NBER WORKING PAPER SERIES

MANAGED CARE AND HEALTH CARE EXPENDITURES: EVIDENCE FROM MEDICARE, 1990-1994

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Working Paper 6187
http://www.nber.org/papers/w6187

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
September 1997

We thank David Cutler, Alan Garber, and Mark McClellan for helpful suggestions regarding this research. This paper is part of NBER's research program in Health Care. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

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ABSTRACT

Increases in the activity of managed care organizations are likely to have a number of implications for the structure and functioning of the U.S. health care market. One possibility is that increases in managed care activity may have "spillover effects," influencing the performance of the entire health care delivery system, so that care for both managed care and non-managed-care patients is affected. Some discussions of Medicare reform have incorporated spillover effects as a way that increasing Medicare HMO enrollment could contribute to savings for Medicare.

This paper investigates the relationship between HMO market share and expenditures for the care of beneficiaries enrolled in traditional fee-for-service Medicare. We find that increases in system-wide HMO market share (which includes both Medicare and non-Medicare enrollment) are associated with declines in both Part A and Part B fee-for-service expenditures. The fact that managed care can influence expenditures for this population, which should be fairly well insulated from the direct effects of managed care, suggests that managed care activity can have broad effects on the entire health care market. Increases in Medicare HMO market share alone are associated with increases in Part A expenditures and with small decreases in Part B expenditures. This suggests that any spillovers directly associated with Medicare HMO enrollment are small.

For general health care policy discussions, these results suggest that assessment of new policies that would influence managed care should account not only for the effects of managed care on enrollees, but also for its system-wide effects. For Medicare policy discussions, these findings imply that previous results that seemed to show the existence of large spillover effects associated with increases in Medicare HMO market share, but did not adequately account for system-wide managed care activity and relied on older data, overstated the magnitude of actual Medicare spillovers.

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I. Introduction

As the influence of managed care grows, understanding its influence on the structure and functioning of the health care marketplace is increasingly important. During recent years, a number of studies have examined the hypothesis that managed care activity may have broad effects on the entire health care system through so-called "spillover effects." These studies argue that managed care organizations may, among other things, compete with non-managed-care providers or insurers, influence the system-wide availability of new technologies or other health care services, influence the structure of hospital markets, and contribute to the spread of conservative practice patterns among non-managed-care providers, all contributing to changes in provider behavior and health care costs throughout the health care system.

Understanding whether managed care can have widespread effects on health care delivery and costs is important for assessing the effects of the ongoing transformation of the health care system on health care costs and patient care, and for evaluating policies that would encourage or discourage growth in managed care. In particular, most analyses of managed care have focused on patients who are enrolled in managed care plans, but the presence of spillover effects would imply the need to include consideration of non-managed-care enrollees as well.

This paper investigates the relationship between system-wide managed care activity and expenditures for the care of patients covered by Medicare's traditional fee-for-service (FFS) plan. These patients should be well insulated from the direct effects of managed care, so that studying their expenditures will provide a strong test of the ability of managed care to influence care for non-managed-care patients. FFS Medicare is a well-defined, stable insurance plan that does not subject patients to the limitations typically imposed by managed care plans. There is little or no central management of provider or patient utilization choices (i.e., utilization review). No strong financial

incentives are imposed on providers to limit utilization. Physicians caring for Medicare FFS patients are paid on a fee-for-service basis, subject only to limitations on the fees for individual services embodied in the Medicare Fee Schedule. Hospitals are paid using diagnosis related groups (DRGs). While DRGs do impose some incentives for cost containment, they are among the weaker incentives used to influence hospitals in today's health care system and, in fact, some work has shown that DRGs do vary with treatment intensity, so that the incentive for hospitals to reduce intensity to contain costs is not complete (McClellan, 1997). In addition, the Medicare fee-for-service program does not compete for patients and is therefore not influenced by the competitive forces that increasingly pervade the overall health care system. Overall, since FFS Medicare patients should be well outside the boundaries of managed care, any effect of managed care on their expenditures may be taken as clear evidence of the power of managed care to fundamentally transform the health care system in ways that affect all patients.

Focusing on Medicare expenditures will also allow us to investigate issues related to Medicare policy. Spillover effects that affect Medicare spending have attracted particular interest in Medicare reform discussions because of the possibility that policy changes that increased HMO enrollment among Medicare beneficiaries could produce spillovers, reducing Medicare costs and contributing to the savings needed to restore balance in Medicare financing. The key question is whether changes in Medicare HMO activity can themselves bring about savings through spillover effects. While most examinations of spillover effects focus on managed care activity throughout the health care system, the existence of expenditure-reducing spillover effects induced by HMO activity outside of Medicare need not imply that changes in Medicare HMO activity will also produce savings. And, existing studies that look specifically at Medicare HMO market share have not fully answered this question since they have not clearly identified the effects of Medicare HMO enrollment separately from

system-wide HMO effects. This paper studies the effect of Medicare HMO market share on expenditures, controlling for changes in system-wide HMO activity.

A number of previous studies have examined spillover effects from various perspectives (e.g., Goldberg and Greenberg, 1979; Frank and Welch, 1985; Feldman et al., 1986; Luft et al., 1986; Dowd, 1987; McLaughlin, 1987, 1988; Noether, 1988; Robinson, 1991, 1996; Baker, 1994; Chernew, 1995; Baker and Corts, 1996). While these studies contribute to our understanding of spillover effects, data limitations have left them generally unable to draw clear, broad-based conclusions about the impact of system-wide managed care activity on non-managed-care patients. Some studies have been forced to rely on data about managed care from only a small number of markets. Many studies have also had to rely on expenditure data from single sectors of the health care market (e.g., only from hospitals), which makes generalization difficult, or have had to lump together spending by managed care and non-managed-care patients, which makes it difficult to separate spillover effects from the effects of managed care organizations on the care provided to enrollees. This paper uses detailed nationwide data on HMO market share along with ambulatory and hospital expenditures for a well-defined group of FFS patients to overcome these difficulties.

Four studies have examined Medicare data for evidence of spillovers. Baker (1997) examined data on Medicare HMO enrollment and FFS expenditures between 1986 and 1990, finding that increases in Medicare market share from 10 to 20 percent were associated with decreases of 4.5 and 4.1 percent in FFS expenditures for hospital and physician services, respectively. Welch (1994) found a negative relationship between Medicare risk HMO market share and aggregate (HMO and non-HMO) Medicare expenditures per beneficiary between 1984 and 1987. Clement et al. (1992) used data from 1985-1988 and estimated that increases of 10 percentage points in Medicare risk HMO market share were associated with 5 percent decreases in Medicare FFS expenditures, although

the results were sensitive to specification. Finally, Rodgers and Smith (1995) reported that increases in Medicare risk market share were associated with decreases in FFS expenditures between 1988 and 1992. While these studies offer insights into the existence of spillover effects in general, their main shortcoming is that they tend to focus only on Medicare HMO market share,[1] and have not been able to distinguish Medicare-specific spillovers from system-wide spillovers. Nonetheless, some have interpreted their results to imply that there would be Medicare-specific spillover effects (e.g., Rodgers and Smith, 1995; Hammonds, 1997). In this paper, we include both system-wide and Medicare-specific HMO market share to disentangle these two effects and evaluate this conclusion.

The remainder of this paper proceeds as follows. The next section discusses the ways in which managed care may be expected to influence expenditures and the issues raised when examining managed care spillovers in Medicare. Section 3 discusses estimation issues and presents results, and section 4 concludes.

II. HMOs and Health Care Expenditures

Mechanisms

The term "managed care," in popular parlance, is often poorly defined and can refer to a wide variety of health care organizations. In this paper, we use this term to refer conceptually to organizations that take an active role in limiting the providers that their patients can use (e.g., through selective contracting), that place incentives on providers that are designed to limit utilization (e.g., capitation), and/or that actively limit patient utilization through other means (e.g., utilization review). This is a purposefully broad set of criteria, and is designed to capture the spirit of recent changes in

[1]Rodgers and Smith, 1995, do include some data on system-wide HMO market share, but are forced to rely on a limited sample of 89 metropolitan areas.

the health care marketplace. While this framework guides conceptual development, practical considerations constrain the empirical work described below to focus only on HMOs.

Managed care may influence FFS expenditures through a variety of mechanisms. First, increases in managed care activity may lead to changes in the structure and capacity of the health care delivery system. For example, managed care may change the incentives associated with the purchase of high-cost medical technologies, affecting technology availability in markets (Baker and Wheeler, 1997; Cutler and Sheiner, 1997). Similar effects could occur if managed care changes the structure of the hospital market, the size or behavior of individual hospitals (e.g., Chernew, 1995), the number and type of health care providers (Baker and Brown, 1997), or other market characteristics. By changing the characteristics of markets in which medicine is practiced, managed care may influence the type and costs of care provided to all patients in that market.

Managed care may also influence the behavior of health care providers, independent of any effects it may have on the overall availability of services. For example, in markets with high levels of managed care activity, all providers may be less likely to use procedures perceived to have high ratios of costs to benefits. This could occur through a variety of mechanisms. If, as some models of physician learning suggest (e.g., Phelps, 1992), physicians tend to adopt the practice patterns of other physicians around them, increases in the number of managed care physicians practicing in a given area may result in faster promulgation of conservative practice techniques. A related possibility is that IPA-affiliated physicians who retain some FFS patients may adopt more conservative practice styles throughout their practices. Finally, it is possible that increases in managed care activity, or other increases in the strength of managed care organizations vis-a-vis traditional providers and insurers, will increase competitive pressure, as non-managed-care providers and insurers compete with managed care organizations for the business of employers and patients. Competition could force

non-managed-care providers to change the ways in which they provide care or prompt insurers to expand utilization review and other oversight efforts, leading to changes in utilization. (It should be noted that competition could also be associated with increasing expenditures. For example, competition from managed care plans may prompt FFS providers to compete on the basis of quality or technology. Or, if managed care pulls patients away from physicians, they may respond by inducing demand from or increasing charges to non-managed-care patients.[2])

A final mechanism by which managed care activity could have spillover effects on FFS expenditures is price. If non-managed-care providers or insurers earn excess profits in the absence of managed care, increasing competition could enhance market discipline and lead to lower prices.

Observing spillover effects in Medicare data

The Medicare program provides an excellent opportunity to observe many of the effects described above. In particular, changes in the structure and capacity of the health care system and changes in utilization patterns should influence Medicare expenditures. Most health care providers and most hospitals care for both Medicare and non-Medicare patients. If, for example, managed care activity reduces the number of MRI machines available in a market, then utilization of MRI for Medicare patients is likely to be influenced. Similarly, if providers adopt more conservative practice styles for their non-Medicare patients, Medicare FFS patients may also be treated more conservatively. Since Part B reimbursement is based on the number and type of procedures performed, variation in utilization will be reflected in Part B expenditures. Part A expenditures will capture variation in the number of hospitalizations and some variation in in-hospital utilization,

[2]The willingness and ability of physicians to do this is a subject of debate. Some evidence (e.g. Mitchell et al., 1989, Cromwell and Mitchell, 1986) indicates that physicians can induce demand and may do so in response to reductions in demand or prices.

although the Prospective Payment System that governs Part A payments dampens the relationship between in-hospital utilization intensity and Part A expenditures.[3]

A word on the role of competition is important here. While competition-driven changes in technology availability or utilization could easily influence care received by Medicare beneficiaries, these competitive effects are likely to arise from non-Medicare sectors of the health care market. The strength of competition for Medicare beneficiaries as a mechanism is limited. Medicare does not compete for the business of the elderly and disabled and does not operate under the same incentives that face for-profit insurance companies and health care providers (Clement et al, 1992). In addition, provider behavior with respect to pricing and utilization has only small effects on the prices that Medicare FFS beneficiaries pay for coverage and care.

While utilization effects should show up in the Medicare data, the structure imposed by Medicare on the payments made to physicians and hospitals severely limits the extent to which managed-care-induced price changes can occur in Medicare. Since 1983, The Health Care Financing Administration (HCFA) has reimbursed hospitals using the Prospective Payment System, which significantly limits managed-care-induced price variation in Part A expenditures. Similarly, in the early 1990s, HCFA began phasing in the Medicare Fee Schedule for reimbursement of physicians under Part B. This schedule limits managed-care-induced variation in physician prices. Since the Fee Schedule was being phased in during the time period on which we focus, all of the data presented here are adjusted to reflect what payments would have been under the 1994 Fee Schedule, which further limits the effect that changes in prices over time could have in this data. However, it remains

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[3]Note, however, that McClellan (1997) shows that substantial portions of the variance in hospital reimbursements under the Prospective Payment System can be explained by variation in procedure codes and outlier payments that reflect variation in utilization patterns, so that Part A expenditures will reflect in-hospital intensity to at least some degree..

theoretically possible that price effects could appear in this data to the extent that managed-care-induced changes in physician or hospital prices were incorporated into the Prospective Payment System or Fee Schedule payment rates, although we believe this effect is relatively weak.

System-wide spillovers vs. Medicare-specific spillovers

For discussions of Medicare policy, it is important to distinguish the effects of system-wide and Medicare-specific managed care activity. "System-wide" managed care activity includes changes in the size, market power, or other aspects of the behavior of managed care organizations throughout the health care system, possibly including the effects of increasing managed care activity within Medicare. "Medicare-specific" managed care activity captures changes in the enrollment in only the Medicare portion of managed care organizations. Changes in expenditures induced by Medicare-specific managed care activity occur because only Medicare managed care activity changed, independent of any other changes in the managed care market. Changes in system-wide managed care activity induce expenditure effects because the influence of the entire sector has changed.

If spillovers occur because managed care activity changes throughout the entire health care system, then changes in Medicare HMO enrollment that might be brought about by Medicare policy changes will produce spillover effects only to the extent that increases in Medicare HMO enrollment increase overall enrollment. Since Medicare enrollment is only a fraction of overall enrollment, this would limit the impact that increases in Medicare enrollment could have through spillovers. On the other hand, if increases in Medicare HMO market share itself directly influences expenditures, independent of system-wide changes in market share, savings obtained could be greater.

It is not clear that the effects of system-wide and Medicare-specific HMO market share should be the same. System-wide changes in managed care activity have broad latitude in the ways they

influence expenditures. In fact, all of the spillover effect mechanisms identified above could plausibly begin with system-wide managed care changes. On the other hand, the potential for Medicare-specific spillovers to have strong effects is much more limited (Clement et al., 1992; Baker 1997). There is little reason to believe that Medicare-specific activity would bring about large changes in structure and capacity of the overall health care market or have important competitive effects. The most plausible way in which significant Medicare-specific effects could occur is through learning and IPA effects. For example, if providers who see elderly or disabled patients share information among themselves but not with other physicians more generally, then increases in Medicare managed care activity could lead to changes in the behavior of Medicare FFS providers independent of changes in the non-Medicare market. Similarly, expansion of Medicare IPAs may have an independent effect on Medicare FFS expenditures if Medicare IPA physicians see mostly Medicare patients.

While understanding Medicare-specific spillover effects is crucial for Medicare policy, it is difficult to draw conclusions about the size of Medicare-specific spillover effects from previous work. Since system-wide and Medicare-specific spillovers need not be the same, inferences cannot reliably be drawn from studies of spillover effects outside of Medicare. While some studies have examined the effects of Medicare HMO market share on expenditures (Baker, 1997; Welch, 1994; Clement et al, 1992; Rodgers and Smith, 1995), they have not typically included system-wide HMO activity. Since system-wide managed care activity and Medicare HMO activity are correlated, both the effects of Medicare-specific and system-wide managed care activity could be captured in the relationship between Medicare HMO market share and expenditures. One goal of this paper is to apply new data to attempt to disentangle these effects.

III. Data

Medicare Expenditures

Data on Part A and Part B Medicare FFS expenditures and enrollment by county for all counties in the United States for the years 1990-1994 were obtained from HCFA. The expenditure data include only expenditures made on behalf of FFS beneficiaries[4]--payments to HMOs and other providers for the care of HMO-enrolled beneficiaries are not included. Expenditures that are not covered by Medicare, such as copayments, deductibles, payments made for services not covered by Medicare, and payments for services covered by Medigap insurance, are also not included. To construct the county-level measures of spending, expenditures for each beneficiary are assigned to his or her county of residence, regardless of where the expenditures were incurred.

The Medicare Fee Schedule, governing Medicare payments to physicians, was phased-in during the time period under study here. To ensure that this did not affect the findings, the data for each year have been adjusted by the HCFA Office of the Actuary to reflect what payments in each year would have been under the 1994 Medicare Fee Schedule. One implication of this adjustment is that the (already small) possibility of observing managed-care-induced changes in physician prices is virtually eliminated.

For our analyses, we aggregate the county-level data to produce measures of spending for Health Care Service Areas (HCSAs). HCSAs are groups of counties thought to approximate markets for health services (Makuc, et al., 1991). There are 803 HCSAs in the United States, representing both urban and rural areas. We expect both HCSAs to be superior to counties as a market definition since many counties are too small to adequately represent markets for health care services.

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[4]The sample includes expenditures for the elderly and disabled, but excludes expenditures for patients with end-stage renal disease, who are also covered by Medicare but make up less than 1 percent of beneficiaries and tend to have distinct health needs.

Table 1 reports national average expenditures per beneficiary for 1990-1994. In 1990, on average, Medicare spent $2,037 per beneficiary for Part A services and $1,233 per beneficiary for Part B services. By 1994, these amounts had risen to $2,865 and $1,539, increases of 40.6 percent and 24.8 percent respectively.

Medicare HMO Market Shares

While the arguments developed above apply to managed care broadly, we focus our analytical efforts on HMO market share. This follows previous work and is, in practice, the only variable for which we can obtain comparable data over time for relatively small geographic areas. County-level data on the number of Medicare Part A beneficiaries enrolled in HMOs for 1989-1994 (including risk, cost, and HCPPs) were obtained from HCFA.[5] County-level HMO market shares are simply the ratio of the number of HMO enrollees to the number of beneficiaries in each county.

As above, we aggregate the county-level data to form measures of Medicare HMO market share for market areas. The top portion of Table 2 presents summary statistics for area Medicare HMO market shares by year. The first column presents means weighted by the number of Medicare beneficiaries in each market area to produce national averages. Between 1990 and 1994, mean Medicare HMO market share grew from 6.4 percent to 7.8 percent. Since 1994, Medicare HMO market share has continued to grow, reaching approximately 10 percent in 1996.

Figure 1 graphs the distribution of 1994 levels and 1990-1994 changes in Medicare market shares. 1994 market-level market shares in the sample range from 0 to 47 percent. The distribution

[5]While some previous analyses have used only risk HMO enrollment, this will not capture HMO activity as broadly or accurately as HMO market share from all contract types. Moreover, focusing only on risk enrollment may induce bias since Medicare HMOs can choose annually whether to operate as risk or cost plans, and this choice is likely to be influenced by FFS expenditure levels.

of Medicare market shares is highly skewed, as evidenced by the fact that the median market shares are all well below the means. Between 1990 and 1994, most areas saw little change in Medicare HMO market share. Among market areas in the sample, 1990-1994 changes ranged from -9 percent to +27 percent. There is some upward movement in HMO market share in some areas, but most experienced only very small changes in market share. In this sample 1.0 percent (N=8) had decreases of more than 5 percent, 4.2 percent (N=34) had increases of more than 5 percent, and 81 percent (N=650) had changes that fell between -1 percent and +1 percent.

System-wide HMO market shares

In addition to Medicare HMO market shares, we also incorporate a set of estimates of system-wide (Medicare and non-Medicare) HMO market share. These estimates were constructed for previous studies using data from the Group Health Association of America (now called the American Association of Health Plans). Conceptually, construction took place in three steps. First, for each HMO in the United States, its total enrollment and service area, specified by county, were obtained from annual surveys conducted by the GHAA which asked all known HMOs in the country about their total enrollment, county service area, and headquarters location. The results of the survey are published in the annual *National Directory of HMOs* (GHAA, various years).[6]

The next step was to distribute the enrollment of each HMO among the counties in its service area. Initially, this was done by simply distributing enrollment proportionally to county population.

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[6]In general, compliance with the survey is quite good. In all 5 of the years taken together, less than 10 HMOs (of a total of about 550 per year) failed to indicate their enrollment. In the missing cases, data from subsequent *Directories* was used. Most HMOs also indicate their service area. In 1990, 459 of 567 HMOs clearly indicated the counties that they served. Response rates improved over time, and by 1994, 566 of 572 HMOs reported their service area clearly. In cases where market area data was not available from the survey, market areas were determined by reference to subsequent *Directories* and/or telephone contact.

In addition, since HMO enrollment may be concentrated near HMO headquarters or since HMOs may locate their headquarters in areas where their enrollment is concentrated, estimates that incorporate both county population and distance from HMO headquarters were constructed. The correlation between estimates produced by the two methods is approximately 0.97. Estimates that incorporate both population and distance are used in this study.

Once enrollments had been distributed over service areas, the total number of enrollees in each county was computed by summing over the set of HMOs serving that county. Using the set of county enrollment estimates, market share estimates were computed as the proportion of the population enrolled in HMOs.

Since the county service areas on which the series are based are quite accurate, it is likely that the series themselves are also quite accurate. Nonetheless, any allocation mechanism that produces enrollment estimates will almost certainly lead to measurement error in some cases. Aggregating market shares to the HCSA level should dampen the effects of any misestimation of market shares that may have occurred at the county level. While geographically detailed independent data on HMO market share for the whole country for these years are not available, the estimates were compared to estimates for selected sets of Metropolitan Statistical Areas from the GHAA for 1991 (Bergsten, 1993) and from Interstudy for 1994 (Interstudy, 1994). The estimates performed relatively well in these comparisons. In a few cases, the estimates were found to be at odds with the Interstudy estimates, and, where the geographic allocation algorithm appeared to produce erroneous results, we adjusted the estimates to conform to the Interstudy estimates.

On average, system-wide HMO market shares rose from 15 to 21 percent between 1990 and 1994 (bottom panel of Table 2). Within any given year, observed system-wide market shares are fairly widely distributed. For example, in 1994, observed market shares range from 0 to 54 percent.

The top portion of Figure 2 illustrates the distribution of system-wide HMO market shares across market areas in 1994. Between 1990 and 1994, most areas saw rising system-wide HMO market shares. The bottom portion of Figure 2 graphs the distribution of changes in Medicare market share for areas. 1990-1994 system-wide HMO market share changes in the sample range from -14 percent to +22 percent. Relatively few areas saw declines in HMO market share. About 1.0 percent (N=8) of the sample had declines of more than 5 percent. On the other hand, 27 percent (N=219) saw increases of more than 5 percent.

An issue that becomes important as we attempt to disentangle the effects of system-wide and Medicare-specific HMO market share on Medicare expenditures is the extent to which the two measures are correlated. In cross-sections for individual years, correlations between the market area estimates range from 0.52 to 0.54. The correlation between the 1990-1994 changes in Medicare and system-wide market share is 0.25.

III. Estimation

Background and strategy

Our interest is in estimating the parameters of a function that relates FFS Medicare expenditures in a market to HMO market share in that market. Specifically,

$$E_i = f(M_i, S_i, X_i) \qquad \textbf{(1)}$$

where E denotes Medicare FFS expenditures, M denotes Medicare-specific HMO activity, S denotes system-wide HMO activity, and X denotes other determinants of Medicare expenditures.

There are a number of issues that must be resolved to satisfactorily estimate equation (1). First, there may be unobservable variables that are correlated with both market share and expenditures. For example, preferences of patients and providers for conservative care might increase

HMO market share and decrease expenditures. Unobserved components of the health status of the population may also influence both market share and expenditures. While we control for a number of potential confounding factors in the analyses, it is possible that we do not include all confounders. We attempt to solve this problem by including fixed effects in our models for areas and years. If the unobserved factors are constant within areas over time, or are constant within years across areas, inclusion of the fixed effects will remove any resulting bias from our estimates. In effect, this approach identifies the effects of HMO market share using changes within areas over time, and not variation in HMO activity across areas within individual years.

A second difficulty is that HMO market share and expenditures may be simultaneously determined. Forward-looking HMOs may consider both current and expected future expenditures when deciding whether to enter or expand operations in a market. HMOs that can effectively reduce costs or utilization may be most successful in markets where FFS expenditures are high. Previous studies (e.g., Porell and Wallack, 1990; Welch, 1984; Goldberg and Greenberg, 1981) have concluded that overall HMO market share is positively related to health care costs and utilization. Within the context of Medicare, simultaneity bias could also arise as a result of the fact that payments to risk HMOs are dependent on FFS spending levels. Areas with high FFS expenditures will also have high risk HMO reimbursement rates, which may attract HMOs serving Medicare beneficiaries. If increases in FFS expenditures cause increases in HMO market share, then estimates of the effect of HMOs on expenditures that do not account for simultaneity will understate any expenditure-reducing effect of HMOs.

We expect that the use of fixed effects in our analyses will alleviate the difficulties associated with simultaneity to a large degree. By relying on changes over time to identify the effect of HMOs, the bias induced by high expenditure levels causing high HMO market share levels will be removed.

However, some bias could remain if changes in market share are prompted by expected future changes in expenditures. Previous work suggests that the conclusions drawn from fixed-effects models are broadly consistent with results from cross-sectional models that rely on instrumental variables to more fully remove simultaneity and omitted variables bias (Baker, 1997). Further, given that previous work suggests that increases in expenditures should be associated with increases in HMO market share, any expenditure-reducing effects of HMO market share identified below can be interpreted as conservative to the extent that there is some persistent simultaneity bias. Finally, we would note that any simultaneity bias induced through the Medicare risk HMO payment mechanism will influence only our estimates of the effects of Medicare-specific HMO enrollment; controlling for Medicare HMO market share should leave estimates of the effects of system-wide HMO activity unaffected by this source of bias.

A final issue for estimation is the possibility of biased selection. Many studies have found that HMOs and other managed care organizations receive a favorable selection of beneficiaries (see, among others, Hellinger 1987, 1995, Hill and Brown, 1990). Given this evidence, selection bias is expected to associate increases in Medicare HMO market share with increases in FFS expenditures since moving healthy beneficiaries into Medicare HMOs will leave the Medicare FFS population progressively sicker and more expensive. Since geographically detailed data on the characteristics of Medicare FFS and HMO beneficiaries are not available, we are not able to directly control for the effects of biased selection. However, all of the relevant selection activity should occur with respect to Medicare HMOs. This means that the Medicare HMO market share variables will capture selection bias, leaving our estimates of the effects of system-wide HMO market share unaffected by selection. We proceed with the expectation that our estimates of the relationship between Medicare HMO market share and expenditures will reflect selection bias as well as any spillover effects.

Results

We begin by estimating fixed-effects regression models of the form:

$$\log (E_{i,t}) = \beta_0 + \beta_1 M_{i,t} + \beta_2 M^2_{i,t} + \beta_3 S_{i,t} + \beta_4 S^2_{i,t} + \beta_5 X_{i,t} + \beta_6 A_i + \beta_7 Y_t + \epsilon_{i,t} \qquad (2)$$

where log(E) represents the natural logarithm of FFS expenditures per beneficiary, M represents Medicare HMO market share, S represents system-wide HMO market share, X is a vector of covariates expected to influence expenditures, A is a set of area-specific intercepts, and Y is a set of year-specific intercepts. The errors, $\epsilon_{i,t}$, are assumed to be independently and identically distributed normal random variables. Subscript i denotes area i and subscript t denotes year t.

We estimate these models using current market share data. Most previous studies have used lagged data because HMO activity may have an effect on FFS expenditures only after a period of time. But, since system-wide HMO market share estimates are available only for the years 1990-1994, using current market share allows us to maximize the number of years in our sample. The year-to-year correlation in HMO market share is quite high, and estimation using lagged market shares and dropping 1990 data from the analysis did not significantly affect the estimates.

In order to capture changes in the effect of HMO market share on expenditures as the level of HMO activity varies, equation (2) is quadratic in HMO market share. Previous work has explored various non-linear functional forms and suggests that a quadratic specification adequately captures the relevant variation. We estimate equation (2) using our market area data, excluding the market area that contains Delta, Gunnison, Montrose, Hinsdale, Ouray, and San Miguel counties in Colorado, which has an implausibly high drop in system-wide HMO market share between 1990 and 1994, along with Alaska and Hawaii. The final models use 801 observations per year (N=4,005).

We estimate separate models for Part A and Part B expenditures since differences between the content and reimbursement of ambulatory and hospital care may cause the effect of HMOs to vary.

To correct for possible heteroskedasticity arising from variation in enrollments across markets and to maintain consistency with previous work, weighted least squares regression was used, with Medicare Part A enrollment as the weight.

The control variables include per capita income, the proportions of the population age 65-74, 75-84, and over age 85, and the proportions of the over-65 population that are female, black, and "other race" (i.e. non-white and non-black). To control for broad characteristics of the health care system that may influence expenditures, we include the number of physicians per 1,000 population and the number of hospital beds per 1,000 population. All of these variables were obtained from the Area Resource File or from the Census Bureau. The inclusion of area- and year-specific intercepts will capture the effects of additional area- and year-specific unobserved or omitted variables.

Estimation results are shown in Table 3. Columns 1 and 4 present coefficients from the main specification. Note that the coefficients have been scaled to represent the effect of a 10 percentage point change in market share (e.g. moving from 10 percent to 20 percent market share). To assess the statistical significance of the estimated relationships, F-tests of the hypotheses that the linear and quadratic market share terms are jointly equal to zero were conducted separately for Medicare market share and system-wide market share. In all cases, the results were highly statistically significant.

For most practical purposes, we are concerned with the magnitude of the change in expenditures that would accompany a given change in market share. We estimate the percent change in expenditures that would be associated with some representative changes in system-wide and Medicare HMO market share using the regression results. Specifically, the ratio of expenditures at system-wide market share S2 to expenditures at system-wide market share S1 can be estimated using:

$$\begin{aligned} E_{S2}/E_{S1} &= \exp(\hat{\log} E_{S2} - \hat{\log} E_{S1}) \\ &= \exp(\hat{\beta}_3(S2 - S1) + \hat{\beta}_4(S2^2 - S1^2)). \end{aligned} \tag{3}$$

where $\hat{\log} E_{S1}$ and $\hat{\log} E_{S2}$ are the predicted values of log (E) at system-wide market shares S1 and S2, respectively.[7] The quantity (E_{S2} / E_{S1} - 1) can then be interpreted as the approximate percent change in expenditures that would be associated with a move from market share S1 to S2. A similar equation can be used for Medicare market share changes, substituting the appropriate estimates from equation (2). The top portion of Table 4 shows the estimated percent changes in expenditures that are associated with moving system-wide HMO market share from 10 to 20, 20 to 30, and 30 to 40 percent. Estimates of the effect of moving HMO market share higher than 40 percent are not computed because there are relatively few sample points in that range.

For part A expenditures, increases in system-wide HMO activity are associated with decreases in expenditures. In the main specification (column 1), increases in system-wide HMO market share from 10 to 20 percent are associated with 1.9 percent reductions in expenditures. Evaluated at the 1994 mean expenditure per beneficiary ($2,865), this corresponds with a decrease of $54.44. As HMO market share increases, the effect of an increase on expenditures becomes larger. For example, increases in system-wide HMO market share from 20 to 30 percent are associated with 2.5 percent reductions in expenditures ($71.63 evaluated at the mean).

For Part B expenditures, increases in system-wide HMO market share are associated with decreases in expenditures (column 4). Increases in system-wide market share from 10 to 20 percent are associated with 1.7 percent decreases in expenditures. At mean 1994 expenditure levels ($1,539), this would correspond to a decrease of $26.16. The effect of increases in HMO market share becomes weaker as HMO market share rises, but only to a limited degree. Increases in system-wide HMO market share from 20 to 30 or from 30 to 40 percent were associated with decreases of 1.7 and

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[7]Technically, this formula assumes that expenditures are lognormally distributed. Our analyses of the Medicare data suggest that these data do approximately follow this distribution.

1.6 percent in Part B expenditures.

These findings are consistent with the hypothesis that system-wide HMO activity can influence the health care system in ways that affect expenditures for all patients. It is useful to note that the Medicare HMO market share variables included in the specification should absorb the effects of selection bias from increasing Medicare HMO enrollment. Thus, the estimates of the effect of system-wide HMO market share are not expected to be substantially biased by selection.

Interpreting the results in Tables 3 and 4 for Medicare-specific market share is less straightforward because the system-wide HMO market share variables include Medicare HMO market share along with non-Medicare HMO market share. To investigate the effect of a change in Medicare HMO market share, independent of any effects of system-wide market share, we could use the regression coefficients β_1 and β_2 directly. But, to fully assess the effects of a change in Medicare HMO market share, we must account for the effects of Medicare market share alone (through β_1 and β_2) as well as the effects of Medicare market share that occur through system-wide market share (captured in β_3 and β_4). Appendix A presents the equations necessary to do this. Table 4 summarizes the implied changes in expenditures that are associated with representative changes in market share using just the Medicare market share coefficients (the "independent" effect) and the implied changes in expenditures when both Medicare and system-wide effects are included (the "total" effect).

For Part A expenditures, increases in market share are associated with relatively large increases in expenditures--independently, increases in Medicare HMO market share from 10 to 20 percent are associated with 9.4 percent increases in expenditures. For Part B expenditures, increases in market share are independently associated with decreases in expenditures for market shares above about 7 percent. Increases in market share from 10 to 20 percent are associated with decreases of 0.7 percent. In both cases, the total effects are quite similar.

Drawing conclusions about the existence and magnitude of Medicare-specific spillover effects from these results is complicated by the fact that the coefficients capture the effects of biased selection and simultaneity, which are expected to associate increases in HMO market share with increases in expenditures, along with any expenditure-reducing spillovers. Thus, the results for Part A suggest that any spillover effects associated with Medicare HMO market share are much smaller than the effects of selection bias and simultaneity. For Part B, the results imply that there may be spillover effects large enough to offset these effects.

To examine the robustness of the results, two alternate specifications of the basic equation were estimated. Because many areas had very low Medicare HMO market shares, equation (2) was reestimated using only data from 522 HCSA market areas in which market share exceeded 1 percent in all years examined (columns 2 and 5 of Tables 3 and 4). Second, equation (2) was reestimated using data at the Metropolitan Statistical Area (MSA) level. MSAs provide an alternative to HCSAs as a market definition, and have been used by other authors, although they do not permit the inclusion of non-metropolitan areas (columns 3 and 6 of Tables 3 and 4). In both cases, the results are consistent with results reported above.

In addition to the models shown in Tables 3 and 4, we tested several additional specifications to examine the robustness of the results reported. We estimated equation (2) using unweighted least squares regression, using lagged rather than current HMO market shares and dropping 1990, and excluding the number of short term acute care hospitals beds per 1,000 population and the number of physicians per 1,000 population in the area since these variables may be influenced by HMO market share, which could cause us to understate the true effect of HMO activity. In all cases, the results were similar to the results shown.

Comparison to earlier work

Four previous studies have examined the relationship between Medicare HMO market share and Medicare FFS expenditures. Table 5 summarizes the percent changes in Medicare FFS expenditures that were estimated in these studies to accompany 10 percentage point increases in Medicare market share. For Part A, previous studies suggested that decreases of 1.3 to 6.6 percent would accompany such increases, with most estimates toward the higher end of that range. For Part B, estimates range from 1.4 to 12.1 percent decreases. The results we present suggest that increases in Medicare HMO market share are associated with *increases* in Part A spending. The estimated declines in Part B spending that we report are generally much smaller than those reported in previous work.

Differences between previous results and the results presented here could occur because our data is newer or because the model specified here differs from specifications in earlier studies (e.g., because we include both system-wide and Medicare market share). To present some information about these two alternatives, we have estimated two additional models. First, we replicated the specification used above eliminating the system-wide HMO market share variables. These results are shown in columns 1 and 3 of Table 6. Here, the implied increases in Part A expenditures are somewhat smaller in magnitude than those observed with system-wide HMO market share included (c.f. Table 4). For Part B expenditures, the results suggest larger declines in expenditures. Together these results suggest that when system-wide HMO market share is omitted from the specification, the Medicare HMO market share variables capture some of its expenditure reducing effect and may overstate the extent of associated cost decreases or understate the extent of associated cost increases.

We have also replicated the specification used in Baker (1997), which included only Medicare HMO market share and was originally run using data from 1986-1990, using our data from 1990-

1994. This specification is similar to that use above, but differs in three ways: the models are estimated at the county, rather than the HCSA level;[8] lagged HMO market share is used instead of current HMO market share; and the variables measuring the number of physicians and hospital beds per capita are not included.

Results are presented in columns 2 and 4 of Table 6. Here, increases in Medicare market share from 10 to 20 percent are associated with 5.4 percent increases in Part A expenditures. Results using data from 1986-1990 showed that Part A expenditures fell by 4.5 percent for the same increase in market share. Comparing these results suggest that the relationship between HMO market share and expenditures may have changed over time and that the differences between the findings reported above and those in previous studies may stem both from changes in the specification and changes over time. For Part B expenditures, 1990-1994 data imply that increases in HMO market share from 10 to 20 percent are associated with declines of 3.8 percent while 1986-1990 data implied that increases in market share from 10 to 20 percent were associated with 4.0 percent decreases. These results suggest that, for Part B, the differences between the findings here and the earlier findings are more closely related to changes in the specification and the inclusion of system-wide market share than changes over time.

An Alternate Specification

The models described above rely on changes in HMO market share and expenditures over time to identify the effects of HMO market share. While this approach has powerful statistical properties, allows us to incorporate five years of data, and is consistent with previous studies, it does

[8]We exclude from the analyses counties with fewer than 50 beneficiaries in any of the years. The final sample included 3,074 counties per year (N=15,370).

not incorporate the baseline levels of expenditures and HMO market share. Thus, it does not allow us to investigate the possibility that initial levels of HMO activity may influence the subsequent growth rate of expenditures. If areas with initially high levels of HMO market shares had slower expenditure growth, for example, this effect would not be captured by fixed effects models that essentially difference out the baseline market share levels. Of particular concern is the possibility that initial levels of HMO market share may also be associated with the subsequent growth rate of HMO market share.[9] If initial HMO market share is associated with both expenditure growth and HMO market share growth, then fixed effects models may lead to inaccurate estimates of the effects of changes in HMO activity.

To account for both initial levels of HMO activity and changes over time, we estimate first differenced models of the form:

$$\log(E_{i,94}) - \log(E_{i,90}) = \beta_0 + \beta_1 M_{i,90} + \beta_2 (M_{i,94} - M_{i,90}) + \beta_3 S_{i,90} + \beta_4 (S_{i,94} - S_{i,90}) + \beta_5 Q1_{i,90} + \beta_6 Q4_{i,90} + \beta_7 X_{i,90} + \beta_8 (X_{i,94} - X_{i,90}) + \eta_i \quad (4)$$

That is, this specification models the difference in log expenditures between 1990 and 1994, which is approximately equal to the percent change in expenditures over that time, as a function of the initial levels of HMO market share and the 1990-1994 changes in market share. We include in X the same set of covariates as above to control for population and health system characteristics, and we add the percent of the population in each market that lives in an urban area to capture urban-rural differences.

Equation (4) is estimated using the market area (HCSA) data. As above, we exclude the Colorado HCSA that appeared to have inaccurate system-wide HMO market share data, Alaska, and Hawaii. We do not include quadratic terms in the market shares since this makes the equation

[9]The observed (weighted) correlation between the 1990 system-wide market share and the 1990-1994 change is 0.23; for Medicare market share, the correlation is 0.41.

unwieldy and does not add substantially to the conclusions. We weighted the regressions using the 1990 Medicare HMO enrollment in each market area.

A potential difficulty with estimation of equation (4) is that expenditures in areas with particularly high or low expenditures in a given year may "regress to the mean" over time. For example, if an area has high expenditures in one year because of particularly bad health outcomes in their population, they are likely to have lower health expenditures in subsequent years since the health outcomes experienced by the area population are likely to fall more near the mean.[10] If managed care organizations disproportionately locate in high expenditure areas, then the resulting association between HMO market share and subsequent regression to the mean in expenditures could produce biased estimates of the effects of HMOs. The variables Q1 and Q4 are dummy variables indicating whether the market area was in the highest or lowest expenditure quartile in 1990, and are intended to capture the effects of regression to the mean.

Estimation results are presented in Table 7. The models in columns 1 and 3 do not control for the initial level of expenditures; the models in columns 2 and 4 do. For Part A, the coefficients on the initial level of system-wide market share are not statistically significant. However, growth in system-wide market share over time is associated with lower expenditure growth. With controls for initial expenditure levels included, 10 percentage point increases in system-wide market share are associated with 4.3 percentage point reductions in expenditure growth rates. At least in this context, changes in HMO activity are more important than the initial level in determining spending growth.

The story is reversed for Medicare HMO market share. While the initial level of Medicare market share is not significant, the results imply that 10 percentage point increases in Medicare

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[10]The observed (weighted) correlations between the log of mean 1990 expenditures and the 1990-1994 changes in log expenditures are -0.36 for Part A and -0.64 for Part B.

market share are associated with 4.5 percentage point increases in the spending growth rate. These results, like those presented above, suggest that selection and simultaneity bias effects may outweigh any Medicare-specific spillovers.

For Part B, the initial level of system-wide HMO market share is again insignificant, and increases in market share over time are associated with decreases in expenditure growth rates. With the controls for the initial level of spending included, a 10 percentage point increase in system-wide market share would reduce the expenditure growth rate by 1.1 percentage points. Both the initial level of Medicare HMO market share and the 1990-1994 change in Medicare market share are associated with decreases in expenditures. Ten percentage point increases in the initial market share level are associated with 2.0 percentage point reductions in expenditure growth and 10 percentage point increases over time are associated with 2.8 percentage point reductions, suggesting that there may be spillover effects directly associated with Medicare HMO market share that are strong enough to overcome positive effects of selection and simultaneity bias.

IV. Discussion

We draw two sets of conclusions from these results. First, increases in system-wide HMO market share reduce expenditures for the care of Medicare FFS beneficiaries, a population that should be well-insulated from the direct effects of managed care. Increases in system-wide market share from 10 to 20 percent were associated with decreases of 1.9 to 2.3 percent in Part A expenditures, and 1.2 to 1.7 percent in Part B expenditures. This is consistent with the hypothesis that managed care can have significant spillover effects that broadly influence the structure and functioning of the entire health care system.

Given the structure of Medicare, we expect that these findings largely reflect spillover effects

that occur through the availability and use of health care services. For example, Baker and Wheeler (1997) report that increases in HMO market share are associated with a decline in the system-wide availability of MRI equipment. Cutler and Sheiner (1997) also report that areas with high levels of HMO activity may have reduced technology availability. Reductions in the general availability of health care equipment and technologies may translate into reduced system-wide use, providing a mechanism for reductions in spending. It is also possible that increases in HMO market share led to changes in the behavior of health care providers independent of any changes in the availability of services.

By extrapolation, these results suggest that managed care may also be able to influence the care provided to non-managed-care patients outside of Medicare. In fact, since the Medicare FFS program is not subject to the competition that pervades the non-Medicare sector of the health care market, and since spillover effects that occur through changes in price are not likely to be observed in Medicare data, it is possible that spillover effects in other sectors of the health care market would be larger.

From a policy standpoint, these results suggest that the system-wide effects of managed care should be considered when assessing the ongoing shift toward managed care, and that the interests of non-managed-care patients should be considered when policies that would influence the growth of managed care are evaluated. In addition, scrutiny should be given to studies that examine differences between utilization and outcomes of managed care and non-managed-care patients, since it is possible that managed care may induce changes in these variables for non-managed-care patients as well.

The second main conclusion we draw from this study is that spillover effects associated directly with Medicare HMO market share are likely to be small. For Part A expenditures, updating previous work revealed that increases in Medicare HMO market share are associated with increases in

expenditures, the opposite of previous findings. Since the Medicare HMO market share coefficients capture the effects of selection bias as well as any spillover effects, these findings suggest that expenditure-increasing effects of biased selection are substantially larger than any expenditure-decreasing spillover effects.

There are a number of reasons that our more recent results may differ from previous results. It is possible that the importance of Medicare-specific spillovers for Part A expenditures has diminished over time, to the point where they are no longer a strong force. A second possibility is that selection bias has become stronger over time. A third possibility stems from the relationship between Medicare and system-wide HMO market share. If Medicare market share was better correlated with system-wide HMO market share in the 1980s than in the 1990s, then the Medicare HMO market share coefficients in the earlier studies may have reflected system-wide spillover effects to a greater degree. In the presence of expenditure-reducing system-wide spillovers, this could have led studies using Medicare market share to show an expenditure-decreasing effect in earlier years when in fact the real action was system-wide.

It is difficult to evaluate the relative strengths of these possible explanations, and further study of them will be necessary. We did explore the possibility that the correlation between Medicare and system-wide market share has changed over time. Since geographically detailed data on system-wide market shares are not available for the 1980s, we used state-level data to examine the correlation between the 1986-1990 change in Medicare and system-wide market share, and compared it to the correlation between the 1990-1994 changes in Medicare and system-wide market share. In the earlier time period, the correlation is 0.27, while in the latter time period, the correlation is 0.20. While neither of these correlations is very high, they do leave open the possibility that some of the difference in the results is due to a reduction in the extent to which Medicare HMO market share proxies system-

wide market share.

Regardless of the cause, these findings suggest that conclusions about Medicare-specific spillovers for Part A expenditures that have been drawn from previous studies that used Medicare-specific HMO market share may substantially overstate actual spillovers. It is important to note that this finding does not prove that there is no spillover effect associated with Medicare market share, only that any spillover effect that is present is smaller than other expenditure-increasing effects associated with increasing Medicare market share (e.g. selection bias).

For Part B expenditures, we find evidence that is consistent with the presence of spillover effects that are associated with Medicare market share. But, holding system-wide market share constant, the magnitude of these results is much smaller than the effect of Medicare market share observed in models that do not include system-wide market share. Our results imply that increases in market share may be associated with decreases in expenditures on the order of 1 to 2 percent after controlling for system-wide market share, while earlier models that did not control for system-wide market share reported results that are generally at least twice as large.

The existence of a spillover effect that stems directly from Medicare HMO market share is interesting, given the relative weakness of the financial incentives within Medicare. It is possible that there are learning spillovers or other phenomena that occur between physicians treating the elderly that are confined to the Medicare world. Further investigation of the source of this finding will be needed.

Taken broadly, these results suggest that managed care transforms the functioning of the entire health care system. But, in the context of Medicare reform discussions, these results suggest that caution should be exercised before relying on spillover effects to generate savings from increases in Medicare HMO market share. While our results do not rule out the possibility that there are

spillovers that are directly associated with increasing Medicare market share, they suggest that the effect may be much smaller than has been previously thought. It should also be noted that the presence of a system-wide spillover effect, to which changes in Medicare HMO market share could contribute, does suggest that Medicare HMO market share can have spillover effects, but that the impact of a change in Medicare market share may be limited by the role of Medicare HMO activity within the broader scope of system-wide HMO activity.

Appendix A: Computing the Effect of a Change in Medicare HMO Market Share for Equation (2).

Let P_m and P_o denote the number of people in an area who are in Medicare and not in Medicare, respectively, and E_m and E_o denote HMO enrollment among Medicare beneficiaries and the rest of the population, respectively. Then, we can write $M=(E_m / P_m)$ and $S = (E_m + E_o) / (P_m + P_o)$. The regression coefficients β_3 and β_4, then capture part of the effect of increasing Medicare HMO market share. To separate out the effect of Medicare HMO market share, we write out the relevant parts of equation (2), inserting the enrollment and population variables:

$$\log(E_{i,t}) = \beta_1 \frac{E_m}{P_m} + \beta_2 \left(\frac{E_m}{P_m} \right)^2 + \beta_3 \frac{E_m + E_o}{P_m + P_o} + \beta_4 \left(\frac{E_m + E_o}{P_m + P_o} \right)^2 .$$

This can be rewritten as:

$$\log(E_{i,t}) = \delta_1 \left(\frac{E_m}{P_m} \right) + \delta_2 \left(\frac{E_m}{P_m} \right)^2 + \beta_3 \frac{E_o}{P_m + P_o} + \beta_4 \left(\frac{E_o}{P_m + P_o} \right)^2 .$$

where

$$\delta_1 = \beta_1 + \frac{P_m}{P_m + P_o} \beta_3$$

and

$$\delta_2 = \beta_2 + \left(\frac{P_m}{P_m + P_o} \right)^2 \beta_4 .$$

That is, δ_1 and δ_2 determine the effect of an increase in Medicare market share, and they incorporate both β_1 and β_2, along with scaled components reflecting the effects of system-wide market share β_3 and β_4, where the scaling factor is the proportion of the population in Medicare. In 1994, approximately 12.4 percent of the population was enrolled in Medicare and the implementations of these formulas used in the paper use this value. Using δ_1 and δ_2 in place of β_1 and β_2, estimated percent changes in expenditures associated with given changes in Medicare HMO market share can be obtained using equation (3) in the text.

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Table 1: Mean Nominal Medicare FFS Expenditures per Beneficiary, 1990-1994

Year	Part A	% change from previous year	Part B	% change from previous year
1990	$2,037		$1,233	
	(574)	---	(346)	---
1991	$2,152	5.6%	$1,273	
	(547)		(338)	3.2%
1992	$2,432	13.0%	$1,322	
	(557)		(324)	3.8%
1993	$2,616	7.6%	$1,397	
	(645)		(367)	5.7%
1994	$2,865	9.5%	$1,539	
	(701)		(361)	10.2%
% change 1990-1994		40.6%		24.8%

Note: Standard errors in parentheses. Values shown are national averages.

Table 2: Summary Statistics for HMO Market Share Measures

Year	Weighted Mean	Unweighted Mean	Standard Deviation	25th pctl	Median	75th pctl	90th pctl
Medicare HMO Market Share							
1990	6.4	2.3	5.4	0.1	0.3	1.5	6.8
1991	5.7	2.1	4.8	0.1	0.3	1.4	5.6
1992	6.0	2.2	5.0	0.2	0.3	1.5	5.9
1993	6.8	2.4	5.6	0.2	0.4	1.5	6.6
1994	7.8	2.8	6.2	0.2	0.4	2.0	7.7
System-Wide HMO Market Share							
1990	15.1	5.9	8.1	0%	2.5%	8.8%	16.2%
1991	15.7	6.1	8.3	0	2.6	9.5	16.2
1992	16.7	6.7	8.8	0.2	3.2	10.3	17.4
1993	18.2	7.5	9.3	0.5	4.1	11.2	18.9
1994	20.5	9.0	9.9	1.4	5.7	13.4	22.5

Note: Sample size is 803 Health Care Services Areas per year. Weighted means reflect nationwide population averages--weighted Medicare market share measures are weighted by Medicare enrollment and weighted system-wide market shares are weighted by county population.

Table 3: Fixed Effects Regression Results Using Both System-Wide and Medicare HMO Market Share, 1990-1994

	Part A			Part B		
Variables	All HCSAs (1)	HCSAs with >1% Mkt. Shr. (2)	MSA-Level (3)	All HCSAs (4)	HCSAs with >1% Mkt. Shr. (5)	MSA-Level (6)
System-Wide HMO Market Share /10	-0.012 (0.008)	-0.019 (0.010)	-0.022 (0.012)	-0.018 (0.005)	-0.016 (0.007)	-0.014 (0.008)
(System-Wide HMO Market Share /10)^2	-0.003 (0.001)	-0.001 (0.002)	-0.001 (0.002)	0.0003 (0.0010)	0.0002 (0.0012)	0.001 (0.001)
Medicare HMO Market Share /10	0.106 (0.012)	0.106 (0.014)	0.099 (0.017)	0.006 (0.008)	0.004 (0.009)	0.013 (0.012)
(Medicare HMO Market Share /10)^2	-0.004 (0.002)	-0.004 (0.003)	-0.006 (0.003)	-0.004 (0.002)	-0.004 (0.002)	-0.006 (0.002)
N	4005	2610	1610	4005	2610	1610
R^2	0.964	0.965	0.965	0.982	0.983	0.980
F[df] (sys-wide mkt shr)	15.162 [2,3187]	11.077 [2,2071]	7.047 [2,1271]	15.808 [2,3187]	8.604 [2,2071]	2.555 [2,1271]
P(F)	0.000	0.000	0.001	0.000	0.000	0.078
F[df] (Medicare mkt shr)	92.751 [2,3187]	69.331 [2,2071]	39.473 [2,1271]	7.312 [2,3187]	5.741 [2,2071]	5.860 [2,1271]
P(F)	0.000	0.000	0.000	0.001	0.003	0.003

Note: Standard errors in parentheses. The dependent variable is the natural logarithm of expenditures per beneficiary. Regressions also contain controls for area population demographics, health system characteristics, year dummies, and an intercept. The F-statistics shown test the hypotheses that the coefficients on the linear and quadratic market share terms are jointly zero. Regressions are weighted by Medicare enrollment.

Table 4: Percent Changes in Medicare FFS Expenditures Associated with Selected Representative Changes in System-Wide and Medicare HMO Market Share

	Part A			Part B		
	All HCSAs (1)	HCSAs with >1% Mkt. Shr. (2)	MSA-Level (3)	All HCSAs (4)	HCSAs with >1% Mkt. Shr. (5)	MSA-Level (6)
System-Wide Market Share						
Moving from 10 to 20%	-1.9	-2.3	-2.3	-1.7	-1.5	-1.2
Moving from 20 to 30%	-2.5	-2.5	-2.4	-1.7	-1.5	-1.0
Moving from 30 to 40%	-3.0	-2.7	-2.5	-1.6	-1.4	-0.8
Medicare Market Share (independent)						
Moving from 10 to 20%	+9.4	+9.3	+8.2	-0.7	-0.8	-0.4
Moving from 20 to 30%	+8.5	+8.5	+7.1	-1.5	-1.6	-1.5
Moving from 30 to 40%	+7.7	+7.7	+6.0	-2.4	-2.4	-2.7
Medicare Market Share (total)						
Moving from 10 to 20%	+9.2	+9.1	+8.0	-0.9	-1.0	-0.6
Moving from 20 to 30%	+8.4	+8.3	+6.9	-1.7	-1.8	-1.7
Moving from 30 to 40%	+7.5	+7.5	+5.7	-2.6	-2.6	-2.8

Note: Values are based on regression coefficients shown in Table 3.

Table 5: Main Estimates from Previous Studies of the Percent Reductions in Medicare FFS Spending Accompanying 10 Percentage Point Increases in Medicare HMO Market Share

Study	Years Examined	Effect of a 10 percentage point increase in Medicare HMO market share on... Part A Expenditures	Part B Expenditures	All Expenditures
Baker, 1997	1986-1990	-4.5, -6.6*	-4.1, -5.6*	--
Rodgers and Smith, 1995	1988-1992	-4.8§	-12.1§	-7.9§
Phelps, 1994	1986-1987	-1.3†	-1.4†	-1.2†
Clement et al, 1992	1985-1988	-6‡	-4‡	-5‡

*Baker (1997) estimated a non-linear specification. Results shown here are for moves from 10-20 and from 20-30 percent market share, respectively.

§ These figures are taken from the "Net HMO Penetration Rate Effect" row in Table 7, as the figures in the "Percent Change in Dependent Variable" row appear to be incorrectly calculated.

† These are Phelps' short run estimates. He argues that the long run effects of a change in market share may be much larger. Only the estimate for Part B expenditures is statistically significant at the p=0.05 level (The estimate for all expenditures is significant at the p=0.10 level).

‡ These are the main results, as reported in the final report from the project. Other specifications presented in the paper produce a range of similar results.

Table 6: Fixed Effects Regression Results from Models with Only Medicare HMO Market Share, 1990-1994

	Part A		Part B	
Variables	Replicate Table 3 (1)	Replicate Baker (1997) (2)	Replicate Table 3 (3)	Replicate Baker (1997) (4)
A. Regression Coefficients				
Medicare HMO Market Share /10	0.096 (0.012)	0.064 (0.008)	-0.0002 (0.0080)	-0.037 (0.005)
(Medicare HMO Market Share /10)^2	-0.004 (0.002)	-0.003 (0.002)	-0.004 (0.002)	-0.001 (0.001)
N	4005	15370	4005	15370
R^2	0.964	0.952	0.982	0.976
F[df] (market share)	79.84 [2, 3189]	78.99 [2, 12283]	12.22 [2, 3189]	101.63 [2, 12283]
P(F)	0.000	0.000	0.000	0.000
B. Implied Percent Changes in Expenditures from Representative Changes in HMO Market Share				
Moving from 10 to 20%	+8.3	+5.4	-1.2	-3.8
Moving from 20 to 30%	+7.4	+4.8	-2.0	-4.0
Moving from 30 to 40%	+6.6	+4.1	-2.9	-4.1

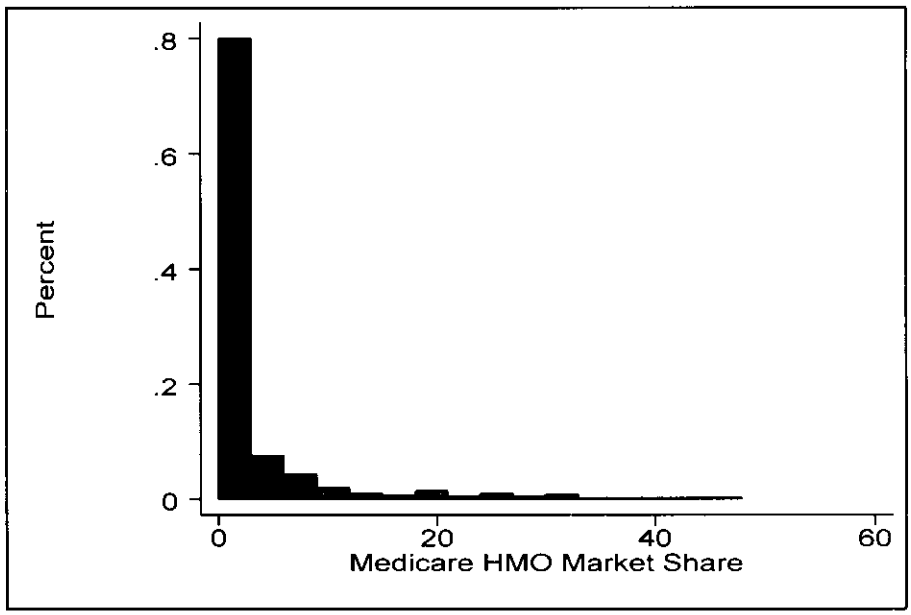
Note: Standard errors in parentheses. The dependent variable is the natural logarithm of expenditures per beneficiary. Columns 1 and 3 replicate the specification used in Table 3, except that system-wide HMO market share is excluded. Columns 2 and 4 replicate the specification used in Baker (1997). In columns 2 and 4, Medicare HMO market share is lagged 1 year. Regressions also contain controls for area population demographics, year dummies, and an intercept. Regressions in columns 1 and 3 also include physicians and hospital beds per capita. The F-statistics shown test the hypotheses that the coefficients on the linear and quadratic market share terms are jointly zero. Regressions are weighted by Medicare enrollment.

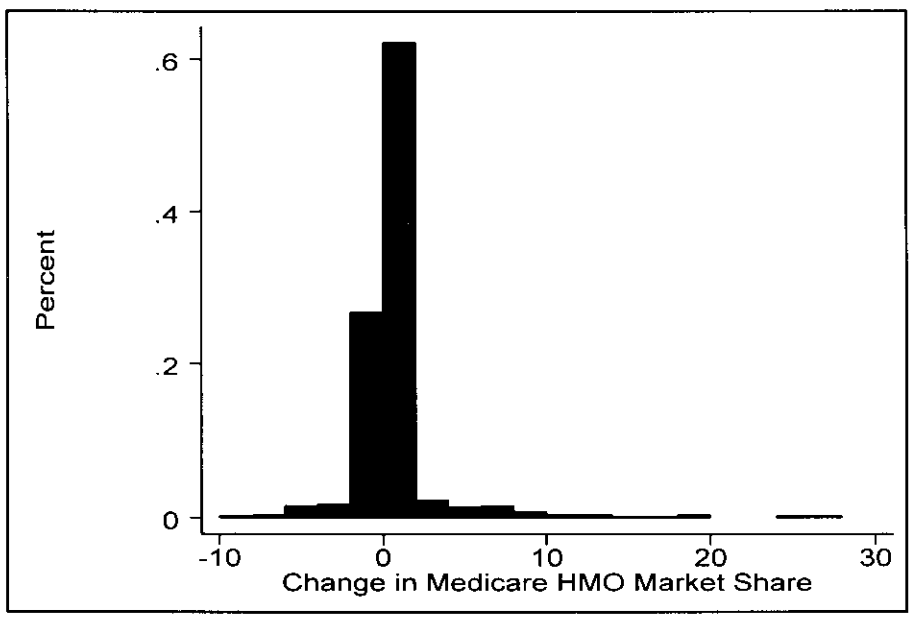
Table 7: Results from First Differenced Models.

Variables	Part A		Part B	
	No Initial Expenditure Controls (1)	Include Initial Expenditure Controls (2)	No Initial Expenditure Controls (3)	Include Initial Expenditure Controls (4)
1990 System-Wide HMO Market Share /10	0.008 (0.006)	0.009 (0.005)	-0.003 (0.003)	-0.002 (0.003)
Δ System-Wide HMO Market Share	-0.043 (0.008)	-0.043 (0.008)	-0.013 (0.005)	-0.011 (0.005)
1990 Medicare HMO Market Share /10	-0.010 (0.006)	-0.006 (0.006)	-0.021 (0.004)	-0.020 (0.003)
Δ Medicare HMO Market Share	0.045 (0.013)	0.041 (0.013)	-0.027 (0.008)	-0.028 (0.007)
Highest Quartile of 1990 Expenditures	---	0.020 (0.034)	---	-0.043 (0.020)
Lowest Quartile of 1990 Expenditures	---	0.081 (0.036)	---	0.027 (0.021)
N	801	801	801	801
R^2	0.519	0.534	0.397	0.461

Note: Standard errors in parentheses. The dependent variable is the 1990-1994 difference in the natural logarithm of expenditures per beneficiary (the mean is 0.357 for Part A and 0.271 for Part B). Regressions also contain controls for 1990 levels and 1990-1994 changes in area population demographics, physicians per capita, and hospital beds per capita. Regressions are weighted by 1990 county Medicare enrollment.

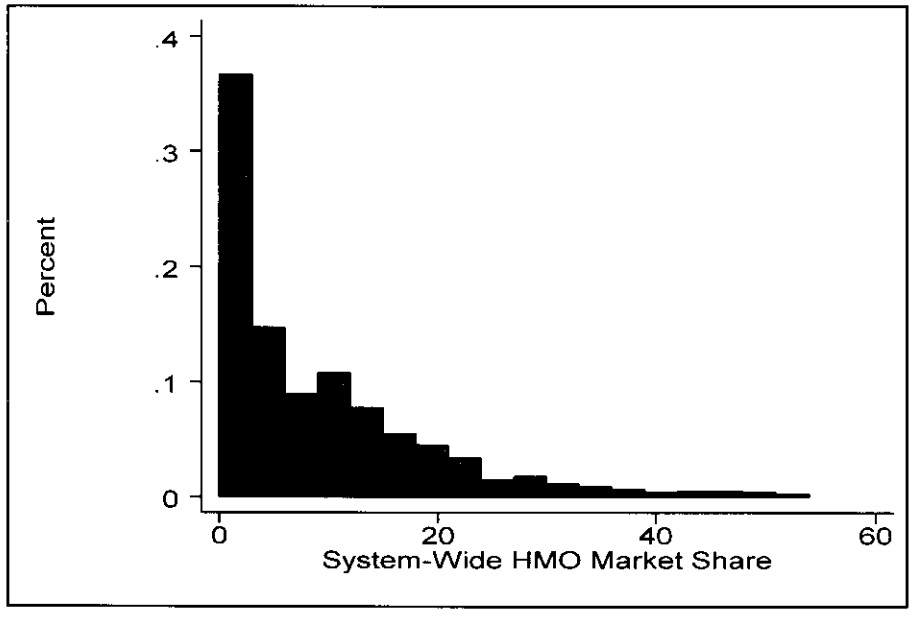
Figure 1: Distributions of 1994 Levels and 1990-1994 Changes in Medicare HMO Market Share

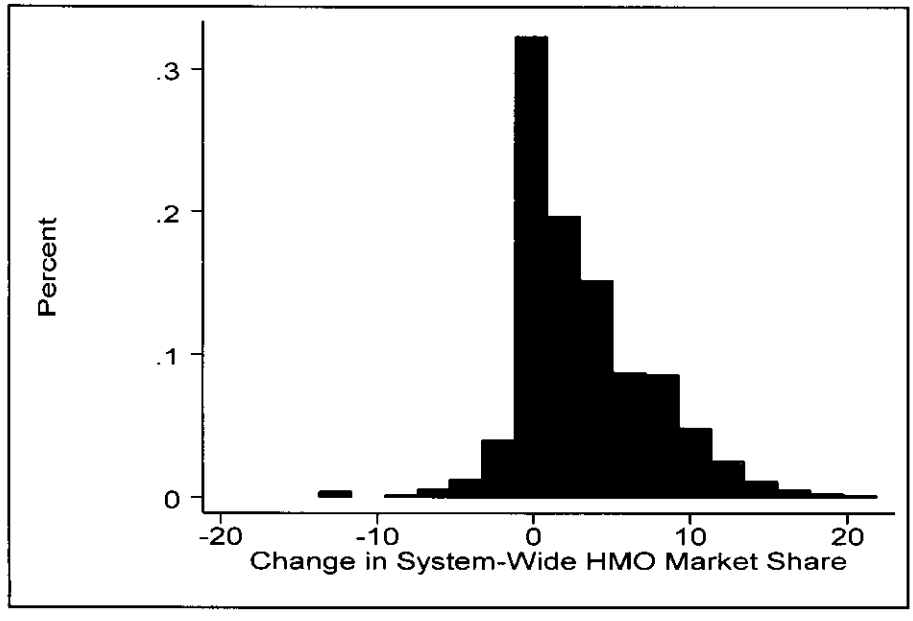




Note: Figures are based on 803 HCSAs each. Market areas are defined using as HCSAs.

Figure 2: Distributions of 1994 Levels and 1990-1994 Changes in System-Wide HMO Market Share





Note: Figures are based on 803 HCSAs each. Market areas are defined as HCSAs.