statistically significant .

b) Hospital-Level Analysis

Table 5 shows our estimates of equation (8). The first column suggests that the fraction of Medicaid and uninsured patients rises with HMO penetration for public hospitals. In particular, the public hospitals' share of Medicaid and uninsured patients rises by approximately 8 percentage points with a 50% increase in HMO penetration, while private hospitals' shares do not fall significantly. Our attempts to break out the charity caseload into its components were not very successful, but the point estimates suggest that much of the increase in the fraction of charity patients at public hospitals is due to an increased share of Medicaid births. In contrast, private hospitals see small reductions in the fraction of their caseload accounted for by Medicaid births rather than reductions in the fraction of uninsured or other Medicaid patients served.

There are a number of factors operating over our sample period which combined to produce a strong shift of Medicaid births away from public hospitals and towards private hospitals, as seen in Table 2. First, the DSH program created powerful incentives for private hospitals to increase the share of "Medicaid moms" served. Second, the increasing generosity of Medicaid is likely to have increased the share of Medicaid mothers served by private hospitals, since lower middle-class women who might previously have gone to such hospitals as uninsured customers gained Medicaid coverage.

Since HMO penetration rose at the same time that these policies were implemented, a failure to properly control for them would tend to produce a spurious positive correlation between HMO penetration and the share of Medicaid births in private hospital caseloads. Hence, the fact that we find a small negative effect rather than a positive one, suggests that we have effectively controlled for these policies.

Given that we have included hospital fixed effects in these models, the indicator for "private" is identified by hospitals that converted from public to private ownership. The third row of Table 5 indicates that hospitals that underwent this conversion actually increased the share of charity patients in their caseloads, and reduced the number of privately insured patients. One possible interpretation of this result is that given the negative publicity associated with takeovers of public hospitals by private operators, newly private hospitals go out of their way to cultivate good publicity by increasing charity care. Alternatively, as our model suggests, both for profit and not-for-profit hospitals have incentives to provide charity care and a for-profit hospital may be less restricted in the amount of charity care it can provide than a struggling non profit.

The signs of PREDMED and PREDUN are roughly as one would expect. Higher predicted shares of Medicaid patients are associated with higher actual shares of Medicaid patients as well as lower shares of uninsured and privately insured patients, and higher shares of Medicare patients. Higher predicted shares of uninsured patients are associated with higher actual shares of uninsured patients, and lower shares of other types of patients.

Table 6 shows estimates of equation (9), which highlights differences between private for-profit and non-profit hospitals. The estimated effects of HMO penetration in these regressions are very similar to those shown in Table 5. Table 6 shows, however, that there are some significant differences between private for-profit and non-profit hospitals in terms of the way that they respond to increasing HMO penetration.

Our estimates indicate that private for-profit hospitals react to increases in HMO penetration by moving away from private customers towards both Medicare patients and Medicaid births, as predicted by our model. The last portion of the table shows that when compared to the means shown in Table 3, the estimates in Table 6 imply that a 50% increase in HMO penetration would cause for-profits to reduce their share of private patients by 34.8%, and increased their shares of Medicare patients and Medicaid births by 24.6% and 39.4%, respectively. On the other hand, non-profit hospitals show small and statistically insignificant effects of HMO penetration on caseloads.

In summary, there is little evidence here to support the hypothesis that HMO penetration is causing existing private hospitals to reduce their charity caseloads. On the contrary, private for-profit hospitals respond to HMO penetration by reducing the share of privately insured patients in

their caseloads, and expanding the share of Medicare patients and Medicaid births. On the other hand, public hospitals do see an increase in the fraction of their caseloads accounted for by charity care, perhaps in response to private hospital closures.

The pattern of patient shifting that we observe in the for-profit sector is exactly what one might expect on the basis of our model: In response to a decline in the payments received from the privately insured, for-profit hospitals reduce the share of such patients and increase the share of Medicare patients and Medicaid births who have become relatively more lucrative. The fact that we find an effect for for-profit hospitals increases our confidence in the validity of our negative results for non-profits. That is, if we had examined non-profits alone and discovered that there was no statistically significant effect of HMO penetration, then we might have suspected that this result was due to measurement error in our measure of HMO penetration, for example. The fact that we find significant results for for-profits using the same measure makes this explanation unlikely.

c) Effects on the Bottom Line

One of the main reasons for public concern about patient shifting caused by HMOs, is that it may place a financial burden on public hospitals. Concerns about the bottom line are addressed in Table 7, which shows estimates of the effects of HMO penetration on revenues per discharge and cost per discharge. These models take the form of equation (9), except that the dependent variables are the logs of revenues and costs per discharge. The models are estimated using robust regression techniques because of the possibility of outliers in the revenue/cost data.[8]

[8] Specifically, we used the rreg command in STATA with the default settings. The standard errors in these regressions are not corrected for clustering within counties and years.

Although the coefficients are imprecisely estimated, these models indicate that HMO penetration is associated with reductions in revenues per discharge in the public sector which are not offset by reductions in costs. In the private sector however, there is little evidence of a decline in revenues. In fact, private non-profits appear to show an increase in revenues, which is largely offset by an increase in costs. Thus, these estimates suggest that HMO penetration may be associated with a shifting of sicker patients from private to public hospitals, and that private hospitals are able to take steps to shield themselves from the adverse financial impacts of HMO penetration, if not through patient shifting then through other means.

It is interesting to note that higher predicted Medicaid and uninsured caseloads are associated with lower revenues. Higher predicted uninsured caseloads are also, however, associated with lower costs per discharge, pointing to lower treatment intensity. A higher fraction of the county population being employed in large firms is associated with higher hospital revenues, perhaps because of the link between firm size and the generosity of health insurance coverage.

Discussion and Conclusions

We find that public hospitals take on a larger share of the charity caseload in markets with higher HMO penetration. Some commentators have interpreted this finding as evidence that private hospitals are turning away charity patients who then end up at public hospitals. However, we find little evidence that individual private hospitals were turning away charity patients in our fixed sample of hospitals. This finding suggests that HMO penetration increases the burden on public hospitals by encouraging the exit of private hospitals from the market (c.f. Barro and

Cutler, 1999). Unfortunately, given the relatively small number of exits over our sample period, we were not successful in establishing a direct link between HMO penetration and hospital entry and exit, but this is clearly an important subject for future research. Moreover, many hospitals appear to have joined (or been taken over) by hospital networks rather than exit the market. This phenomena also bears further investigation.

The main evidence of patient shifting is found in the for-profit sector, where higher HMO penetration is linked to reductions in the share of private patients in the caseload, and corresponding increases in the share of Medicare patients and Medicaid births. Our interpretation of this result is that HMO penetration reduces the price paid by private patients, making them less attractive to for-profit hospitals. These hospitals respond by turning away from these patients towards the next most lucrative groups, Medicare patients and Medicaid moms.

When we examine data on revenues and costs, we find some evidence that increasing HMO penetration is associated with a reduction in revenues per discharge in public hospitals, which is not offset by a corresponding reduction in costs. Private hospitals may be able to avoid these changes by choosing healthier patients within each group. In this case, increasing HMO penetration may result in a sicker caseload at public hospitals.

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Table 1: HMO Penetration Rates in California

County	Dec-88	Dec-89	Dec-90	Dec-91	Jul-92	Jul-93	Jul-94	Jul-95	Jul-96	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97
Alameda	41.7%	44.3%	43.0%	44.7%	48.8%	40.6%	43.6%	48.9%	58.8%	44.1%	42.3%	46.8%	53.1%	62.8%
Alpine	3.2%	3.7%	4.4%	4.4%	0.0%	0.0%	0.0%	0.0%	3.3%	0.0%	0.0%	0.0%	0.0%	3.3%
Amador	27.8%	29.5%	32.4%	31.9%	27.9%	29.2%	35.1%	37.5%	48.8%	28.0%	29.7%	37.3%	38.9%	50.1%
Butte	3.2%	3.7%	4.4%	4.4%	9.2%	11.3%	14.3%	20.4%	23.4%	12.3%	12.1%	16.3%	21.6%	22.4%
Calaveras.	3.2%	3.7%	6.3%	7.1%	2.6%	5.3%	6.1%	10.4%	13.6%	2.8%	5.5%	6.4%	10.6%	13.6%
Colusa	3.2%	3.7%	4.4%	5.3%	5.8%	6.9%	9.1%	13.1%	16.3%	8.2%	7.3%	10.3%	13.4%	16.3%
Contra Costa	43.5%	46.3%	45.3%	49.3%	43.9%	43.3%	46.3%	48.9%	61.6%	46.7%	45.1%	50.2%	53.1%	65.3%
Del Norte	3.2%	3.7%	4.5%	5.7%	0.4%	2.3%	3.1%	3.6%	7.4%	0.6%	2.6%	3.3%	4.0%	7.6%
El Dorado	29.5%	31.0%	33.8%	33.0%	31.5%	34.9%	40.0%	44.5%	58.4%	33.9%	35.6%	42.0%	46.1%	58.9%
Fresno	29.5%	31.5%	35.3%	36.1%	39.2%	36.7%	39.5%	41.7%	53.8%	39.9%	37.6%	37.8%	43.7%	55.5%
Glenn	3.2%	3.7%	6.3%	7.1%	5.4%	6.4%	8.0%	16.6%	22.1%	7.9%	7.0%	9.6%	17.5%	21.1%
Humboldt	3.2%	3.7%	4.5%	4.9%	3.7%	8.0%	10.1%	11.5%	15.9%	3.9%	8.7%	10.8%	12.6%	16.5%
Imperial	3.2%	3.7%	4.5%	4.4%	0.9%	3.5%	5.3%	5.5%	9.7%	1.0%	4.4%	5.8%	6.3%	10.2%
Inyo	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	2.0%	3.1%	6.5%	0.0%	2.0%	2.0%	3.2%	6.0%
Kern	15.4%	16.8%	17.9%	22.5%	25.8%	28.8%	34.8%	36.0%	39.5%	26.6%	30.3%	34.7%	38.2%	38.5%
Kings	27.8%	29.5%	33.2%	33.5%	35.2%	35.0%	40.7%	38.1%	53.0%	36.0%	35.6%	40.9%	39.7%	53.4%
Lake	3.2%	12.1%	14.6%	14.8%	16.3%	16.0%	19.8%	21.9%	31.4%	16.7%	16.7%	21.2%	23.5%	31.9%
Lassen	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.5%	0.4%	3.6%	0.0%	0.0%	2.9%	0.4%	3.7%
Los Angeles	27.7%	30.6%	35.8%	35.3%	28.9%	32.1%	35.4%	39.4%	42.6%	30.0%	34.8%	38.2%	40.8%	41.7%
Madera	29.5%	31.5%	33.5%	33.7%	37.8%	36.7%	38.7%	41.8%	52.8%	38.4%	37.6%	37.2%	43.8%	54.4%
Marin	50.5%	52.2%	47.9%	47.6%	44.5%	49.4%	49.8%	55.9%	69.5%	46.8%	50.9%	51.4%	60.5%	73.4%
Mariposa	3.2%	3.7%	4.4%	7.8%	9.5%	7.5%	6.8%	7.8%	11.8%	9.8%	7.9%	4.1%	8.6%	12.2%
Mendocino	3.2%	12.1%	14.6%	14.8%	13.7%	16.0%	19.8%	22.9%	28.3%	14.0%	16.7%	21.2%	24.5%	28.8%
Merced	3.2%	3.7%	11.6%	12.4%	16.5%	71.4%	14.2%	20.5%	25.6%	17.6%	15.4%	12.1%	22.2%	26.3%
Modoc	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.5%	0.4%	3.6%	0.0%	0.0%	2.9%	0.4%	3.7%
Mono	0.0%	0.0%	0.0%	0.0%	0.0%	2.0%	2.0%	3.1%	6.5%	0.0%	2.0%	2.0%	3.2%	6.0%
Monterey	3.2%	3.7%	4.5%	4.4%	0.5%	8.0%	10.1%	11.5%	14.2%	0.7%	8.7%	10.8%	12.6%	13.6%
Napa	30.6%	32.6%	34.5%	33.6%	36.6%	40.1%	40.8%	20.3%	24.6%	38.7%	41.8%	42.3%	22.0%	28.5%
Nevada	3.6%	4.0%	6.5%	6.5%	6.2%	8.0%	15.1%	18.5%	24.6%	6.5%	8.6%	17.0%	19.5%	25.0%
Orange	27.1%	29.7%	33.0%	32.0%	25.1%	32.0%	33.8%	37.6%	41.6%	25.6%	33.1%	36.6%	39.9%	40.5%
Placer	29.5%	31.0%	35.3%	34.4%	31.1%	39.2%	40.0%	45.3%	60.6%	32.6%	40.7%	42.0%	47.0%	64.3%
Plumas	0.0%	0.0%	0.0%	0.8%	0.0%	2.1%	2.2%	4.3%	7.5%	2.1%	2.2%	2.6%	4.4%	7.7%
Riverside	25.6%	29.0%	28.2%	30.9%	25.3%	31.3%	32.7%	36.6%	40.5%	26.0%	32.8%	35.5%	38.8%	39.3%
Sacramento	33.5%	34.7%	37.0%	36.4%	38.7%	39.2%	40.0%	47.4%	60.6%	40.7%	40.7%	42.0%	49.4%	64.3%
San Benito	3.2%	3.7%	4.4%	4.4%	3.3%	3.1%	6.2%	4.3%	7.5%	3.3%	3.2%	6.8%	4.4%	7.7%
San Bernardino	24.7%	29.5%	33.0%	32.3%	32.8%	31.6%	34.0%	37.8%	41.8%	34.1%	33.2%	36.7%	40.1%	40.8%
San Diego	29.0%	27.8%	29.7%	27.8%	26.7%	25.3%	31.4%	35.8%	39.5%	27.8%	27.0%	34.3%	37.9%	39.0%
San Francisco	45.7%	44.9%	43.1%	45.0%	40.2%	39.9%	42.0%	44.9%	57.8%	42.7%	41.1%	44.9%	48.7%	61.6%
San Joaquin	36.2%	37.4%	39.7%	40.1%	42.9%	39.2%	44.3%	51.4%	71.1%	44.4%	41.0%	46.8%	53.7%	77.4%
San Luis Obispo	3.2%	3.7%	4.4%	4.4%	8.8%	13.3%	14.5%	20.7%	22.8%	9.5%	13.9%	15.9%	22.3%	23.0%
San Mateo	42.5%	44.2%	42.3%	41.4%	40.8%	40.7%	43.3%	47.5%	58.4%	43.2%	42.4%	46.5%	51.6%	62.4%
Santa Barbara	5.1%	5.9%	8.6%	10.0%	11.9%	14.5%	20.0%	24.1%	29.0%	12.7%	15.3%	22.8%	25.9%	27.5%
Santa Clara	41.5%	44.2%	39.1%	42.0%	41.5%	41.0%	43.6%	47.8%	26.4%	44.5%	42.6%	46.8%	51.9%	29.1%
Santa Cruz	5.8%	5.6%	6.5%	7.1%	10.5%	11.6%	14.2%	20.3%	23.5%	12.1%	12.8%	15.4%	23.8%	23.0%
Shasta	3.2%	3.7%	4.5%	4.9%	0.4%	0.6%	3.4%	3.2%	7.2%	0.6%	0.6%	3.6%	3.5%	7.3%
Sierra	0.0%	0.0%	0.0%	0.8%	0.0%	2.1%	0.0%	4.3%	7.5%	2.1%	2.2%	0.0%	4.4%	7.7%
Siskiyou	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	3.6%	0.0%	0.0%	0.0%	0.4%	3.7%
Solano	30.6%	32.6%	38.6%	38.7%	61.3%	39.8%	40.9%	51.2%	58.2%	43.7%	41.9%	42.5%	55.2%	62.0%

Table 1 (continued): HMO Penetration Rates in California

County	Dec-88	Dec-89	Dec-90	Dec-91	Jul-92	Jul-93	Jul-94	Jul-95	Jul-96	Jan-93	Jan-94	Jan-95	Jan-96	Jan-97
Sonoma	39.7%	39.9%	46.2%	47.0%	44.1%	50.7%	51.6%	58.4%	41.0%	46.3%	52.6%	53.5%	63.2%	43.8%
Stanislaus	5.6%	9.8%	11.9%	13.4%	16.1%	11.8%	17.5%	24.4%	27.1%	17.7%	13.0%	19.7%	26.0%	26.6%
Sutter	27.8%	29.5%	32.4%	32.3%	33.9%	34.4%	39.1%	42.8%	54.3%	36.4%	35.0%	41.4%	44.3%	55.7%
Tehama	3.2%	3.7%	6.3%	6.3%	2.6%	1.8%	4.1%	7.9%	13.2%	2.8%	1.9%	4.6%	8.4%	13.1%
Trinity	3.2%	3.7%	4.5%	4.9%	0.4%	0.6%	3.1%	0.8%	4.2%	0.6%	0.6%	3.3%	0.9%	4.5%
Tulare	27.8%	29.5%	33.2%	33.5%	32.1%	30.6%	35.9%	39.0%	54.3%	32.2%	30.8%	35.5%	40.7%	54.7%
Tuolumne	3.2%	3.7%	8.9%	12.4%	11.7%	9.8%	11.6%	10.4%	15.3%	13.5%	10.8%	13.2%	10.6%	15.4%
Ventura	10.7%	17.5%	20.7%	23.6%	34.3%	31.2%	32.3%	36.0%	40.4%	31.5%	32.1%	35.0%	38.2%	39.4%
Yolo	30.7%	32.3%	35.3%	32.8%	35.8%	39.2%	42.4%	48.9%	61.3%	38.1%	41.2%	44.7%	50.8%	65.2%
Yuba	27.8%	29.5%	32.4%	31.9%	33.9%	34.4%	33.9%	42.8%	54.3%	36.4%	35.0%	35.4%	44.3%	55.7%
California	28.0%	30.1%	32.5%	32.7%	30.6%	32.1%	34.8%	38.9%	43.2%	31.3%	33.5%	37.2%	41.1%	43.6%

Table 2: Average Share of County's Total Discharges Accounted for by Each Hospital Type, 1988 and 1996

	1988			1996		
	Priv.For Profit	**Private Non-Profit**	**Public**	**Priv.For Profit**	**Private Non-Profit**	**Public**
Medicaid and Uninsured	.127 (.027)	.486 (.051)	.387 (.041)	.147 (.031)	.575 (.030)	.277 (.029)
Uninsured	.131 (.034)	.448 (.033)	.420 (.044)	.106 (.025)	.450 (.057)	.444 (.063)
Medicaid	.125 (.027)	.506 (.64)	.369 (.045)	.156 (.033)	.602 (.028)	.242 (.029)
Medicaid Births	.130 (.030)	.474 (.075)	.396 (.055)	.173 (.038)	.613 (.028)	.214 (.038)
Other Medicaid	.120 (.024)	.541 (.052)	.339 (.037)	.135 (.029)	.588 (.041)	.277 (.028)
Private	.171 (.040)	.733 (.027)	.097 (.033)	.162 (.031)	.717 (.022)	.121 (.033)
Medicare	.173 (.033)	.690 (.030)	.136 (.042)	.147 (.026)	.782 (.022)	.071 (.020)
# Hospitals	135	243	94	116	240	85

Notes: Shares are weighted by the 1988 county caseloads of each type. One county that did not have both a public and a private hospital is excluded from the table. Standard errors in parentheses.

Table 3: The Average Hospital's Share of Discharges of Each Kind, Average Revenues, and Average Costs, by Hospital Type

	All Hospitals	Private For-Profit	Private Non-Profit	Public
Panel A: Full Sample of 4055 Hospital Years				
Medicaid and Uninsured	.312	.281	.246	.589
	(.007)	(.009)	(.005)	(.019)
Uninsured	.071	.060	.050	.156
	(.002)	(.002)	(.001)	(.007)
Medicaid	.241	.221	.196	.432
	(.005)	(.009)	(.005)	(.014)
Medicaid Births	.137	.137	.109	.246
	(.003)	(.007)	(.003	(.009)
Other Medicaid	.104	.084	.087	.187
	(.003)	(.003)	(.002)	(.008)
Private Payer	.403	.411	.458	.186
	(.005)	(.008)	(.005)	(.011)
Medicare	.256	.285	.268	.183
	(.003)	(.006)	(.003)	(.009)
Revenue per discharge	7824	6825	7986	8107
	(92)	(119)	(106)	(285)
Cost per discharge	7735	6593	7861	8245
	(81)	(106)	(104)	(208)
# Observations	4055	1070	2180	805
Panel B: Fixed Sample of Hospitals--3528 Hospital Years				
Medicaid and Uninsured	.315	.286	.248	.593
	(.007)	(.010)	(.005)	(.020)
Uninsured	.071	.060	.051	.158
	(.002)	(.002)	(.001)	(.007)
Medicaid	.244	.226	.197	.436
	(.006)	(.009)	(.005)	(.014)
Medicaid Births	.139	.140	.110	.248
	(.003)	(.007)	(.003)	(.009)
Other Medicaid	.105	.085	.087	.187
	(.003)	(.003)	(.002)	(.008)
Private Payer	.400	.404	.457	.185
	(.006)	(.008)	(.005)	(.012)
Medicare	.255	.290	.268	.180
	(.003)	(.007)	(.003)	(.009)
Revenue per discharge	7834	6769	7997	8073
	(95)	(123)	(109)	(290)

Cost per discharge	7716	6437	7849	8199
	(84)	(103)	(107)	(211)
# Observations	3528	823	1966	739

Notes: Estimates are weighted by each hospital's total discharges in 1988. Standard errors in parentheses.

Table 4: Effects of HMO Penetration on the Share of County Caseloads Seen at Public Hospitals

	Medicaid & Unins.	Unins.	All Medicaid	Medicaid Births	Other Medicaid	Private Payer	Medicare	Variable Mean
HMO Percent	.214	.239	.144	.150	.220	.192	.234	.350
	(.075)	(.108)	(.094)	(.109)	(.090)	(.065)	(.061)	(.008)
Predicted Medicaid	-.641	2.04	-1.41	-2.35	-.490	.744	.774	.221
	(.383)	(.554)	(.484)	(.563)	(.460)	(.335)	(.313)	(.005)
Predicted Uninsured	-1.16	-.641	-1.53	-2.42	-1.09	.113	.163	.063
	(.460)	(.665)	(.581)	(.674)	(.552)	(.402)	(.376)	(.002)
% Firm Size > 50	.720	-2.15	1.70	2.73	-.592	-1.49	-2.46	.207
	(.955)	(1.38)	(1.21)	(1.40)	(1.15)	(.834)	(.781)	(.008)
% Agriculture & Mining	3.94	-2.29	2.97	5.66	-.692	4.94	4.90	.004
	(3.16)	(4.56)	(3.99)	(4.62)	(3.79)	(2.76)	(2.58)	(.002)
% Manufac-turing	-.072	-.087	-.482	-.529	1.34	1.89	3.54	.094
	(.988)	(1.43)	(1.25)	(1.45)	(1.19)	(.863)	(.808)	(.004)
% Trade	.116	-.421	.954	.770	.512	.204	-.241	.132
	(1.07)	(1.55)	(1.35)	(1.57)	(1.28)	(.934)	(.874)	(.002)
% Services	-.905	1.98	-2.41	-4.39	.595	1.15	2.97	.167
	(.959)	(1.39)	(1.21)	(1.43)	(1.15)	(.838)	(.784)	(.005)
% Unclassified sector	8.40	35.33	-5.59	.166	-6.36	-3.00	-6.65	.001
	(5.10)	(7.37)	(6.44)	(7.47)	(6.12)	(4.45)	(4.17)	(.0002)
HSA Wage	8.53	6.64	8.52	14.77	7.55	-3.54	-2.89	.026
	(3.61)	(5.22)	(4.56)	(5.32)	(4.33)	(3.15)	(2.95)	(.0004)
R-squared	.954	.900	.941	.938	.946	.946	.962	

Notes: Estimates are weighted by the total number of discharges in the county in 1988. There are 265 county year observations. Regressions also included year and county dummies. Standard errors in parentheses. The percent employed, etc. variables refer to the percent of employees in the county who fall in the particular firm size or industrial sector category. The omitted sector group is the percentage of the county population that is not employed. The wage is the total wage bill in the HSA divided by the number of workers, divided by 1,000. Thus, the mean of .026 means that the average worker in a county earned $26,000 per year.

Table 5: Effects of HMO Penetration on Individual Hospital's Shares of Various Types of Patients, Private vs. Public Hospitals

	Medicaid & Unins.	Unins.	All Medicaid	Medicaid Births	Other Medicaid	Private Payer	Medicare
HMO Percent	.153	.017	.169	.208	-.038	-.057	-.019
	(.072)	(.066)	(.106)	(.124)	(.032)	(.041)	(.035)
HMO * Private	-.200	.005	-.204	-.232	.027	.086	.004
	(.072)	(.074)	(.120)	(.138)	(.039)	(.050)	(.030)
Private	.074	.029	.045	.056	-.010	-.048	.002
	(.030)	(.024)	(.042)	(.047)	(.014)	(.022)	(.015)
Predicted	.002	-.084	.086	.028	.058	-.107	.074
Medicaid	(.034)	(.021)	(.034)	(.025)	(.026)	(.035)	(.017)
Predicted	.213	.628	-.415	-.231	-.184	-.137	-.019
Uninsured	(.060)	(.073)	(.080)	(.063)	(.041)	(.051)	(.031)
% Firm Size	-.606	-.085	-.521	-.503	-.018	.899	.129
> 50	(.279)	(.135)	(.230)	(.202)	(.144)	(.304)	(.262)
% Agriculture	-.785	.275	-1.06	-.413	-.647	-2.32	2.12
or Mining	(1.05)	(.454)	(.980)	(.921)	(.434)	(.817)	(.932)
% Manufacturing	-.476	-.238	-.238	.335	-.573	-.354	.153
	(.305)	(.135)	(.277)	(.235)	(.151)	(.307)	(.316)
% Trade	.589	.270	.319	.774	-.456	-.573	-.154
	(.344)	(.151)	(.300)	(.267)	(.152)	(.353)	(.295)
% Services	-.282	-.043	-.239	-.157	-.081	-1.02	.666
	(.305)	(.160)	(.246)	(.214)	(.172)	(.357)	(.305)
% Unclassified	3.30	2.32	.972	1.97	-1.00	-3.00	-.600
	(2.39)	(1.09)	(1.78)	(1.62)	(.593)	(1.65)	(1.71)
HSA Wage	-5.17	-1.88	-3.29	-.386	-2.90	3.63	1.36
	(1.36)	(.658)	(1.28)	(1.08)	(.664)	(1.39)	(1.16)
R-squared	.959	.885	.939	.891	.944	.932	.894

Notes: Estimates are weighted by the total number of discharges in the hospital in 1988. There are 3528 hospital-year observations. Regressions also included hospital fixed effects, year dummies, and interactions between year dummies and "private". Standard errors are corrected for clustering within county-year cells and appear in parentheses.

Table 6: Effects of HMO Penetration on Individual Hospital's Shares of Various Types of Patients, Private For-Profit, Non-Profit, and Public Hospitals

	Medicaid & Unins.	Unins.	All Medicaid	Medicaid Births	Other Medicaid	Private Payer	Medicare
HMO Percent	.149	-.017	.166	.205	-.039	-.054	-.019
	(.072)	(.065)	(.106)	(.124)	(.037)	(.039)	(.036)
HMO * Private	-.063	-.026	-.038	-.097	.059	-.233	.159
	(.093)	(.076)	(.123)	(.140)	(.056)	(.108)	(.059)
HMO * Private * Non-Profit	-.131	.033	-.165	-.136	-.029	.340	-.176
	(.067)	(.022)	(.073)	(.053)	(.038)	(.108)	(.055)
Private	.094	.042	.052	.049	.003	.043	-.092
	(.035)	(.024)	(.044)	(.026)	(.018)	(.045)	(.025)
Private Non-Profit	-.020	-.015	-.005	.008	-.013	-.102	.103
	(.023)	(.007)	(.025)	(.019)	(.014)	(.045)	(.024)
Predicted Medicaid	.003	-.085	.088	.030	.058	-.112	.076
	(.033)	(.021)	(.033)	(.026)	(.026)	(.034)	(.027)
Predicted Uninsured	.212	.627	-.415	-.231	-.184	-.143	-.014
	(.060)	(.073)	(.080)	(.062)	(.041)	(.051)	(.034)
% Firm Size > 50	-.536	-.098	-.439	-.438	-.001	.757	.191
	(.271)	(.138)	(.226)	(.202)	(.137)	(.302)	(.259)
% Agriculture or Mining	-.782	.295	-1.08	-.439	-.638	-2.17	1.99
	(1.04)	(.455)	(.974)	(.915)	(.431)	(.788)	(.920)
% Manufacturing	-.506	-.236	-.270	.313	-.582	-.322	.151
	(.301)	(.135)	(.274)	(.236)	(.149)	(.317)	(.306)
% Trade	.537	.290	.247	.711	-.464	-.388	-.267
	(.343)	(.151)	(.300)	(.262)	(.155)	(.356)	(.293)
% Services	-.334	-.043	-.291	-.193	-.098	-.989	.682
	(.298)	(.161)	(.240)	(.211)	(.170)	(.352)	(.295)
% Unclassified	3.27	2.25	1.02	2.06	-1.04	-3.57	-.102
	(2.35)	(1.09)	(1.76)	(1.61)	(.590)	(1.62)	(1.63)
HSA Wage	-5.28	-1.97	-3.31	-.332	-2.98	3.02	1.96
	(1.30)	(.664)	(1.29)	(1.09)	(.655)	(1.37)	(1.13)
R-squared	.959	.885	.940	.892	.944	.933	.895

% Change in Caseloads of Each Type With a 50% Increase in HMO Penetration

Public	12.6*	5.4	19.0	41.3	-10.4	-14.3	-5.2
Private For-Profit	15.0	-35.8	29.0	39.4*	11.9	-34.8*	24.6*
Private Non-Profit	-9.1	-9.8	-9.4	-12.7	-5.2	5.8	-6.7

Notes: Estimates are weighted by the total number of discharges in the hospital in 1988. There are 3528 hospital-year observations. Regressions also included hospital fixed effects, year effects, and year effects interacted with "private". Standard errors are corrected for clustering within county-year cells and appear in parentheses. A * indicates that the sum of the coefficients is significantly different from zero at the 95% level of confidence.

Table 7: Effects of HMO Penetration on Hospital Revenues and Costs

	Log Revenue	Log Revenue	Log Cost	Log Cost
HMO Percent	-.171	-.151	-.080	-.069
	(.106)	(.106)	(.101)	(.101)
HMO * Private	.184	-.051	.109	-.156
	(.112)	(.145)	(.106)	(.138)
HMO * Private	-	.283	-	.322
* Non-Profit		(.100)		(.095)
Private	-.005	.180	.023	.141
	(.036)	(.051)	(.035)	(.049)
Non-Profit	-	-.211	-	-.142
		(.040)		(.038)
Predicted	-.184	-.198	-.011	-.023
Medicaid	(.069)	(.068)	(.065)	(.065)
Predicted	-.366	-.358	-.292	-.287
Uninsured	(.106)	(.106)	(.101)	(.101)
% Firm Size	1.51	1.43	.810	.710
> 50	(.625)	(.624)	(.593)	(.595)
% Agriculture	-3.42	-3.93	-1.51	-1.88
or Mining	(1.50)	(1.50)	(1.43)	(1.43)
% Trade	-.776	-.670	-.008	1.76
	(.775)	9.774)	(.736)	(.642)
% Services	-.669	-.694	-.113	.197
	(.627)	(.625)	(.595)	(.738)
% Unclassified	-5.02	-6.41	-7.61	-.107
	(3.70)	(3.69)	(3.51)	(.596)
HSA Wage	-1.41	-2.89	3.69	2.75
	(3.13)	(3.13)	(2.97)	(2.99)

Notes: Estimates are computed using robust regression. Models also included hospital and year fixed effects. Standard errors in parentheses.