

HMO PARTICIPATION IN
MEDICARE MANAGED CARE

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Introduction

Created by the Social Security Amendments of 1965, Medicare has for the past thirty-five years provided hospital and medical coverage to elderly and disabled Americans. Since its inception, Medicare has reimbursed providers on a fee-for-service basis; that is, doctors and hospitals charge Medicare for each covered service that they provide. Faced with rapidly rising Medicare costs, Congress in the 1982 Tax Equity and Fiscal Responsibility Act directed the Health Care Financing Administration (HCFA) to contract with health maintenance organizations (HMOs) to provide managed care to Medicare beneficiaries. Under such risk contracts, the HMO furnishes all Medicare-covered services in exchange for a per-capita (or capitated) prospective payment.¹

It was hoped that the expansion of managed care into Medicare would benefit the U. S. Federal government, HMOs, and Medicare beneficiaries. The U. S. government would benefit if managed care slowed the growth of Medicare spending.² HMOs would benefit if the Medicare market represented a new source of profit. Medicare beneficiaries would benefit if HMOs offered additional benefits, particularly preventive care and prescription drug coverage, relative to fee-for-service Medicare.

This paper studies how the equilibrium number of HMOs participating in county Medicare managed care markets varies with the HCFA capitation payment. Our identification strategy is to observe how the number of participating HMOs varies over counties and time in response to changes in HCFA payment while controlling for estimated costs.

The outcome of interest, the number of HMOs participating in Medicare managed care markets, is important for several reasons. The participation of a single HMO in a Medicare managed care market offers Medicare beneficiaries in that market an alternative to fee-for-service care. The participation of several HMOs in a market results in greater competition for

¹ In the past, HCFA also wrote cost contracts with HMOs under which HMOs cared for Medicare beneficiaries on a fee-for-service basis. This paper is concerned exclusively with Medicare risk contracts.

² In nominal dollars, Medicare benefit payments per enrollee rose from \$1,200 in 1980 to \$5,700 in 1999; see HCFA (1998).

enrollment, which has the salutary effect of increasing benefits and/or lowering costs for managed care enrollees.³

Under current law, those eligible for Medicare Part A (Hospital Insurance) and enrolled in Medicare Part B (Supplementary Medical Insurance) may enroll in a managed care plan, if available.⁴ Traditional fee-for-service Medicare is still available to all Medicare beneficiaries. Figure 1 depicts the number of Medicare managed care enrollees from 1985 to 2001, a period during which enrollment grew from 440,000 in 1985 to 6.35 million in 1999 before falling to 5.6 million in 2001.⁵ In 2001, fifteen percent of all Medicare beneficiaries chose managed care.⁶

INSERT FIGURE 1 HERE

The continuous growth in enrollment 1985-1999 masks considerable change in the number of HMO plans participating in Medicare managed care. Figure 2 shows that many plans exited Medicare managed care in the late 1980s, but the number of participating plans rose considerably during the early- and mid-1990s. Between 1998 and 2001, however, the number of participating plans fell from 346 to 174.

INSERT FIGURE 2 HERE

As a result of the reduced participation of HMOs, many Medicare beneficiaries have been involuntarily disenrolled from the program. As Table 1 shows, 407,000 (or 7% of all) Medicare HMO enrollees were involuntarily disenrolled at the end of 1998 and 327,000 enrollees (5.3%) were involuntarily disenrolled at the end of 1999.⁷ It is estimated that 934,000 enrollees (15.1%) were disenrolled at the end of the year 2000.⁸

³ HMOs competing for market share in the Medicare managed care market tend to lower their premia or offer additional benefits to enrollees; see Physician Payment Review Commission (1996) and GAO Report 97-133 (1997).

⁴ Medicare beneficiaries may enroll only in those HMOs with a risk contract from HCFA to serve the beneficiary's county of residence. Medicare beneficiaries suffering from End-Stage Renal Disease are not eligible for Medicare managed care.

⁵ HCFA Medicare Managed Care Contract Reports are the source of the data shown in Figures 1 and 2. The data for each year are from the December report, except that for 2001, which are from the January report.

⁶ HCFA Medicare Managed Care January Contract Report (2001).

⁷ Laschober et al. (1999).

⁸ HCFA (2000b).

INSERT TABLE 1 HERE

Beneficiaries involuntarily disenrolled from a Medicare managed care plan are forced either to find another HMO in their county with a risk contract from Medicare or to return to traditional fee-for-service Medicare. Laschober et al. (1999) surveyed Medicare beneficiaries whose HMO had recently withdrawn from Medicare. They found that a third experienced a decline in benefits, 39% reported higher monthly premiums, and one in seven lost prescription drug coverage.

Our estimates indicate that in the year 2001 only 12.3% of counties in the contiguous 48 United States received a HCFA payment greater than what was necessary to support a single HMO in the Medicare managed care market. In particular, HCFA appears to underestimate the payment necessary to support HMOs in rural, sparsely populated areas.

The outline of this paper is as follows. Section 1 outlines the methodology for examining the relationship between HCFA payment rates and the extent of HMO participation. Section 2 describes the data used in this study, and Section 3 presents the results of the empirical work. Section 4 conducts a check of robustness, and the final section concludes.

1. Methodology

We begin this section with an illustration of why a rise in HCFA payment may result in the participation of more HMOs in Medicare managed care. A competitive Medicare managed care market is depicted in Figure 3. The marginal cost, average variable cost, and average cost curves depicted are those for the market; i.e. they are the horizontal sum of each participating HMO's cost curves. For convenience we assume that, within each market, the cost curves of each participating HMO are identical.⁹

⁹ This implies that, within markets, each HMO has equal enrollment.

Figure 3 is a simplification in that it assumes that all enrollees are identically costly and that managed care is a homogenous good.¹⁰ From the perspective of firms, payment level is exogenous, set at the county level by HCFA. Demand does not vary with the payment because it is paid by HCFA, not by the enrollees. In a competitive market, HMOs compete for market share by offering additional benefits to enrollees. In equilibrium, marginal and average costs have risen to the level of the payment and profits are zero.¹¹ Note that in perfectly competitive market, competition over benefits has made the plans identical and the enrollees indifferent with regard to which HMO they choose.¹²

INSERT FIGURE 3 HERE

To illustrate why higher payments may lead to a larger number of participating HMOs, suppose that the Medicare managed care market is in equilibrium, and then HCFA raises the payment to HMOs (assume that costs remain constant). This payment hike is depicted in Figure 4 as a shift from P1 to P2. The payment has been raised above the marginal cost of caring for additional Medicare beneficiaries, so HMOs will compete to increase enrollment and therefore profits. HMOs compete for enrollment by increasing benefits (and, therefore, marginal and average costs). The provision of additional benefits raises the cost curves; in particular, the average cost curve will rise to equal the new, higher payment. The provision of additional benefits also shifts the demand curve to the right from D1 to D2 because Medicare managed care has become more attractive relative to fee-for-service Medicare. Because demand has shifted outward, the new equilibrium will be associated with a higher quantity of enrollment: Q2 as opposed to Q1. Since marginal costs are rising in enrollment, the higher enrollment may be associated with a larger number of participating HMOs.¹³ In Figure 5, the marginal and average

¹⁰ For the sake of simplicity, Figure 3 ignores the premium that some HMOs charge (subject to HCFA approval) in exchange for benefits beyond those guaranteed under Medicare. Consistent with this simplification, Cassidy and Gold (2000) find that most enrollees pay no premium.

¹¹ In a noncompetitive Medicare HMO market, a monopolist has some ability to choose lower cost curves. Specifically, a monopolist HMO could reduce benefits such that a gap opened between the average cost curve and the payment, yielding monopoly profits. The demand curve, a function of services, would also shift in. The ability of a monopolist to reduce benefits, and therefore costs, is limited by HCFA standards and oversight.

¹² However, the intuition that a rise in payments increases the number of active HMOs in the market is true even if there exists product differentiation and firm heterogeneity.

¹³ Although in this paper we analyze the aggregate number of firms participating in a market, implicit in such an analysis is a theory of firm entry and exit. Our analysis is based on the theory, refined by Dixit (1989) of firm

costs of individual HMOs replace the aggregate cost curves displayed in Figure 4, and a rise in price is shown to result in an increase from two to five participating HMOs. If the provision of each benefit is characterized by rising marginal costs, higher enrollment cannot result in fewer participating HMOs.

INSERT FIGURES 4 AND 5 HERE

Costs in managed care appear to be U-shaped, with economies of scale at low enrollments followed by rising marginal costs at higher enrollments. Using data from 1988-91, Wholey et al. (1996) estimate that economies of scale are exhausted once enrollment reaches 50,000. Clement (1995) concludes that the optimal or efficient size of an HMO in the years 1977-86 was an enrollment between 40,000 and 60,000 and that once an HMO reached 100,000 members it could decrease costs by reorganizing into units of 40,000 – 60,000 members. The reason for the rising marginal costs has not been well explored but may be due to a difficulty of monitoring costs and care across a large number of providers.

Just as higher payments from HCFA may result in more HMOs participating in Medicare managed care, a reduction in payment may result in fewer participating HMOs. If HCFA were to decrease its per-capita payment and costs remained constant, HMOs could reduce benefits in order to equate marginal and average costs with payment. The demand curve would shift in because Medicare managed care would have become relatively less attractive than fee-for-service Medicare. The lower demand in the market may result in the exit of HMOs.

HCFA mandates a minimum level of benefits in Medicare managed care. If HMOs in the market are already operating on the cost curves associated with minimum benefits when HCFA lowers the payment, the HMOs are prevented from choosing to operate at new, lower cost curves. HMOs will exit the market if the new payment is below their exit trigger.

Congress, in the Balanced Budget Act (BBA) of 1997, changed HCFA's formula for setting payment levels effective 1998. During the early part of our sample (1993-1997), the county HCFA payments were set according to the 1982 Tax Equity and Fiscal Responsibility Act

participation in markets with price uncertainty, which states that firms will enter a market when the prevailing price exceeds the average variable costs of operation (evaluated at the level of output that minimizes average variable costs) plus the interest on any fixed costs of entry, and that firms will exit a market when the prevailing price is less

(TEFRA). Under TEFRA, HMOs were paid 95% of the projected average fee-for-service costs of Medicare beneficiaries in that county, multiplied by a risk-adjustment factor based on the enrollee's age, sex, Medicaid eligibility, institutional status, and working status. HMOs were paid only 95% of projected local costs because HCFA expected that HMOs could save 5% by operating more efficiently and with fewer unnecessary procedures than fee-for-service providers. TEFRA allowed Medicare HMOs to earn a rate of profit equal to that earned in their non-Medicare business.¹⁴ Subject to HCFA approval, HMOs were allowed to charge a premium to enrollees in exchange for services not covered by Medicare.

The TEFRA payment formula was criticized for overpaying HMOs. Despite the strategy of paying HMOs 95% of projected average fee-for-service costs, several studies concur that it cost HCFA more to enroll beneficiaries in managed care than if they had remained in fee-for-service Medicare. The reason is that enrollees to Medicare managed care have proven to be systematically healthier than fee-for-service Medicare beneficiaries and as a result the medical expenses of the Medicare managed care enrollees were far lower than 95% of average fee-for-service costs.¹⁵

The TEFRA payment formula was also criticized for creating disparities in payments across counties; in particular, few HMOs entered rural counties. It was argued that tying managed care payments to local fee-for-service charges rewarded counties that were inefficient at providing fee-for-service care and those with high reimbursements for graduate medical education, which are included in the fee-for-service costs.

Concerned about the rising cost of caring for Medicare beneficiaries, Congress passed the BBA of 1997, which created the Medicare+Choice program (M+C) and changed the way that

than the average variable costs of operation (evaluated at the level of output that minimizes average variable costs) minus the interest on any fixed costs of exit.

¹⁴ If the expected rate of Medicare profit exceeds that on non-Medicare business, the HMO must either return the excess to HCFA, provide additional benefits, or reduce copayments and deductibles.

¹⁵ Studies of data prior to 1990 find that the health care costs of Medicare managed care enrollees were 20-42% lower than fee-for-service beneficiaries with the same demographic characteristics. Studies of post-1990 data find that the health care costs of Medicare managed care enrollees were 12-37% lower than comparable fee-for-service Medicare beneficiaries; see the review in GAO Report 97-16 (1997). This has held true even after passage of the BBA. It is estimated that in 1998 HMOs were paid on average \$1,000 more per enrollee than HCFA would have paid had the enrollees remained in fee-for-service Medicare; see GAO Report 00-161 (2000). This favorable selection occurred even though HMOs are prohibited by law from selecting enrollees on the basis of health status.

HMOs are reimbursed for risk contracts.¹⁶ Under M+C, HCFA, beginning in 1998, pays HMOs the greatest of the following three rates:¹⁷

1. A blend of an input-price adjusted national rate and an area-specific rate; however, if total projected payments exceed a budget limit, the blended rate is reduced. The blend is intended to reduce the variation in payments across counties by increasing the lowest rates and decreasing the highest rates.
2. A minimum or “floor” payment, adjusted annually, intended to increase the rates in historically lower-rate counties where Medicare managed care plans generally have not been offered.
3. A minimum increase over the previous year’s payment, which is intended to somewhat protect high payment areas. For 1998, 1999, and January and February of 1999, the minimum increase over the previous year’s payment was 2%. Since March of 2001 the minimum increase is 3%.

Since the BBA took effect, the budget limits have typically been binding, forcing reductions in the blended rate. These reductions have been so great that only in the year 2000 did any county receive the blended payment.

The BBA also affected HMO profits by increasing their administrative burdens and charging them user fees (which amounted to \$95 million in both 1998 and 1999), the proceeds of which are used to inform Medicare beneficiaries about their managed care options.

There is one final component of HMO payment in this program. The Balanced Budget Refinement Act of 1999 mandates that HCFA, starting in the year 2000, pay bonuses of 5% the first year, and 3% the second year, to HMOs that offer Medicare+Choice in previously-unserved counties.¹⁸

¹⁶ Some provisions of the BBA were amended by the Balanced Budget Refinement Act of 1999 and the Medicare, Medicaid, and SCHIP Benefits Improvement and Protection Act of 2000.

¹⁷ In addition, the BBA requires HCFA to adjust payments by the health status of plan enrollees. The risk adjustment will be phased in; payments in 2001 are 10 percent risk adjusted and 90 percent adjusted only for demographic factors. The full amount of the payment will be risk-adjusted by 2004. BBA also requires that graduate medical education reimbursements be phased out of the county payments.

¹⁸ The bonus is paid to the first HMO to enter a previously unserved county, but if several HMOs enter on the same date they each receive the bonus.

Three studies have modeled the decisions of individual HMOs to participate in the Medicare managed care market (Adamache and Rossiter 1986, Porell and Wallack 1990, and Abraham et al. 2000). Each of these studies used HMO-level data, which entails two complicated problems, neither of which is addressed by the three referenced studies.

The first problem is that, in counties that have noncompetitive Medicare managed care markets, the entry decision of each firm is a function of the entry decisions of all potential participants in that market. Complicating the problem, some potential participants are not observed because they chose not to enter.

The second problem inherent in the use of HMO-level data to study this problem is the likelihood of multiple equilibria. For example, a county may be able to support two HMOs in its Medicare managed care market, but it may be largely random which two HMOs actually end up participating. Bresnahan and Reiss (1991a) show that multiple equilibria occur in simultaneous-move models under very general conditions.¹⁹

In this paper, we study the aggregate number of HMOs participating at the county level. This avoids the problems of simultaneity and multiple equilibria because we are concerned only with the number of firms that can be supported in the county, not the identities of the individual HMOs.

In our focus on the number of firms that can be supported in distinct geographic markets we are similar to an earlier literature that includes Bresnahan and Reiss (1987, 1990, 1991b), Dranove, Shanley, and Simon (1992), Kronick, Goodman, Wennberg, and Wagner (1993), and Brasure, Stearns, and Ricketts (1999).²⁰ However, we differ from this literature in that our regressor of interest is not the market size but the market “price”.

We follow the methodology developed in Bresnahan and Reiss (1987, 1990, 1991b) in using a latent profit variable to motivate the use of an ordered probit to study the number of firms that can be supported in a geographic market. If N HMOs are active in a market, we assume that the N^{th} HMO earns zero economic profits when

¹⁹ Solutions to this type of problem generally involve making the model recursive (Heckman, 1978), assuming that players randomly choose among the multiple equilibria, or using simulation estimators (Berry, 1992).

²⁰ These papers did not study the market for Medicare managed care. Bresnahan and Reiss (1987, 1990, 1991b) studied markets for retail and professional service industries, Dranove, Shanley, and Simon (1992) studied hospitals, and Brasure, Stearns, and Ricketts (1999) studied physicians. Kronick, Goodman, Wennberg, and Wagner (1993) estimated the metropolitan area population necessary to support three HMOs in the commercial managed care market.

$$\Pi_N(P) = [P - AVC(q_N, W)] \frac{1}{N} d(Z)S - rF = 0$$

where P is the HCFA payment, $AVC(\bullet)$ is the average variable cost function of the HMO, S is the number of Medicare beneficiaries, $d(\bullet)$ is the probability that a Medicare beneficiary enrolls in Medicare managed care, F is the fixed cost of entry, Z is a vector of variables that affect the probability of enrollment, W is a vector of variables affecting costs, and q is the number of Medicare managed care enrollees in the HMO (i.e. $q_N = \frac{1}{N} d(Z)S$).

Rearranging, it is obvious that the larger the variable or fixed costs, the greater the HCFA payment necessary to support N HMOs:

$$P = \frac{AVC(q_N, W) \frac{1}{N} d(Z)S + rF}{\frac{1}{N} d(Z)S}$$

We assume that profit has an additively separable unobserved component, represented by an error term. It is assumed that the error term is normally distributed, independent across markets, and independent of the regressors. We assume that all HMOs in the same market have the same unobserved profit. These assumptions permit the use of the ordered probit to estimate entry thresholds. The dependent variable is the number of HMOs participating in Medicare managed care in a county.

A county will have N active HMOs when the N^{th} HMO to participate earns nonnegative profits but an additional entrant would earn negative profits.

$$\Pi_N \geq 0 \text{ and } \Pi_{N+1} < 0$$

The probability that zero HMOs participate in the market equals

$$\Pr(\Pi_1 < 0) = 1 - \Phi(\bar{\Pi}_1)$$

where $\Phi(\cdot)$ is the cumulative standard normal distribution function and

$$\Pi_1 = \bar{\Pi}_1 + \varepsilon$$

are a monopolist's profits. Given

$$\bar{\Pi}_1 \geq \bar{\Pi}_2 \geq \dots \geq \bar{\Pi}_N$$

the probability of observing in equilibrium N participating firms (where N is fewer than the maximum) equals

$$\Pr(\Pi_N \geq 0 \text{ and } \Pi_{N+1} < 0) = \Phi(\bar{\Pi}_N) - \Phi(\bar{\Pi}_{N+1})$$

The residual probability of observing the maximum number of firms M is:

$$\Pr(\Pi_M \geq 0) = \Phi(\bar{\Pi}_M)$$

We estimate the latent profit function using a reduced form approach. Cameron and Trivedi (1998) conclude that when the data generating process is a continuous latent variable (in our case unobserved profits) an ordered model should be used in place of a count data regression model.²¹ Accordingly, we estimate the model using an ordered probit regression, in which the number of participating HMOs in a given county in a given year on payment and the factors that affect variable costs, market size, the probability of enrollment, and fixed costs.

The ordered probit regression takes the general form (with time and county subscripts suppressed for simplicity):

$$N = f(P, AVC, S, d, F)$$

Ordered probit regression will provide us with threshold values of HCFA payments for HMO participation. If β_p represents the coefficient on HCFA payment, β represents the vector of all other coefficients, and X represents the set of regressors other than HCFA payment, then the minimum HCFA payment P needed to encourage N HMOs to participate is:

$$P = \frac{\lambda_N - X\beta}{\beta_p}$$

where λ_H is the cutoff in the ordered probit regression associated with N HMOs.²² We predict that a higher HCFA payment controlling for observable factors that affect costs will be associated with the participation of a greater number of HMOs.

2. Data

In this section, we define HMO participation in county markets and explain how we control for each component of the profit function introduced in the previous section. The data used in this paper come from two sources. The Health Care Financing Administration (HCFA)

²¹ Cameron and Trivedi (1998), p. 86.

is the source for data on Medicare managed care enrollment, Medicare managed care contracts with HMOs, HCFA payments by county, and input price indices. The second major source of data for this paper is the Area Resource File (ARF), which provides medical and demographic data at the county level.²³

The unit of observation in this paper is the county. A market has traditionally been defined as a region in which a single price prevails for a homogenous good.²⁴ By this definition, counties represent distinct markets for Medicare managed care; HCFA sets Medicare managed care payments on a county-by-county basis. Furthermore, HCFA requires separate contracts from HMOs for each county in which they wish to offer Medicare managed care.

Defining HMO Participation in County Markets

HCFA geographic service area reports can be used to define HMO participation. These files list the counties in which each plan has risk contracts with HCFA. However, many plans with contracts have zero or negligible enrollment; that is, HMOs appear to have taken out some contracts for their option value and not exercised the options to enter the county markets. Table 2 shows that of all plan-county contracts with HCFA, more than 22% in each year 1997-2000 enrolled less than one half of one percent of county Medicare eligibles. Another drawback to using the geographic service area reports to define market participation is that these reports are not available for years prior to 1997.

INSERT TABLE 2 HERE

For the purposes of this study, a risk plan is defined as participating in a county Medicare managed care market if HCFA market penetration files indicate that the plan has enrolled at least 0.5% of the county's Medicare-eligible residents.²⁵ We exclude plans that have enrolled less than 0.5% of eligible residents because plans with such low county enrollment may not actually

²² If the dependent variable in an ordered probit regression has M categories, the cutoffs represent fitted values above which the model predicts that the dependent variable will equal m for $m = 1, \dots, M$.

²³ The Area Resource File (ARF) is a compilation of data from a variety of sources. Unless otherwise noted, the original source of data taken from the ARF is the 1990 Census of Population and Housing.

²⁴ See, e.g., Marshall (1920), Book V, Chapter 1.

be operating in the county. HCFA market penetration files list enrollees by their county of residence instead of the county in which they have enrolled in an HMO, and as a result there are many plan enrollees found in counties where the plan does not have a contract to operate.

As shown in Table 2, 63.5% to 77.5% of plan-counties with contracts in the years 1997-2000 have enrolled at least 0.5% of eligible Medicare beneficiaries. In addition, 0.4% to 1.1% of plan-counties without contracts in the years 1997-2000 also meet this standard. We include in our data these plan-county observations that lack contracts because no plan-county level contract information is available for 1993-1996 and we wish to apply the same definition of market participation in all years included in our data. Figure 6 depicts the number of HMOs participating in Medicare Managed Care by county of the U.S. in the year 2001.

INSERT FIGURE 6 HERE

Plan-county data are aggregated to the HMO level and HMO-level data are aggregated to the county level.²⁶ The sample contains, with one exception, every county in the contiguous 48 United States plus Washington D.C. for each year 1993-2001.²⁷ The dependent variable used in this paper is the number of HMOs participating in a county in a given year. In ordered probit regressions, this dependent variable is top-coded at six or more.²⁸ The number of HMOs participating in a county, by year, is shown in Table 3. (We acknowledge that differences in county population likely explain much of the cross-sectional difference across counties in the number of participating HMOs; we address the role of market size later in this paper.) Table 3 indicates that the number of counties with zero HMOs participating in Medicare managed care fell every year from 1993 to 1999, but rose 1999 to 2001.

²⁵ The enrollment data used to determine HMO participation is that for December for 1993-1997 and 2000, October for 1998-1999, and March in 2001. December reports are not used for 1998 and 1999 because the figures listed in those December reports are actually from the following January.

²⁶ A plan is a uniform set of benefits and premiums. Each HMO may offer multiple plans. In our data we find only 37 counties in which a single HMO offers two plans.

²⁷ Menomonee County, Wisconsin is dropped from the sample because it is the only county for which we do not know per capita income.

²⁸ We top-code the dependent variable for the ordered probit regressions because it can be very difficult to estimate an ordered probit for values of the dependent variable that appear very rarely in the data. In the checks of robustness later in the paper, we estimate the model using negative binomial regression and do not top-code the dependent variable.

INSERT TABLE 3 HERE

The HMO Profit Function

To recap, the profit function for all HMOs in a market is:

$$\Pi = [P - AVC]dS - rF + \varepsilon$$

where P is the HCFA payment, AVC is the average variable cost function, d is the probability of enrollment in Medicare managed care of the representative Medicare eligible, S is the number of Medicare eligibles, F is the fixed cost of entry, and ε represents unobserved profits. Listed below are the variables we use to proxy for each of the components of the profit function.

P : Payment

Our regressor of interest is the HCFA per-enrollee per-month payment specific to the county. We enter the HCFA payment directly and interact it with an indicator for the BBA regime (1998-2001), which allows the affect of the HCFA payment to vary before and after the BBA of 1997 took effect. These payment variables include bonuses, paid only in 2000 and 2001, and which are equal to 5% of the per-enrollee payment for the first year, and 3% of the per-enrollee payment for the second year, that an HMO operates in a previously unserved county.²⁹

Although in practice the per-capita payments of HCFA to HMOs are adjusted to take into account the demographic and (more recently) risk factors associated with the enrollee, we do not make these adjustments and thus the payment used in our empirical work represents the payment for the average enrollee.³⁰ The payment for the average enrollee by county of the U.S. in the year 2001 is depicted in Figure 7.

INSERT FIGURE 7 HERE

Summary statistics of the HCFA per-enrollee monthly payments are listed in Table 4 in nominal dollars. Table 4 indicates that the average HCFA county monthly payment per enrollee

²⁹ We determine whether each county is eligible for a bonus by checking the Medicare Managed Care geographic service area reports to see whether any HMO had a risk contract with HCFA to serve the county the previous calendar year.

³⁰ Demographic and risk adjustments are uniform across counties.

rose each year 1993-2001. Note that the variance in the county payments rose until 1997, when the BBA was passed in part to reduce disparities in payments across counties. Since 1997, the variance in payments across counties has fallen each year. HCFA payments to HMOs are constant during a calendar year; the exception to this rule is 2001, when payments were raised effective March 2001 by the Medicare, Medicaid, and SCHIP Benefits Improvement and Protection Act of 2000. We use the March payment rate for 2001 because the dependent variable is also created using March data.

INSERT TABLE 4 HERE

AVC : Average Variable Costs

We do not observe the average variable costs of HMOs. We assume that average variable costs in county c in year t , denoted $AVC_{c,t}$, have the following structure:

$$AVC_{c,t} = \beta_A A_{c,1991} \left(1 + \frac{P_{A,t} - P_{A,1991}}{P_{A,1991}}\right) + \beta_B B_{c,1991} \left(1 + \frac{P_{B,t} - P_{B,1991}}{P_{B,1991}}\right) + \beta_x X_c + \sum_{t=1994}^{2001} \beta_t I_t$$

$A_{c,1991}$ is the average Medicare Part A (Hospital Insurance) reimbursement per enrollee in county c in 1991; this amount is multiplied by the percent change in Part A costs since 1991, as measured by the HCFA Hospital Input Price Index, which is represented in the equation above by $P_{A,t}$. The Hospital Input Price Index tracks changes in the prices of hospital inputs, such as: wages, salaries, benefits, professional fees, utilities, liability insurance, pharmaceuticals, food, chemicals, medical instruments, photographic supplies, rubber and plastics, paper products, apparel, machinery and equipment, and other inputs. Likewise, $B_{c,1991}$ is the average Medicare Part B (Supplementary Medical Insurance) reimbursement per enrollee in county c in 1991; this amount is multiplied by the percent change in Part B costs since 1991, as measured by the HCFA Medicare Economic Index, which is represented in the equation above by $P_{B,t}$. The Medicare Economic Index tracks changes in the prices of inputs to physician-provided care, such as: physician compensation, non-physician compensation, office expenses, medical materials and supplies, liability insurance, medical equipment and other expenses. It should be noted that the change in costs that we observe over time is that due to prices, not necessarily utilization. It

should also be noted that the Hospital Input Price Index and the Medicare Economic Index are nationwide indices and therefore all of the difference across counties in costs is due to the baseline difference in costs in 1991. In our regression model we will enter the Part A and Part B costs separately because we do not wish to constrain their coefficients to be equal; HMOs may be better able to control one type of costs than the other and therefore costs in the two areas may have different impacts on the likelihood that HMOs will participate.

In the average variable costs equation listed above, X_c is a vector of county characteristics that may affect costs, specifically: the number of general practitioners in 1990, the number of registered nurses in 1990, the number of hospitals in 1993, and median rent in 1990.³¹ We also include as regressors population density and the percent of the population that is urban because geographically dispersed populations may be more costly to serve. Finally, year-specific costs are captured by I_t , an indicator variable that equals one if the observation is for year t .

S : Size of the market

We control for the size of the county market using the number of Medicare beneficiaries in the county in 1990.³² We also include the percent change in this number 1980-90 to account for the fact that HMOs may prefer to enter growing markets.

F : Fixed Costs of Entry

We control for two factors that Brown and Gold (1999) suggest affect the fixed costs of entry into the Medicare managed care market. The first is whether the HMO already operates in the commercial market in the county; this may affect the fixed costs of entering Medicare managed care for two reasons. First, the HMO would have already sunk the costs of establishing a network of health care providers in the county; i.e. there are economies of scope to participating in multiple managed care markets in the same county. Second, HCFA limits participation in the Medicare managed care market to HMOs participating in the county's

³¹ The source of the data on number of doctors is the American Medical Association Physician Masterfile, and that for the number of hospitals is the American Hospital Association Survey of Hospitals.

³² The number of Medicare beneficiaries includes both elderly and disabled beneficiaries (both are eligible for managed care). In 1998, the elderly represented 87.06% of all Medicare beneficiaries.

commercial market. HMOs that historically participated in the commercial market of the county may face lower barriers to entering the Medicare managed care market.

We do not simply control for the number of HMOs participating in the county's commercial managed care market; because an HMO could enter a county's commercial market for the purpose of subsequently entering its Medicare managed care market, current participation in the commercial market is endogenous. Instead, we control for the number of HMOs in the county in 1980, before the TEFRA of 1982 created the modern Medicare managed care market.³³ We also control for the likelihood of HMOs participating in the county commercial market using the percent of the workforce in manufacturing or white-collar jobs in 1990. The presence of these types of employees proxies for the presence of employers likely to demand commercial managed care for its employees.

The second factor that affects the fixed cost of entering a county Medicare managed care market is whether an HMO participates in nearby counties. It may be cheaper for an HMO to enter a county adjacent to its current service area because the HMO may already be familiar with local providers and have acquired information about the local market. To proxy for the likelihood of participating in adjacent counties, we control for the total number of Medicare beneficiaries in 1990 in all adjacent counties and its percent growth 1980-90.

d : Probability that Medicare Eligibles will enroll in Medicare managed care

It has repeatedly been found that relatively healthy Medicare beneficiaries are the most likely to enroll in managed care.³⁴ In order to capture cross-county differences in the proportion of healthy beneficiaries (and therefore demand for Medicare managed care), we control for per capita income, the poverty rate among the county's elderly, the percent of adults with a high

³³ The source of the HMO participation data is the National HMO Census of Prepaid Plans.

³⁴ Chapter 15 of Physician Payment Review Commission (1996) summarizes the literature that finds that Medicare beneficiaries who enroll in managed care, compared to those who remain in fee-for-service Medicare, tend to have had lower utilization and Medicare costs in the preceding few years. Also see GAO Report 97-160 (1997). A similar difference in prior utilization characterizes those who enroll in commercial managed care plans; see the summary in Glied (2000). Possible reasons that the relatively healthy are more likely to enroll in managed care are that they are less likely to have an established health care provider and that they may be less averse to the risk that HMOs may deny them certain treatments.

school diploma, and the percent of adults with a college degree.³⁵ Each of these variables was measured in 1990.

Summary statistics for the variables used in this paper appear in Table 5.

INSERT TABLE 5 HERE

We acknowledge that characteristics of the individual HMOs participating in the market may affect variable or fixed costs, or the triggers at which the HMO will enter or exit. For example, certain model types may be more efficient at providing care and the exit trigger may be lower for non-profit than for-profit HMOs. We ignore the characteristics of the individual participating HMOs for two reasons. First, these characteristics are endogenous. An HMO may change its model type or profit status to suit the characteristics of the markets in which it participates. Second, as mentioned earlier, HMO entry into Medicare managed care is an example of a multiple-agent discrete-move game. It is likely that multiple equilibria exist, and that the number of firms participating is determined but which individual HMOs participate is to some extent random.

3. Empirical Results

The results of the ordered probit regression of the number of HMOs participating in Medicare managed care at the county level are presented in Table 6. In all the results reported in this paper, standard errors are cluster-corrected to account for the dependence in errors within each county over time.

INSERT TABLE 6 HERE

The coefficients on HCFA payment and HCFA payment interacted with BBA regime are positive and statistically significant at the 1% level, which is consistent with our hypothesis that

³⁵ We assume that the per capita income and education of Medicare beneficiaries track those of the entire adult population in the county. The source of data on the poverty rate among the elderly is the Bureau of Census' Small

controlling for costs, a higher payment is associated with the participation of more HMOs. The coefficients on the indicator variables for year in Table 6 indicate that there was a trend toward increased participation 1993-1997; this trend was reversed 1997-2001. This is suggestive evidence that, even controlling for its effect on HCFA payment levels, the BBA 1997 regulations have reduced the probability of HMO participation. This may reflect the increased administrative burdens imposed on HMOs by the BBA.

As described in Section 1, the coefficients presented in Table 6 can be used to calculate the HCFA payments necessary to encourage a given number of HMOs to enter the market. These payment thresholds are presented in Table 7.

INSERT TABLE 7 HERE

Derivation of standard errors for the thresholds is difficult because the thresholds are nonlinear functions of several random variables. Accordingly, we calculate bootstrap standard errors. Specifically, bootstrap samples of size equal to the overall sample are formed by randomly selecting with replacement from the overall sample all observations of a particular county. The standard errors are calculated from the variance observed in the thresholds calculated using the bootstrapped samples. We follow the recommendation of Efron and Tibshirani (1993) and conduct 200 replications to estimate standard errors. The bootstrapped standard errors are presented along with the estimated payment thresholds.³⁶

The payment threshold necessary to support a given number of Medicare HMOs varies by county. Table 7 presents the year 2001 thresholds for the county at the 25th percentile, the median county, the county at the 75th percentile, and the county with the highest payment threshold. Table 7 indicates that in order to support a single HMO in the median county, it is necessary for HCFA to pay \$799.24 per average enrollee per month in the median county. To support a single HMO to enter every county, HCFA would have to pay \$1198.02 per average enrollee per month in the marginal county.

Area Income Poverty Estimates and that for per capita income is the U.S. Department of Commerce.

³⁶ The standard errors may be irrelevant because our sample is the entire population of counties. However the standard errors are meaningful if one allows for measurement error in the dependent variable or one interprets the sample (which covers 1993-2001) as drawn from all possible years.

Table 7 also lists the HCFA payment thresholds necessary to support multiple HMOs in county Medicare managed care markets. HCFA may desire multiple HMOs in each market because the competition between the HMOs for market share leads to lower out-of-pocket costs and additional benefits for enrollees. Table 7 suggests that, conditional on two HMOs already participating, HCFA must pay roughly \$120 more per enrollee per month to support each additional Medicare HMO.

Table 8 compares the mean characteristics of two groups of counties: those in which HCFA payments in the year 2001 were more than the estimated payment necessary for one HMO to participate in the county, and those in which HCFA payment was less than that threshold. The table also lists the difference in means and the t statistic associated with the test of the hypothesis that the means are equal across the two groups of counties.

INSERT TABLE 8 HERE

In the year 2001, 337 counties were assigned HCFA payments that exceeded the estimated payment necessary to support one HMO, while 2,696 counties were assigned payments less than the single-HMO threshold. Table 8 indicates that counties assigned payments greater than the estimated single-HMO threshold have both higher HCFA payments and higher Part A and B Medicare costs than the counties assigned payments less than the threshold. In addition, the counties with above-threshold payments have many more hospitals and general practitioners, much larger populations of Medicare beneficiaries, and have in general better educated and wealthier populations. Each of these differences is statistically significant at the 1% significance level.

If a below-threshold payment can be interpreted as an underestimate by HCFA of costs in that county, then our results suggest that HCFA tends to underestimate the costs of HMO participation in sparsely-populated counties. Several studies noted that, under the TEFRA payment scheme that was used prior to 1998, rural counties were particularly unlikely to be served by HMOs.³⁷ Passage of the BBA was intended to eliminate such disparities by raising payments more quickly in low-payment than high-payment counties. We find that even three years after the BBA took effect, counties with HCFA payment insufficient to support HMO

³⁷ See, e.g., Serrato, Brown, and Bergeron (1995).

participation tend to be far less populous than counties that receive what we estimate to be sufficient payment.³⁸

4. Extensions

This section conducts two checks of robustness. First, we use a negative binomial regression in place of the ordered probit regression to calculate the payment thresholds necessary to support a given number of participating HMOs for the entire sample of counties. Second, we re-estimate the ordered probit and negative binomial models with a sample that excludes the 40% of counties with the fewest Medicare beneficiaries.

Extension 1: Negative Binomial Regression

As an extension, we estimate the payment thresholds using negative binomial regression instead of ordered probit regression. There are two advantages to using negative binomial relative to ordered probit. First, the ordered probit requires top-coding the dependent variable, which results in a loss of information, whereas the negative binomial uses all of the variation in the dependent variable. Second, unlike the negative binomial, the ordered probit regression does not exploit the fact that in this case the dependent variable is not just a ranking but also a count.

We prefer a negative binomial to a Poisson model for the following reasons: first, the assumption in the Poisson that the conditional mean equals the conditional variance is restrictive. Violation of this assumption results in underestimated standard errors of coefficients.³⁹ Second, the assumptions behind the Poisson model are such that its use would imply that the participation of each HMO in a county is independent of the participation of all other HMOs in the county. In contrast, the negative binomial model can be derived assuming dependence in the underlying

³⁸ Another piece of evidence that the BBA has not worked as intended appears in Table 10; specifically, the relationship between the number of Medicare beneficiaries in a county and the probability of a participating Medicare HMO is stronger in 2001 than in 1993.

³⁹ Cameron and Trivedi (1986, 1998).

random process; in this case, that the participation of one HMO may affect the probability that other HMOs will participate in the market.⁴⁰

Using the coefficients from negative binomial regression, the level of HCFA payment necessary to produce a conditional mean equal to N HMOs in a given county is:

$$P = \frac{\ln(N) - X\beta}{\beta_p}$$

where β_p represents the coefficient on HCFA payment, and β represents the vector of all other coefficients. For the sake of brevity, the negative binomial coefficients are not presented. Table 9 presents the estimated HCFA payments necessary to support the first five participating HMOs per county.

INSERT TABLE 9 HERE

A comparison of the ordered probit thresholds in Table 7 with the negative binomial thresholds in Table 9 indicates that the negative binomial thresholds are generally higher. For example, the ordered probit regression suggests that \$799.24 per enrollee per month is necessary to support a single participating HMO in the median county; the comparable figure from the negative binomial regression is \$975.27. In contrast, the payment necessary to support one HMO in the highest-threshold county is \$1198.02 when estimated using ordered probit and \$1665.64 when estimated using negative binomial.

291 counties are paid more, and 2,782 counties are paid less, than the minimum payment necessary to support a single HMO as estimated using the negative binomial regression. Differences across counties paid more and less than this threshold are similar to those reported in Table 8 for the ordered probit regression. In short, none of our conclusions change when we estimate a negative binomial rather than an ordered probit model.

Extension 2: Limiting the Sample by Excluding the Least Populous Counties

The ordered probit model results presented in Table 7, and the negative binomial results presented in Table 9, were estimated using the sample of all counties. However, it may not be

⁴⁰ Cameron and Trivedi (1998).

cost-effective for HCFA to support HMO participation in Medicare managed care in relatively rural or unpopulated counties. Table 10 lists the percent of counties with at least one HMO participating in Medicare managed care, by the quintile of its population of Medicare beneficiaries. The table shows that counties in the fifth (most populous) quintile are several times more likely to have a participating HMO than are counties in the first quintile (least populous). The figures in Table 10 also suggest that the positive correlation between the size of the Medicare population and the probability that an HMO participates in Medicare managed care is stronger in 2001 than in 1993.

INSERT TABLE 10 HERE

If many counties are too rural or unpopulated to ever support HMO participation, then it may be desirable to exclude these counties from the sample so their history of nonparticipation does not influence the payment thresholds estimated for other counties. For this reason, we re-estimate the ordered probit and negative binomial models using only counties whose population of Medicare beneficiaries is in the top three quintiles. For the sake of brevity we omit the tables of coefficients. The HCFA payments necessary to support a given number of HMOs in Medicare managed care in the counties in the top three quintiles of Medicare population are presented in Table 11 (calculated using ordered probit coefficients) and Table 12 (calculated using negative binomial coefficients).

INSERT TABLES 11 AND 12 HERE

Again, the payment thresholds estimated using the negative binomial coefficients tend to be higher than those estimated using the ordered probit coefficients. For example, the ordered probit results indicate that a payment of \$679.97 in the marginal county is necessary to support one HMO in half the counties in the smaller sample, whereas the analogous figure estimated using the negative binomial coefficients is \$809.13. A comparison of the far-right columns in Tables 11 and 12 to those in Tables 7 and 9 confirms that the excluded rural counties were among those requiring the highest payment to support HMO participation in this program.

Conclusion

At the end of 1998, 1999, and 2000, HMO exits from Medicare managed care markets resulted in the involuntary disenrollment of hundreds of thousands of elderly and disabled Americans from a program that was hoped would generate additional benefits for beneficiaries and savings for Medicare. This paper estimates the HCFA payments necessary to support the participation in Medicare managed care of a given number of HMOs per county market. Ordered probit estimates suggest that in order to support one Medicare HMO in half of U.S. counties in the year 2001, HCFA would have to pay \$799.24 per average enrollee per month in the marginal county. Analogously, to support one Medicare HMO in *every* county in the U. S. in the year 2001, HCFA would need to pay \$1198.02 per enrollee per month in the marginal county. These thresholds exceed current HCFA payments, which in 2001 average \$498.82 and range from \$475.00 to \$833.55.

It has been found that competition among Medicare HMOs generates additional services at lower cost for enrollees; if HCFA desires multiple HMOs to participate in county markets, our estimates suggest that even greater payments are required. Conditional on two HMOs already participating, roughly an extra \$120 per enrollee per month is necessary to support each additional Medicare HMO.

We find that 87.7% of all counties in the contiguous 48 United States received less than the estimated amount necessary to support an HMO in this market. Compared to counties that received more than the estimated threshold for HMO participation, the counties receiving an insufficient payment are on average more rural and less populated with citizens who are less wealthy and less educated. The relative disadvantage of rural and unpopulated counties persists three years after the BBA 1997, designed to eliminate such disparities, took effect.

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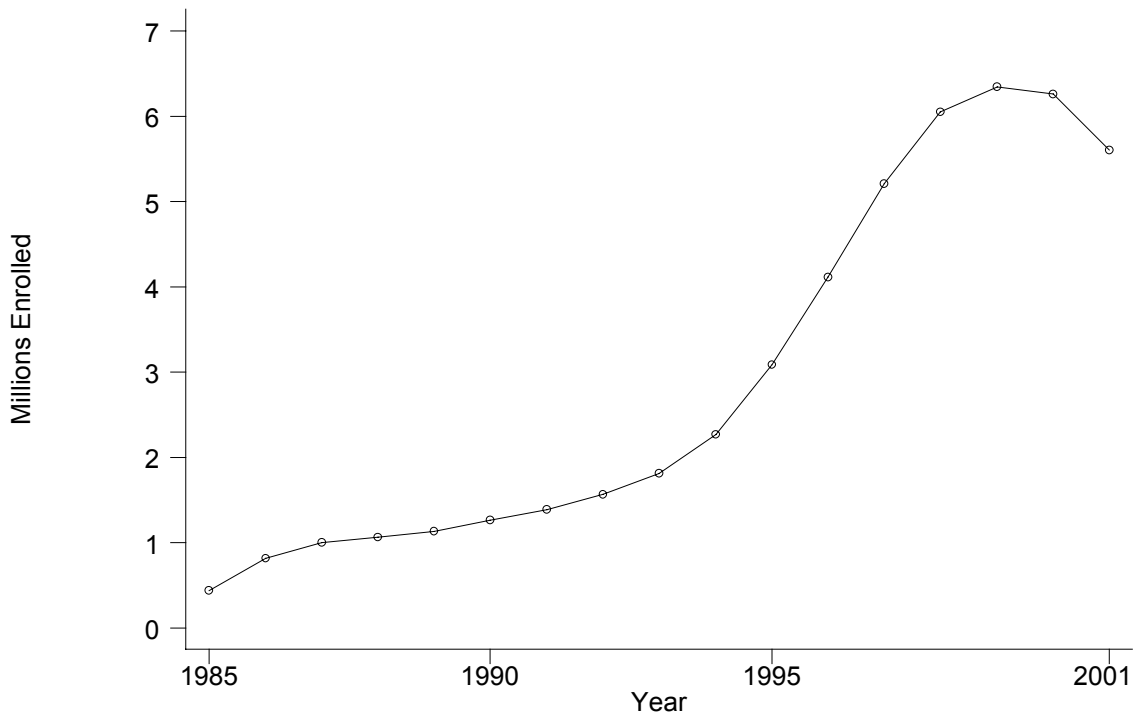


Figure 1: Medicare Managed Care Enrollment

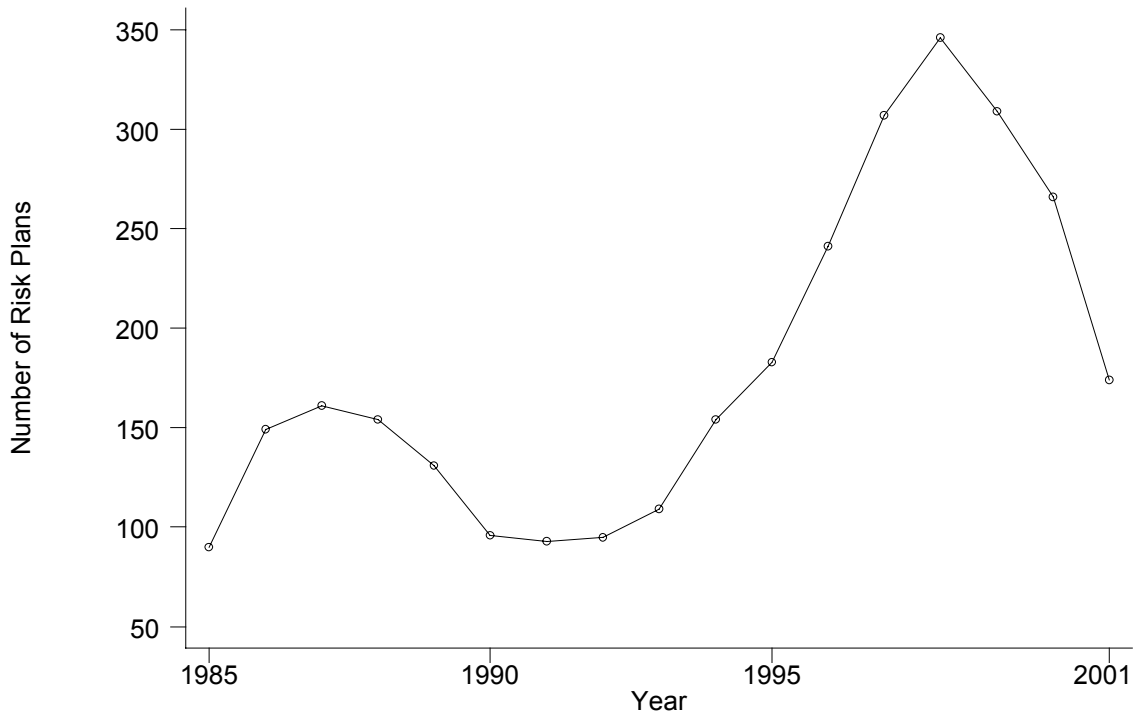


Figure 2: Number of Medicare Managed Care Plans

Figure 3
A Competitive Market for Medicare Managed Care

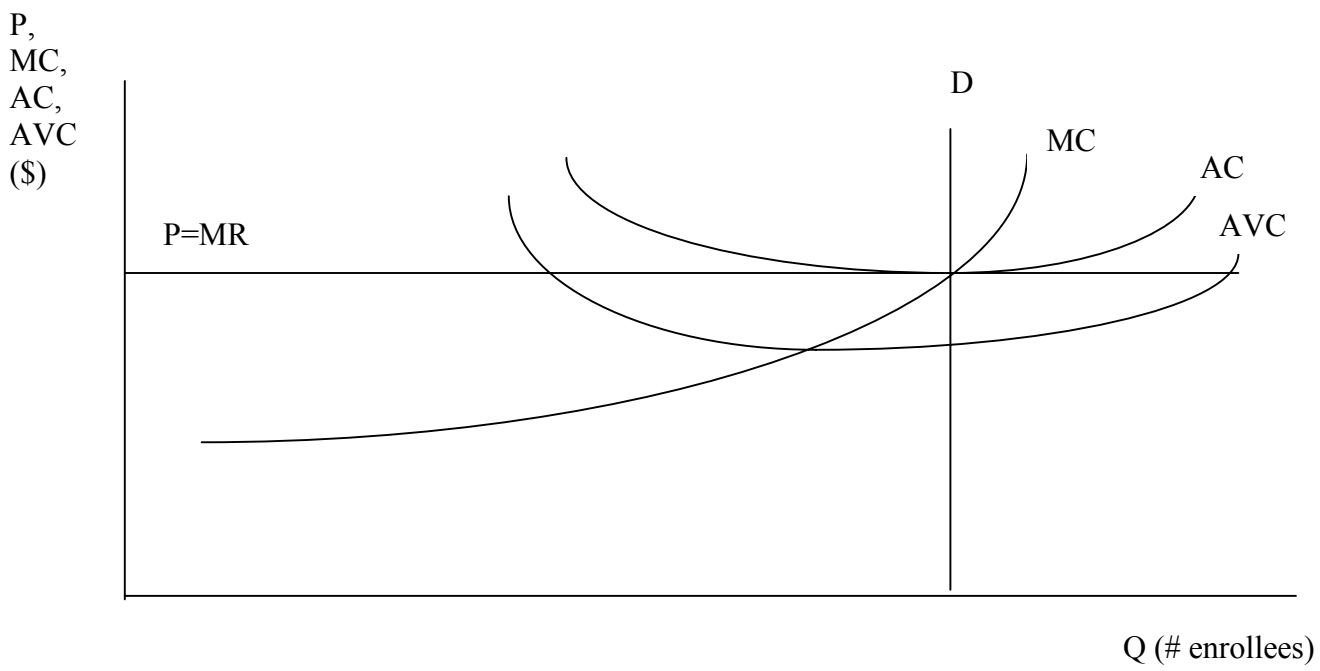


Figure 4
Effect of a Rise in HCFA Payment in a Competitive Market for Medicare Managed Care

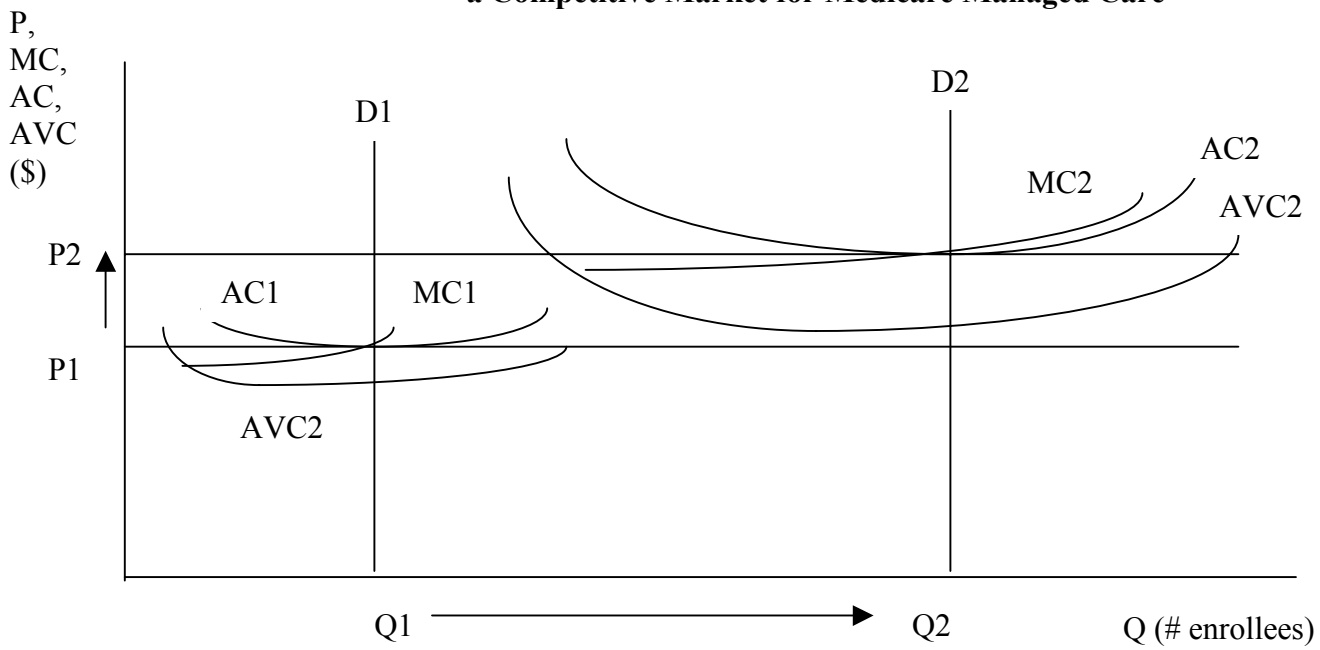


Figure 5
Effect of a Rise in HCFA Payment on the
Number of HMOs Participating
in a Medicare Managed Care Market

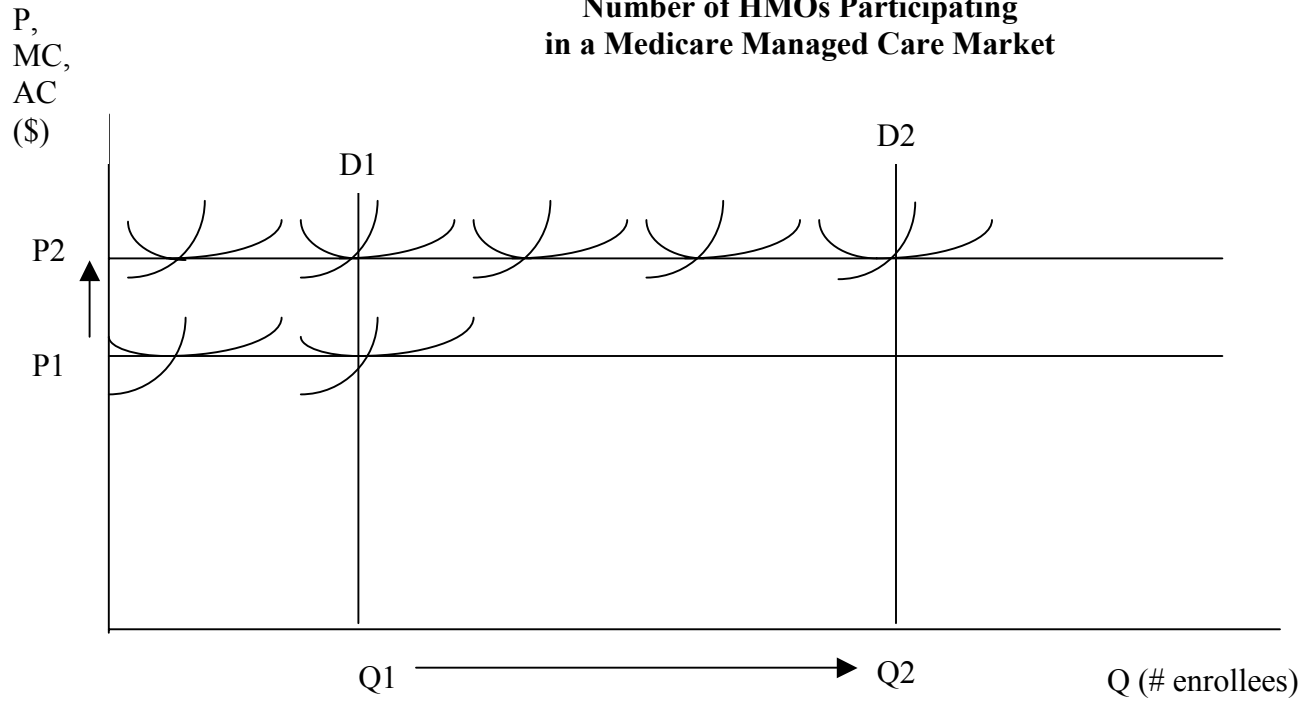


Figure 6
Number of HMOs
Participating in Medicare Managed Care
Per County in 2001

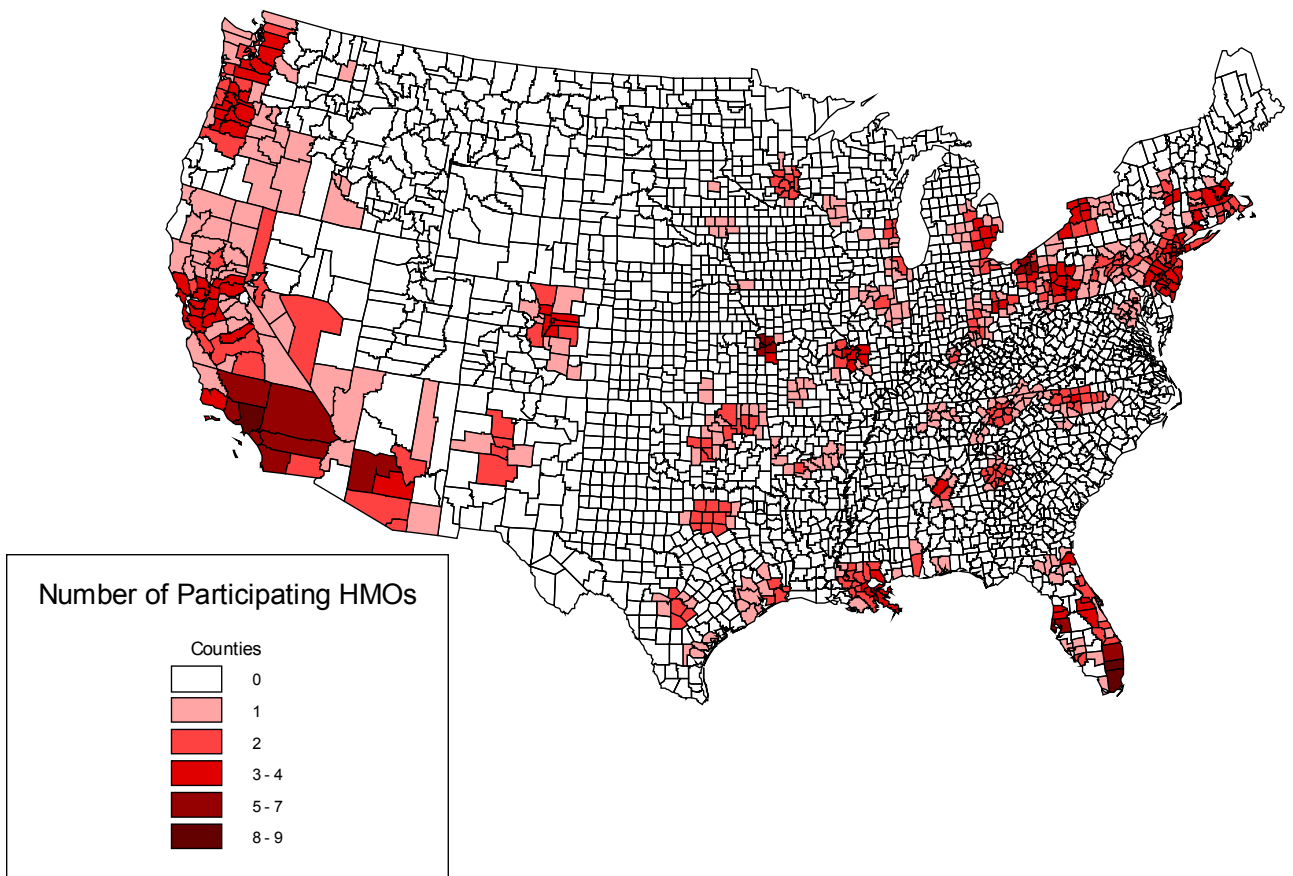


Figure 7
Medicare Managed Care
Monthly Per Enrollee Payment Rates
By County in 2001

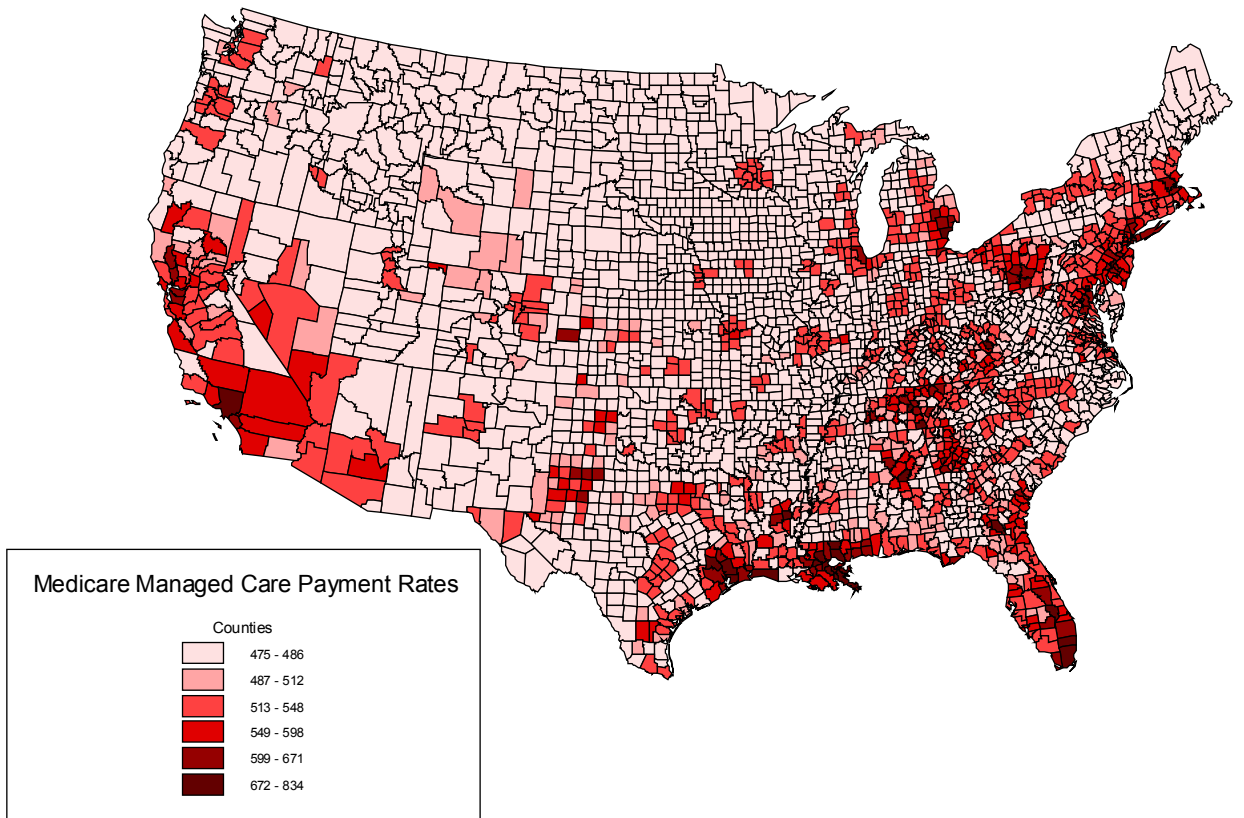


Table 1
Number of Medicare Managed Care Enrollees
Involuntarily Disenrolled, 1998-2000

Year	# Enrollees Affected	% Enrollees Affected
1998	407,000	7
1999	327,000	5.3
2000	934,000	15.1

Sources: HCFA (1999), Laschober et al. (1999), and HCFA (2000b). Figures for 2000 are estimated. The year in the first column indicates the last year the HMOs participated in the market.

Table 2
County Risk Plans with 0.5% of Medicare Eligibles Enrolled,
by Contract Status and Year

	1997	1998	1999	2000
Plans with contracts	68.4	63.5	65.9	77.5
Plans without contracts	0.4	1.1	0.9	0.3

Data: HCFA Medicare managed care geographic service area reports and market penetration files, 1997-2000.

Table 3
Number of Counties With a Given Number of HMOs
Participating in Medicare Managed Care, by Year

Number of HMOs in County Participating in Medicare Managed Care	Year								
	1993	1994	1995	1996	1997	1998	1999	2000	2001
0	2816	2728	2569	2401	2289	2230	2210	2273	2415
1	166	202	281	309	317	329	387	366	336
2	55	81	114	155	188	205	199	189	183
3	21	30	56	101	105	126	126	116	88
4	4	22	28	48	84	80	74	70	23
5	7	3	14	43	51	57	34	27	14
6	4	5	5	9	23	25	27	20	6
7	1	1	2	3	11	17	9	7	6
8	0	2	4	3	5	2	6	3	2
9	0	0	1	2	1	3	2	2	1
10	0	0	0	0	0	0	0	1	0
Total Number of Counties	3074	3074	3074	3074	3074	3074	3074	3074	3074

Data: HCFA Medicare managed care market penetration files, 1993-2001.

Table 4
Summary Statistics
of Monthly Per-Enrollee HCFA Payments,
by Year

Year	Mean	Std. Deviation	Minimum	Maximum
1993	301.86	55.46	168.15	598.65
1994	314.72	58.29	171.07	653.44
1995	332.43	62.99	177.32	678.90
1996	372.13	70.58	207.31	881.35
1997	394.78	76.69	220.92	767.35
1998	417.09	62.99	367.00	782.70
1999	427.33	62.69	379.84	798.35
2000	449.78	56.85	401.52	809.28
2001 (Jan-Feb)	460.39	56.66	414.88	825.46
2001 (Mar-Dec)	498.82	41.70	475.00	833.55

Source: HCFA Medicare managed care historical payment files, 1993-2001.

Notes: Figures are in nominal dollars. The BIPA of 2000 raised payments to HMOs effective March 2001.

Payments do not include bonuses for operating in previously unserved counties during 2000 and 2001.

Table 5
Summary Statistics

Variable	Year(s) of Data	N	Mean	S.D.	Min	Max
Number of HMOs Active in Medicare Managed Care	1993-2001	27657	.44	1.09	0	10
HCFA payment (Per enrollee, per month)	1993-2001	27657	393.81	91.14	168.15	881.35
Average Medicare Part A Costs	1993-2001	27657	2213.87	488.66	385.18	5658.37
Average Medicare Part B Costs	1993-2001	27657	1219.05	257.89	482.03	2910.01
# General Practitioner Medical Doctors	1990	25821	23.24	77.04	1	2605
# Registered Nurses	1990	27315	617.55	2004.48	1	52780
Number of Hospitals	1993	22617	2.60	5.23	1	148
Number of HMOs Active in Commercial Market	1980	1161	1.80	1.39	1	11
Per Capita Income	1993	27657	16792.5	3781.89	6306	52277
Poverty Rate Among Elderly	1990	27594	.17	.083	.01	.58
Median Rent	1990	27657	319.97	94.75	140	926
% Adults High School Graduates	1990	27657	69.54	10.34	31.6	95.5
% Adults College Graduates	1990	27657	13.42	6.47	3.7	53.4
Number of Medicare Beneficiaries	1990	27657	10835.2	31799.9	14	877581
% Growth in Medicare Beneficiaries	1980-90	27657	.309	.233	-.31	2.98
Medicare Beneficiaries in Neighboring Counties	1990	27286	58881.1	91414.1	994	1452320
% Growth of Medicare Beneficiaries in Neighboring Counties	1980-90	27286	.327	.170	-.10	1.38
% Population Urban	1990	20691	48.28	23.81	.1	100
Population Density	1994	27657	208.59	1439.6	.2	53801.1
% Workers in Manufacturing	1990	27630	18.57	10.54	.4	53.6
% Workers White Collar	1990	27657	45.37	9.30	17.8	81.4

Table 6
Ordered Probit Regression
Of Number of HMOs in County on County Characteristics

Variable	Coefficient	Z Score
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Payment

HCFA Payment	.0029	4.54
HCFA Payment * Indicator for 1998-2001	.0015	4.86

Indicator Variables for Year

1994	.2146	7.83
1995	.5131	13.42
1996	.7509	13.30
1997	.9115	13.69
1998	.2834	1.90
1999	.2104	1.38
2000	-.0495	0.30
2001	-.5469	2.86

Variables Affecting Average Variable Costs

Average Medicare Part A Costs	.00002	0.19
Average Medicare Part B Costs	.00019	1.32
Number of General Practitioners	.0027	2.96
Number of Registered Nurses	-.0001	2.92
Number of Hospitals	.0122	1.32
Median Rent	.0027	6.08
Population Density	-.00002	2.05
Percent Population in Urban Areas	.0008	0.57

Measures of the Size of the Market

Number of Medicare Beneficiaries	.000006	1.98
Percent Growth in Medicare Beneficiaries	.1398	1.21

Variables Affecting Fixed Costs of Entry

Number of HMOs in County in 1980	.0986	1.79
Percent Workforce in Manufacturing	.0012	0.46
Percent Workforce White Collar	.0283	4.31
Number of Medicare Beneficiaries in All Adjacent Counties	.000003	9.34
Percent Growth in Medicare Beneficiaries in All Adjacent Counties	1.5194	8.43

Table 6 (continued)
Ordered Probit Regression
Of Number of HMOs in County on County Characteristics

Variable	Coefficient	Z Scores
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Variables Affecting the Probability of Enrollment

Per Capita Income	-.00001	1.37
Poverty Rate Among Elderly	-1.2052	2.13
Percent of Adults with High School Diploma	.0190	3.78
Percent of Adults with College Degree	-.0312	4.06

Number of observations	27,657
Log Likelihood	-15,699.341

Z Scores reflect cluster-corrections of standard errors by county.
Coefficients on indicator variables for missing values are omitted.

Table 7
Estimated Monthly Payments
Necessary to Support Given Numbers of
Medicare Managed Care HMOs Per County
in the Year 2001
Bootstrapped Standard Errors in Parentheses
Ordered Probit Regression

Desired Number of HMOs / County	Monthly HCFA Payment Necessary (\$)			
	25 th Percentile	Median	75 th Percentile	Maximum
1	667.34 (37.98)	799.24 (71.60)	902.67 (96.98)	1198.02 (184.84)
2	827.33 (76.29)	959.23 (110.61)	1062.66 (136.03)	1358.01 (222.91)
3	963.08 (109.39)	1094.99 (143.82)	1198.42 (169.27)	1493.76 (255.38)
4	1089.46 (142.76)	1221.36 (177.23)	1324.79 (202.69)	1620.14 (288.25)
5	1208.32 (171.89)	1340.22 (206.38)	1443.65 (231.81)	1739.00 (316.81)
6 or more	1334.94 (204.97)	1466.84 (239.37)	1570.27 (264.78)	1865.62 (349.38)

Note: calculated using coefficients reported in Table 6.

Table 8
Difference in Mean Characteristics
Between Counties with Actual Payments Above and Below
Estimated Payment Threshold for One HMO to Participate
in Medicare Managed Care in the Year 2001

County Characteristic	Mean for Counties with Actual Payment > Threshold	Mean for Counties with Actual Payment < Threshold	Difference in Means	T Statistic for Equality of Means
Number of Participating HMOs, 2001	1.93	.19	1.74	20.17
Monthly HCFA Payment, 2001	563.81	510.67	53.15	17.02
Average Medicare Part A Costs, 1991	2106.20	1820.70	285.50	11.54
Average Medicare Part B Costs, 1991	1331.53	1051.95	279.58	20.83
Number of General Practitioners, 1990	100.92	11.64	89.28	9.01
Number of Hospitals, 1993	8.32	1.70	6.62	10.00
Per Capita Income, 1993	21245.39	16169.79	5075.60	18.84
Poverty Rate Among Elderly, 1990	9.87	18.18	-8.31	30.35
% Adults High School Graduates, 1990	78.18	68.33	9.84	23.30
% Adults College Graduates, 1990	21.08	12.35	8.73	19.83
Number Medicare beneficiaries, 1990	50212.86	5328.80	44884.06	11.19
% Population Urban, 1990	73.74	43.51	30.23	22.36
Population Density, 1994	1239.89	64.38	1175.51	5.77

Number of Counties	377	2696
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Table 9
Estimated Monthly Payments
Necessary to Support Given Numbers of
Medicare Managed Care HMOs Per County
in the Year 2001
Bootstrapped Standard Errors in Parentheses
Negative Binomial Regression

Desired Number of HMOs / County	Monthly HCFA Payment Necessary (\$)			
	25 th Percentile	Median	75 th Percentile	Maximum
1	781.33 (126.36)	975.77 (224.67)	1149.13 (302.44)	1665.64 (549.31)
2	954.66 (207.19)	1149.10 (306.00)	1322.46 (383.81)	1838.98 (630.21)
3	1056.06 (254.69)	1250.49 (353.63)	1423.85 (431.44)	1940.37 (677.61)
4	1128.00 (288.44)	1322.43 (387.43)	1495.79 (465.25)	2012.31 (711.26)
5	1183.80 (314.63)	1378.23 (413.66)	1551.59 (491.47)	2068.11 (737.38)
6	1229.39 (336.04)	1423.82 (435.09)	1597.18 (512.90)	2113.70 (758.73)
7	1267.93 (354.14)	1462.37 (453.21)	1635.73 (531.03)	2152.25 (776.78)
8	1301.33 (369.83)	1495.76 (468.91)	1669.12 (546.72)	2185.64 (792.42)
9	1330.78 (383.66)	1525.22 (482.76)	1698.57 (560.57)	2215.09 (806.22)
10	1357.13 (396.04)	1551.56 (495.14)	1724.92 (572.96)	2241.44 (818.57)

Note: 27,657 county-year observations in sample.

Table 10
Percent of Counties
with at Least One Active Medicare Managed Care HMO,
By Quintile of Medicare Beneficiaries in 1990

Year	Quintile of Medicare Beneficiaries in 1990				
	1	2	3	4	5
1993	4.7	2.4	3.9	7.5	23.5
1994	5.4	3.6	6.0	10.7	30.6
1995	7.6	4.9	9.8	15.3	44.6
1996	9.8	7.2	13.0	22.4	57.2
1997	9.9	9.3	17.1	27.8	63.7
1998	10.9	10.4	18.9	31.4	65.8
1999	7.6	12.8	20.3	33.3	66.4
2000	6.5	12.4	17.1	31.1	63.4
2001	4.2	9.4	13.8	22.6	57.2

Number of Counties	615	615	615	615	614
Minimum Number of Medicare Beneficiaries in Quintile	14	1,482	2,783	4,714	9,718
Maximum Number of Medicare Beneficiaries in Quintile	1,479	2,781	4,708	9,680	877,581

Data: HCFA market penetration files, 1993-2001, and Area Resource File.

Table 11:
Estimated HCFA Payments
Necessary to Support Given Numbers of
Medicare Managed Care HMOs Per County
in the Year 2001
Counties with Medicare Population in Top Three Quintiles
Ordered Probit Regression

Desired Number of HMOs / County	Monthly HCFA Payment Necessary (\$)			
	25 th Percentile	Median	75 th Percentile	Maximum
1	565.34 (18.19)	679.97 (53.39)	768.32 (82.72)	995.37 (141.76)
2	706.00 (56.56)	820.63 (95.39)	908.98 (124.84)	1136.03 (182.84)
3	826.41 (92.31)	941.04 (131.62)	1029.39 (161.09)	1256.44 (218.46)
4	940.62 (127.15)	1055.26 (166.67)	1143.60 (196.16)	1370.65 (253.29)
5	1045.58 (156.14)	1160.21 (195.72)	1248.56 (225.20)	1475.61 (282.23)
6 or more	1155.83 (187.63)	1270.46 (227.32)	1358.81 (256.82)	1585.86 (313.55)

Note: 16,596 county-year observations in sample.

Table 12
Estimated Monthly Payments
Necessary to Support Given Numbers of
Medicare Managed Care HMOs Per County
in the Year 2001
Counties with Medicare Population in Top Three Quintiles
Bootstrapped Standard Errors in Parentheses
Negative Binomial Regression

Desired Number of HMOs / County	Monthly HCFA Payment Necessary (\$)			
	25 th Percentile	Median	75 th Percentile	Maximum
1	639.96 (108.39)	809.13 (249.43)	951.21 (368.40)	1360.22 (660.87)
2	812.00 (234.06)	981.18 (376.76)	1123.25 (495.81)	1532.26 (787.51)
3	912.64 (308.34)	1081.81 (451.34)	1223.89 (570.70)	1632.90 (861.74)
4	984.04 (361.15)	1153.22 (504.27)	1295.29 (623.34)	1704.30 (914.45)
5	1039.43 (402.14)	1208.60 (545.34)	1350.68 (664.41)	1759.69 (955.35)
6	1084.68 (435.65)	1253.86 (578.90)	1395.93 (697.97)	1804.94 (988.79)
7	1122.94 (463.99)	1292.12 (607.28)	1434.19 (726.34)	1843.20 (1017.06)
8	1156.09 (488.55)	1325.26 (631.86)	1467.34 (750.92)	1876.34 (1041.56)
9	1185.32 (510.21)	1354.50 (653.54)	1496.57 (772.60)	1905.58 (1063.18)
10	1211.47 (529.59)	1380.65 (672.94)	1522.72 (792.00)	1931.73 (1082.51)

Note: 16,596 county-year observations in sample.