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The Effects of Hospital Ownership on Medical Productivity

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Abstract

To develop new evidence on the effects of hospital ownership and other aspects of hospital market composition on health care productivity, we analyze longitudinal data on nonrural elderly Medicare beneficiaries hospitalized for new heart attacks over the 1985-1994 period. Our analysis differs from previous studies. First, we consider effects on both resource use and health outcomes. Second, we model individual patients' hospital choice decisions as a function of exogenous patient, area, and hospital characteristics, particularly relative distances. Based on these estimates, we construct area-based measures of the "density" of hospitals of different types that depend only on exogenous patient, area, and hospital characteristics; we also include zip code fixed effects. This allows us to avoid the problem of patient selection into different types of hospitals on the basis of unobservable characteristics. It also allows us to examine "spillover" effects of ownership and other hospital characteristics, for example, effects of changes in ownership on the behavior of *other* hospitals in a market. We find that spillover effects of ownership are quantitatively important. Moving from essentially no presence of for-profit ownership in a market to any nontrivial presence is associated with significant reductions in hospital expenditures in less competitive markets. The "direct" effect of for-profit ownership appears to be less important, suggesting that within a market, for-profit and not-for-profit behavior is not that different. Greater teaching hospital presence and public hospital presence also have important spillover effects, particularly in less competitive markets. Hospital systems reduce expenditures, particularly in more competitive markets. At all levels of market competition, these differences in market composition generally have limited if any consequences for patient health. Differences in ownership and other aspects of market composition influence hospital productivity, mainly through spillover effects.

Introduction

The social welfare implications of for-profit versus non-profit, and private versus public ownership have been of interest to economists for over 35 years. In stylized microeconomic models of organizations, basic theory predicts that the for-profit organizational form is efficient, because of the high-powered incentives that arise from the presence of a well-defined residual claimant with legally enforceable property rights. In an early work, however, Arrow (1963) observed that non-profit organizations may be a socially-optimal response to incomplete markets. Although this line of research has been developed extensively (e.g., Nelson and Krashinsky 1973; Easley and O'Hara 1983; Hansmann 1980, 1987, 1996; Rose-Ackerman 1996; Weisbrod 1977, 1988), other theoretical work has shown that the non-profit form may be socially inferior or equivalent to the for-profit form, even if markets are incomplete (e.g., Newhouse 1970, Feldstein 1971, Pauly and Redisch 1973).

This theoretical indeterminacy has translated into a long-standing policy debate in health economics about the welfare implications of for-profit, private non-profit, and public ownership, particularly ownership of hospitals (see Sloan 1997 for a comprehensive overall review; see Hamilton 1994 and Philipson 1997 for discussion of the impact of ownership status in the context of nursing homes). Researchers exploring the effects of for-profit, private non-profit, and public hospital ownership on medical productivity have reported empirical results consistent with a wide range of theoretical results. On one hand, some researchers report that the for-profit form achieves greater productive efficiency (e.g., Wilson and Jadlow 1982, Herzlinger and Krasker 1987, Cutler and Horwitz 1997). On the other hand, many studies find that for-profit hospitals have higher costs or markups than do non-profits (e.g., Lewin et al. 1981, Coelen 1986, Ettner and Hermann 1997, Pattison and Katz 1983, Pattison 1986, Zuckerman et al. 1994), that for-profit hospitals offer lower quality (Hartz et al. 1989, Mark 1996), or that for-profit hospitals supply less uncompensated or charity care (Frank, Salkever, and Mitchell 1990, Norton and Staiger 1994, Mann et al. 1995; but see Sloan and Vraiciu 1983 and Young, Desai, and Lukas 1997). And, a substantial literature argues that non-profit hospitals have costs and/or quality similar to that of for-profits, concluding that hospitals are socially indistinguishable on the basis of ownership status (e.g., Sloan and Vraiciu 1983, Becker and Sloan 1985, Gaumer 1986, Shortell and Hughes 1988, Keeler et al. 1992, Patel, Needleman, and Zeckhauser 1994, Sloan et al. 1998, McClellan and Staiger 1999).

The existing empirical literature has three key limitations. First, it does not generally examine both the financial implications and patient health consequences of hospital ownership structure; without significant additional assumptions, it is not possible to draw conclusions about the impact of ownership on productivity or welfare. Second, those studies that do seek to make welfare comparisons generally suffer from potential selection bias. If hospital ownership (or any other hospital characteristic) does affect productivity, and sicker patients (who value productivity more highly) seek out more productive hospitals, then estimates of the impact of ownership status that do not completely control for patient heterogeneity will represent a combination of the true impact and unobserved differences between patient populations. Although some work has

sought to control for differences in patient populations based on measurement of observable patient characteristics, observational data on health status is notoriously incomplete, making past estimates of the impact of ownership difficult to interpret.

Third, it does not generally evaluate the spillover effects of for-profit hospitals on the practices of other types of hospitals in a market. From a policy perspective, spillover effects may be much more important than direct (own-hospital) effects because public and for-profit hospitals account for a small fraction of admissions in most markets. For example, if for-profit hospitals account for approximately 10 percent of admissions in a market, and for-profit hospitals have 5 percent higher expenditures per patient, then even a doubling of the share of for-profit hospitals' admissions would lead to health care costs that were 1 percent higher in aggregate. Moreover, the aggregate increase may be even smaller or negative, if increasing presence of for-profits results in more efficient behavior by not-for-profits. The fact that hospitals of different ownership statuses may engage in different types of strategic behavior, or that the ownership status of an area's hospitals may interact with competitive forces to affect medical decision-making, may be much more important than the "direct" effects of for-profit hospitals on practice patterns, health care costs, and health outcomes.

Our approach in this paper addresses these limitations. We use longitudinal data on all nonrural elderly Medicare recipients hospitalized for a treatment of a new heart attack in 1985-94, matched with comprehensive data on all nonrural U.S. hospitals over the same period. This enables us to examine the resources used in and the health benefits of treatment for a given occurrence of illness in hospitals of different ownership. Our methods offer an alternative approach to dealing with selection bias and measuring spillover effects. As we discuss below, this approach can be used to estimate consistently the effect of any hospital characteristic. Based on a model of individual patients' demand for hospital services, we construct area-based measures of the "density" of hospitals of different ownership types -- that is, the probability that a patient residing in an area will be admitted to a hospital of a given ownership type, based only on exogenous determinants of hospital demand. We assess the effect of ownership-type densities on medical expenditures and health outcomes, holding constant the area densities of other hospital characteristics, the competitiveness and other features of hospital markets, patient characteristics, and zip-code level fixed effects.

This approach allows us to assess the relative efficiency of ownership-induced differences in medical practice by identifying the "cost-effectiveness" of hospital organizational form, that is, the cost of an additional year of life or an additional year of cardiac health associated with different ownership forms in a market. For example, if non-profit hospitals provide lower levels of treatment intensity, without leading to any deterioration in patient health outcomes, then the non-profit form is the most productive way to organize hospital markets. If the non-profit form leads to higher levels of intensity, but not to lower levels of adverse outcomes, then the non-profit form is not a productive way to provide hospital services. If the non-profit form either increases or decreases both costs and health, then our results still provide quantitative guidance for policies. For example, if non-profits provide treatment that leads to low expenditures per

year of life saved relative to generally accepted costs per year of life saved of other medical treatments, then they lead to efficient care; but if non-profits provide treatment that leads to high levels of expenditures per year of life saved, then they provide incentives for socially excessive care.

Section I of the paper discusses the theoretical ambiguity of the impact of hospital ownership on medical productivity. Section II reviews the previous empirical literature on this topic. Although this literature has helped to shape understanding of markets for medical care, Section II describes its three key limitations, and how these limitations affect its assessments of the consequences of hospital ownership. Section III describes how our approach addresses these limitations, and presents our econometric models of the effects of hospital ownership on medical treatment decisions, health care costs, and health outcomes. Section IV discusses our two data sources, Section V presents our empirical results, and Section VI concludes.

I. Theoretical Models of the Impact of Hospital Ownership

In stylized microeconomic models of organizations, basic theory predicts that the for-profit organizational form leads to efficient production, because of the high-powered incentives that arise from the presence of a well-defined residual claimant with enforceable property rights. However, markets for health care in general, and markets for hospital services in particular, deviate substantially from the assumptions behind this model. For this reason, there is an extensive theoretical literature examining the welfare implications of hospital ownership status.

One line of research, starting with Arrow (1963), hypothesizes that market failures in health care can lead the non-profit organizational form to be socially superior. At the base of these models is the assumption that non-profits either do not or can not pursue an objective of pure profit maximization (for a general review, see Rose-Ackerman 1996). Because of this constraint, non-profits might address contract failures in the presence of informational asymmetries between consumers and producers (e.g., Nelson and Krashinsky 1973; Easley and O'Hara 1983; Hansmann 1980, 1987, 1996). In markets for health care services, for-profit firms may have both the incentive and the opportunity to take advantage of customers by providing less service to them than was promised. A private nonprofit or publicly-owned firm, in contrast, may offer consumers the advantage that those who control the firm either do not or can not pursue pure profit maximization. Thus, physicians and managers of public or private non-profit hospitals may have less incentive and/or ability to take advantage of patients than do their counterparts at for-profit hospitals. Alternatively, private non-profit hospitals might serve as an extragovernmental means to satisfy residual demand for public health services, if hospital markets have public good aspects (Weisbrod 1977, 1988). Specifically, if governments support public goods only at the level demanded by the median voter, then non-profits may arise to supplement public provision of public goods in areas with above-median demand.

Another line of research shares the assumption that non-profits pursue different objectives than do for-profits, but concludes that the non-profit form may be socially inferior to

the for-profit form. Newhouse (1970), for example, models non-profit hospitals as maximizing quantity and quality of treatment subject to a zero-profit constraint. Non-profit hospitals are able to behave in this fashion both because the government gives tax benefits to non-profit providers of health care services, and because health-insurance and tax incentives make consumers of medical care relatively insensitive to price. The welfare implications of a Newhouse-type model are in general ambiguous. On one hand, if the additional quantity and quality of treatment attributable to the non-profit form results in the provision of additional treatments with expected value greater than cost, then non-profit hospitals may increase efficiency, even if their treatments are more expensive. On the other hand, if quality maximization leads to marginal treatment that results in high expenditures per year of life saved, then the non-profit form provides socially excessive care.

Other work has pointed out that there is no definitive relationship between ownership status and social welfare, even if both non-profit and for-profit hospitals seek to maximize revenues less costs. Pauly and Redisch (1973) model the formation of non-profit hospitals' strategy directly, hypothesizing that non-profit hospitals behave as cooperatives controlled by physicians, operated to maximize physicians' private benefit. As they observe, this model is consistent with the supply of socially excessive quality by non-profit hospitals. If "quality" is produced through the application of nonphysician labor and capital, then noncooperative behavior among controlling physicians could lead to rent dissipation that took the form of high quality. An alternative implication of this approach (e.g., Becker and Sloan 1985) is that non-profit hospitals may have costs and quality similar to that of for-profits, if doctors monitor the efficiency of non-profit hospitals just as effectively as do equity-holders in a for-profit enterprise.

These models also highlight the fact that there may be important spillover effects of hospital ownership. For example, in markets with a high density of for-profit hospitals, non-profits may be less able either to provide social benefits or impose social costs (described by Kennedy (1985) as the "proprietorization of voluntary hospitals"). Alternatively, if they face competition from for-profits, they may be more likely to emulate for-profit behavior, for example by exploit loopholes in Medicare reimbursement (e.g., Cutler and Horwitz 1997). Spillover effects may also mediate the effects of competition more generally. If nonprofits seek to maximize quality subject to a slack constraint (e.g., Newhouse 1970), and the slack constraint is tighter in more competitive markets, then the social costs of the non-profit form might be greater in less-competitive markets. Alternatively, common ownership status of hospitals in a market may inhibit competition, if hospitals of a given ownership status are more able to engage in collusive practices.

II. Previous Empirical Literature

The theoretical debate over the effect of hospital ownership structure on medical productivity and social welfare has spawned a vast empirical literature that includes results consistent with a wide range of theoretical models. One reason for the empirical literature's indeterminacy – indeed, its main shortcoming – is that many of the studies do not assess directly

both the financial implications and patient health consequences of hospital ownership structure. Much of the literature analyzes the impact of ownership status on staffing, spending, costs, charges, or price/cost markups (Lewin 1981, Wilson and Jadlow 1982, Pattison and Katz 1983, Sloan and Vraiciu 1983, Becker and Sloan 1985, Coelen 1986, Pattison 1986, Watt et al. 1986, Grosskopf and Valdmans 1987, Herzlinger and Krasker 1987, Patel, Needleman, and Zeckhauser 1994, Zuckerman et al. 1994, Kao 1998, Silverman, Fisher, and Skinner 1999). However, without information on differences in patient health outcomes (e.g., output) by ownership status, these studies can not draw conclusions about the impact of ownership on medical productivity without significant additional assumptions. Conversely, several other studies focus only on the effect of ownership on outcomes, but not on the effect of ownership on resource use (Gaumer 1986, Shortell and Hughes 1988, Hartz et al. 1989, Keeler et al. 1992, McClellan and Staiger 1999). Other research is concerned with the effect of hospital ownership and the interaction between hospital market structure and ownership on the provision of uncompensated or charity care (e.g., Sloan and Vraiciu 1983, Frank, Salkever, and Mitchell 1990, Norton and Staiger 1994, Mann et al. 1995, Young, Desai, and Lukas 1997), and so does not address the issue of how ownership status affects welfare through productivity.

Some recent studies use data on individual patients admitted to the hospital to measure the impact of the ownership status of patients' hospital of admission on both the inputs and the outputs of the medical care production process (Mark 1996, Ettner and Hermann 1997, Sloan et al. 1998). However, these studies generally suffer from another important shortcoming: possible selection bias. If hospital ownership (or any other hospital characteristic) does affect productivity, and sicker patients (who value productivity more highly) seek out more productive hospitals, then estimates of the impact of ownership status that do not completely control for patient heterogeneity will represent a combination of the true impact and unobserved differences between hospitals' patient populations. Although the studies have sought to correct for selection bias by controlling for measures of patient demographic characteristics and pre-admission comorbidity and functionality in their estimation of the impact of ownership status, observational data on health status is notoriously incomplete, making estimates of the impact of ownership difficult to interpret. Ettner and Hermann (1997) use instrumental variables techniques to examine the effect of hospital ownership on Medicare charges and costs for a given psychiatric admissions, and the effect of ownership on the probability of readmission and mode of discharge. According to their IV estimates, non-profit psychiatric hospitals have lower costs but higher charges per admission than do for-profits; among patients admitted to psychiatric units of general hospitals, non-profit hospitals have lower costs and charges than do for-profits. In all cases, non-profit and for-profit hospitals have similar measures of health outcomes. However, even this study does not account for the possible spillover effects of hospital ownership. And, it does not fully control for other characteristics of hospitals – such as their system membership status – that may be correlated with ownership status and medical productivity.

Few studies have provided empirical evidence on the spillover or market-level effects of ownership. Silverman, Skinner and Fisher (1999) find significantly more rapid growth of Medicare expenditures between 1989-95 in "hospital service areas" characterized by complete

for-profit ownership by the end of the period. However, their stratification of service areas into all-not-for-profit, "mixed," and all for-profit may be best suited to differentiating the consequences of exclusive for-profit ownership. This is a relatively rare occurrence: 241 service areas were entirely for-profit by the end of the period, in contrast to 2,885 that were entirely not-for-profit and 295 that were "mixed." Their framework is not designed for identifying the competitive interactions among hospitals and ownership types that is the focus of our analysis: the service areas are relatively small (there are approximately 5,000 acute-care hospitals in the country), with significant numbers of patients were treated by hospitals other than those in their service areas. Moreover, they do not examine the outcome consequences of differences in spending growth. We discuss this study further below, in describing some of the limitations of our results.

III. Models

We offer an alternative approach to dealing with selection bias that also measures spillover effects, and thus provides a more complete assessment of the market-level consequences of hospital ownership for medical productivity. As we describe in more detail in the next section, we analyze longitudinal data on all nonrural elderly Medicare recipients hospitalized for a treatment of a new heart attack in 1985-94, matched with comprehensive data on all nonrural U.S. hospitals over the same period. To avoid the problems of prior studies in obtaining accurate estimates of the effects of ownership structure, we use a three-stage method. The core idea of our method is to develop an explicit model of the demand for hospital services based on exogenous factors such as travel distances, and then to use this model as a basis for the construction of exogenous measures of patient flows to hospitals of different ownership statuses and other broad types. This approach allows us to assess the impact of ownership status, holding other hospital characteristics constant, while avoiding the major empirical obstacles in previous studies of ownership described in Section II. In addition, our data permit a thorough evaluation of the consequences of ownership and other hospital characteristics for the medical expenditures and outcomes of a given episode of care.

In stage one, we specify and estimate patient-level hospital choice models as a function of exogenous characteristics of the patient, the geographic area, and all of the nearby hospitals, along the lines of Kessler and McClellan (2000).[1] Estimates from these models provide for each patient the probability of admission to every nearby hospital, based only on exogenous factors. We model the extent to which hospitals with various characteristics -- for-profit, private non-profit, or public ownership; size, in terms of the number of beds; teaching status; and system

[1]We define "nearby" to include all nonfederal, general medical /surgical hospital within 35 miles of the patient's residence with at least five AMI admissions, and any large, nonfederal, general medical/surgical teaching hospital within 100 miles of the patient's residence with at least five AMI admissions. (We explain the reason for these *a priori* constraints on patients' choices below; because markets for cardiac care are generally much smaller than the constraints, they are not restrictive.)

membership status – at various distances from each patient's residence affect each patient's hospital choice, and we also allow each patient's demographic characteristics to affect her likelihood of choosing hospitals of one type over another.

In stage two, we use this vector of probabilities in two ways. First, we use the vector of probabilities to construct area-based measures of the "density" of admissions to hospitals with different characteristics, including ownership type. We calculate the probability of each individual's admission to hospitals of different sizes and different ownership, teaching, and system membership statuses, based only on exogenous factors. Weighted sums of these probabilities define the density of admissions to hospitals of each type in every zip code of patient residence in the country. The calculation of the probabilistic-admission-weighted densities of hospital characteristics, $hosp\_char^{pat*}$, is described in Kessler and McClellan (2000).

Second, we use the vector of probabilities to construct the exogenous patient zip-code measures of market competitiveness (very concentrated, moderately concentrated, unconcentrated markets, and very unconcentrated, as measured by a Hirschman-Herfindahl index) and capacity utilization described in Kessler and McClellan (2000). Because hospital ownership status may be correlated or interact with hospital market structure, simply examining the unconditional average effect of hospital ownership status on decision-making may lead to biased assessments of the effect of ownership, and may mask important differences in the impact of ownership in different market environments (e.g., Dranove 1988, Kopit and McCann 1988, Lynk 1995).

Stage three of our method estimates the effect of the area density of hospital ownership status, the density of other hospital characteristics, and hospital market structure on Medicare hospital expenditures in the year after the individual's admission for a new heart attack and on several important measures of patient health outcomes.[2] These models provide a consistent estimate of the sum of the strategic and the area-average direct effects, holding constant the area average density of other characteristics, regardless of the correlation between unobserved determinants of patient health status and hospital characteristics.

We assess the impact of ownership on hospital expenditures and health outcomes, using longitudinal data on cohorts of elderly Medicare beneficiaries with heart disease in 1985, 1988,

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[2]Ideally, we would like to identify separately three theoretically distinct ownership status effects: the direct effect of an individual's initial hospital of admission, the direct effect of an individual's subsequent hospital(s) of admission, and the (spillover) effects of other area hospitals. However, our principal source of exogenous variation in hospital demand – differential distances between patients' residences and different types of hospitals – is not sufficient to distinguish between the direct effects of an individual's several hospitals' ownership statuses and area-based spillover effects. Interactions between area-based instruments and individual patient characteristics are theoretically sufficient to separate direct from strategic effects; but as we discuss below, these interactions have very low power in practice.

1991, and 1994. We use zip-code fixed effects to control for all time-invariant heterogeneity across small geographic areas, hospitals, and patient populations; our estimates of the effect of competition are identified using *changes* in hospital markets. In addition, we include separate time-fixed-effects for individuals from differently-sized geographic areas (i.e., smaller and larger metropolitan areas), and include controls for time-varying characteristics of geographic areas (such as the travel distance between individuals' residence and their closest hospital), to address the possibility that our estimated effects of competition are due to still other omitted factors that were correlated with health care costs, health outcomes, and hospital markets. We describe these variables in more detail in the next section.

In zip code k during year t = 1,. . ., T, observational units in our analysis consist of individuals i=1,. . ., N_{kt} who are initially admitted to hospital j with new occurrences of particular illnesses such as a heart attack. Each patient has observable characteristics U_{ikt}: four age indicator variables (70-74 years, 75-79 years, 80-89 years, and 90-99 years; omitted group is 65-69 years), gender, and black/nonblack race; plus a full set of interaction effects between age, gender, and race; and interactions between year and each of the age, gender, and race indicators. The individual receives treatment of aggregate intensity R_{ikt}, where R is total hospital expenditures in the year after the health event. The patient has a health outcome O_{ikt}, possibly affected by the intensity of treatment received, where a higher value denotes a more adverse outcome (O is binary in all of our outcome models).

For comparison with previous work, we first estimate linear models of average expenditure and outcome effects of the ownership status of each patient's hospital of admission. These models are of the form

$$\begin{aligned}\ln(R_{ikt}) = {} & \delta_k + \sigma_t M_k + U_{ikt}\phi + OWN_{jt} * I(1985 \vee 1988)\,\eta_{1980s} + OWN_{jt} * I(1991 \vee 1994)\,\eta_{1990s} \\ & + Z_{jt} * I(1985 \vee 1988)\,\psi_{1980s} + Z_{jt} * I(1991 \vee 1994)\,\psi_{1990s} + \xi_{ikt} \quad ,\end{aligned} \tag{1}$$

where δ_k is a zip-code fixed-effect; σ_t is a time fixed-effect; M_k is a vector of six indicator variables denoting the size of individual i's MSA; I(.) is an indicator function; OWN_{jt} is a vector of two indicator variables denoting whether hospital j is a public or a for-profit hospital (omitted group is non-profit); Z_{jt} is a vector of three indicator variables describing the size (>300 beds), teaching status, and system membership status of hospital j; and ξ_{ikt} is a mean-zero independently-distributed error term with $E(\xi_{ikt}|. . .) = 0$. Based on the results from our research into the effects of competition, we allow η and ψ to vary in the 1980s and 1990s. Our dataset includes essentially all elderly patients hospitalized with the heart diseases of interest for the years of our study, so that our results describe the actual average changes in expenditures associated with changes in competition. We report standard errors for inferences about average differences that might arise in potential populations (e.g., elderly patients with these health problems in other years).

In this model, η represents the impact on treatment intensity or health outcomes of

admission to a hospital of a given ownership status. OLS estimates of η suffer from potential selection bias, because $E(\zeta_{ikt} \mid OWN_{jt}) \neq 0$. If hospital ownership (or any other hospital characteristic) does affect productivity, and sicker patients (who value productivity more highly) seek out more productive hospitals, then estimates of the impact of ownership status that do not completely control for patient heterogeneity will represent a combination of the true impact and unobserved differences between patient populations. Furthermore, if the true model of the impact of ownership status on medical productivity includes both a direct effect of the ownership status of a patients' hospital of admission and a strategic effect of the ownership status of other hospitals in a relevant market, even IV estimates of η from equation (1) would be inconsistent.

To address these issues, we estimate models of the area effects of the density of admission to hospitals of different ownership type, holding constant the area densities of admissions to hospitals with various other characteristics, and the competitiveness and other characteristics of hospital markets:

$$\begin{aligned}\ln(R_{ikt}) = {} & \delta_k + \sigma_t M_k + U_{ikt}\phi + OWN_{kt} * I(1985 \vee 1988)\, \eta_{1980s} + OWN_{kt} * I(1991 \vee 1994)\, \eta_{1990s} + \\ & HHI_{kt}^{pat*} * I(1985 \vee 1988)\, \gamma_{1980s} + HHI_{kt}^{pat*} * I(1991 \vee 1994)\, \gamma_{1990s} + \\ & OMC_{kt} * I(1985 \vee 1988)\, \psi_{1980s} + OMC_{kt} * I(1991 \vee 1994)\, \psi_{1990s} + \xi_{ikt} \quad ,\end{aligned} \tag{2}$$

where OWN_{kt} is a vector of two indicator variables denoting whether zip code k has a high density of for-profit relative to non-profit hospitals, or public relative to non-profit hospitals; HHI_{kt}^{pat*} is a vector of three indicator variables from Kessler and McClellan (2000) denoting the competitiveness quartile of a zip code's hospital market for AMI (very concentrated, moderately concentrated, or unconcentrated markets, as measured by a Hirschman-Herfindahl index, omitted group is very unconcentrated); and OMC_{kt} is a vector of other market characteristics, including capacity utilization (CAP_{kt}^{pat*} from Kessler and McClellan (2000)), the travel distance to the hospital nearest to zip code k, an indicator for above-median HMO enrollment in the state, and three indicator variables denoting whether zip code k has a high density of large, teaching, and system hospitals. We use two alternative definitions of OWN_{kt}: whether zip code k has probabilistic-admission-weighted for-profit/non-profit (or public/non-profit) relative density above the median, and relative density above the 75th percentile, to investigate the impact of increasing rates of for-profit and public ownership status at different levels of relative ownership.

In addition, we estimate a variant of (2) to investigate whether ownership status effects vary in more versus less competitive markets:

$$\begin{aligned}\ln(R_{ikt}) = {} & \delta_k + \sigma_t M_k + U_{ikt}\phi + OWN_{kt} * I(1985 \vee 1988)\, \eta_{1980s}^{A} + OWN_{kt} * I(1991 \vee 1994)\, \eta_{1990s}^{A} + \\ & OWN_{kt} * VHI\_HHI_{kt} * I(1985 \vee 1988)\, \eta_{1980s}^{B} + OWN_{kt} * VHI\_HHI_{kt} * I(1991 \vee 1994)\, \eta_{1990s}^{B} + \\ & OWN_{kt} * HILO\_HHI_{kt} * I(1985 \vee 1988)\, \eta_{1980s}^{C} + OWN_{kt} * HILO\_HHI_{kt} * I(1991 \vee 1994)\, \eta_{1990s}^{C} + \\ & HHI_{kt}^{pat*} * I(1985 \vee 1988)\, \gamma_{1980s} + HHI_{kt}^{pat*} * I(1991 \vee 1994)\, \gamma_{1990s} + \\ & OMC_{kt} * I(1985 \vee 1988)\, \psi_{1980s} + OMC_{kt} * I(1991 \vee 1994)\, \psi_{1990s} + \xi_{ikt} \quad ,\end{aligned} \tag{2a}$$

where VHI_HHI and HILO_HHI are indicator variables denoting whether zip code k is a very concentrated (top quartile), or a moderately or unconcentrated (second or third quartile) hospital market.

IV. Data

We use data from four sources. First, we use comprehensive longitudinal Medicare claims data for the vast majority of elderly nonrural beneficiaries who were admitted to a hospital with a new primary diagnosis of acute myocardial infarction (AMI) in 1995, 1988, 1991, and 1994. Data on patient demographic characteristics were obtained from the Health Care Financing Administration's HISKEW enrollment files. Patients with admissions for the same illness in the prior year were excluded to insure that we examine only new occurrences of illness. We calculate four different measures of the financial consequences of differences in hospital markets and hospital ownership. Measures of one-year hospital expenditures were obtained by adding up all acute plus nonacute inpatient hospital reimbursements (including copayments and deductibles not paid by Medicare) from insurance claims for all treatments in the year following each patient's initial admission for AMI. This is a nontrivial exercise under the DRG-based Medicare PPS, since more intensive treatments, transfers, and readmissions lead to higher expenditures, and hospital ownership status may affect resource use through these channels.

We examine three measures of health outcomes. We calculate mortality rates within one year of the index AMI admission with death dates based on death reports validated by the Social Security Administration. Measures of the occurrence of cardiac complications were obtained by abstracting data on the principal diagnosis for all subsequent admissions (not counting transfers and readmissions within 30 days of the index admission) in the year following the patient's initial admission. Cardiac complications included rehospitalizations within one year of the initial event with a primary diagnosis (principal cause of hospitalization) of either subsequent AMI or heart failure. Treatment of AMI patients is intended to prevent subsequent AMIs if possible, and the occurrence of heart failure requiring hospitalization is evidence that the damage to the patient's heart from ischemic disease has serious functional consequences.

Second, we use data on U.S. hospital characteristics collected by the American Hospital Association (AHA). The response rate of hospitals to the AHA survey is greater than 90 percent, with response rates above 95 percent for large hospitals (>300 beds). Because our analysis involves nonrural Medicare beneficiaries with AMI, we examine only nonrural, nonfederal hospitals that ever reported providing general medical or surgical services (for example, we exclude psychiatric and rehabilitation hospitals from analysis). To assess hospital size and bed capacity per patient, we use total general medical/surgical beds, including ICU/CCU and emergency beds. We classify hospitals as teaching hospitals if they report at least 20 full-time residents.

Third, we use a hospital system database constructed from multiple sources (see Madison 1999 for a detailed discussion). The AHA survey contains extensive year-by-year information on

hospital system membership status. First, the AHA supplies a system identification code (SYSID) that groups hospitals into systems according to an internal AHA process. Second, the AHA asks hospitals to self-report any system affiliations that they might have. Our validity checking indicated that the universe of systems and system hospitals, and the timing of hospitals' system membership, as defined by AHA did not conform to discussion of hospital systems in the trade press such as *Modern Healthcare*. We therefore created our own system database based on the AHA SYSID, the AHA self-reported system affiliation, and our own research using other sources, including results from an annual survey of hospital systems published in *Modern Healthcare*. We also corrected the timing of hospitals' reported entry and exit from systems as defined by the AHA, based on independent sources and our own algorithms. For example, if a hospital reported membership in a system from 1985-1990, and from 1992-95, we imputed that hospital's system membership in 1991.

Fourth, we calculate annual HMO enrollment rates by state based on information from InterStudy Publications, a division of Decision Resources, Inc. Enrollment rates were calculated by dividing the number of enrollees (exclusive of Medicare supplemental enrollees) by the population. We excluded residents of the District of Columbia are excluded from all analyses because of concerns about the validity of measured HMO enrollment rates for DC.

Table I describes the population of elderly AMI patients and the densities of hospital characteristics in areas defined by their zip codes of residence over the 1985-94 period. The first column descirbes our overall sample, the next three columns describe patient characteristics by ownership status of their hospital of initial admission, and the last three columns describe the relative differences in each of these characteristics for the different ownership types. The first four rows of the table show that the inpatient treatment intensity and health outcomes of elderly AMI patients admitted to for-profit hospitals was very similar to the treatments and outcomes of patients admitted to nonprofit hospitals. Inpatient hospital expenditures and mortality were virtually identical, and readmission rates for cardiac complications were at most .7 percentage point lower among those admitted to a for-profit hospital. Patients initially admitted to a public hospital had significantly lower expenditures (about 11 percent lower), but very similar outcomes. However, differences between columns of Table fail to account for other differences in the characteristics of individual hospitals (such as system membership or teaching status) that may be correlated with ownership status; differential selection of patients on the basis of their health status into different types of hospitals; differential trends in ownership status over time; and market effects, including both market competitiveness and spillover effects of ownership.

The last rows of Table I show how patients were divided into the geographic areas on which our principal analysis is based. About half of elderly AMI patients lived in areas with above-median density of probabilistic hospital admissions to for-profit/nonprofit hospitals and to public/nonprofit hospitals (the population of patients is not divided equally between above- and below-median density areas because the median area is determined without weighting by the number of patients). The cutoffs in Table I show that the median area is very heavily nonprofit -- the median area has approximately 83 times (1/.012) the density of probabilistic admissions to a

nonprofit as to a for-profit hospital, and approximately 30 times (1/.033) the density of probabilistic admissions to a nonprofit as to a public hospital. Table I also reflects the dominance of the non-profit form in the hospital industry: approximately 80 percent of elderly AMI patients were initially admitted to a nonprofit hospital, with the remaining 20 percent split almost equally between for-profit and public hospitals.

Using data from 1985 and 1994, Tables IIa-IId illustrate how our methods will account for factors that have confounded previous investigations into the effects of hospital ownership. Table IIa groups patients into areas, depending on the relative level and growth rate of probabilistic-admission-weighted densities of for-profit/nonprofit and public/nonprofit hospitals in their zip code of residence. Table IIa classifies areas as having moved from above- to-below median; remained below median; remained above median; or moved from below-to-above median in terms of the relative density of for-profit and public hospitals. Table IIb replicates Table IIa, substituting the 75th percentile of the distribution of relative ownership-type densities for the median as the cutoff; Tables IIc and IId replicate Tables IIa and IIb, substituting mortality for the level of inpatient hospital expenditures.

Table IIa suggests that spillover effects of ownership might exert an important impact on hospital resource use. The rightmost column shows that patients from areas that moved from below-median to above-median density of for-profit hospitals – in general, moving from exclusively non-profit ownership in the area to entry by at least one nearby for-profit – showed dramatically lower growth in inpatient hospital expenditures. Real expenditures rose approximately 14 percent, as compared to an average of 34.6 percent across all areas. In contrast, areas that had a presence of for-profit hospitals in both 1985 and 1994 had much higher expenditure growth (35.7 percent) than did below-to-above median areas, but still had lower expenditure growth than areas that essentially no for-profit hospitals in either 1985 or 1994 (37.9 percent). Expenditure-saving spillover effects of for-profit entry do not appear to exist only around the median relative density. As Table IIb shows, patients from areas moving from below to above the 75th percentile of for-profit relative density (approximately 5 times as many probabilistic admissions to nonprofits as to for-profits) have lower rates of expenditure growth than do patients from areas moving from above to below the 75th percentile (21.88 percent as compared to 33.79 percent growth), and patients from areas that were always above the 75th percentile had lower expenditure growth than patients from areas that were always below the 75th percentile (26.27 percent as compared to 37.97 percent growth).

The effects of public hospitals on expenditures, in contrast, are more equivocal. Areas gaining a presence of public hospitals have slightly lower expenditure growth than areas losing a presence of public hospitals (compare the fourth and first columns of Table IIa), but areas with a long-run presence of public hospitals have higher expenditure growth than areas with a long-run absence of public hospitals (compare the third and second colums).

Tables IIc and IId present average one-year mortality by the relative density of hospital ownership types in patients' zip code of residence. Table IIc shows that areas losing a presence

of for-profit hospitals show larger mortality improvements – 9.0 percentage points decline as compared to an average 7.3 percentage point decline over this period. However, areas with a presence of for-profit hospitals in both 1985 and 1994 had slightly better mortality trends than did areas with an absence of for-profit hospitals – 7.6 percentage points as compared to 7.3 percentage points. Gaining a presence of public hospitals led to a very large mortality decline, although areas with a presence of public hospitals in both periods had very similar mortality trends to areas without a presence of public hospitals in both periods. In contrast to the expenditure effects, above versus below 75th percentile for-profit areas looked very similar, although this is not as true for public hospitals (Table IId).

These results suggest that changes in ownership composition in a market may have nonlinear effects on costs and outcomes. Still, because these results do not control for other area characteristics that may be correlated with but not causally related to hospital ownership, nor for potentially correlated effects of changes in market competitiveness, they do not isolate the independent effect of for-profit or public hospitals on medical productivity.

V. Results

Table III presents for comparison purposes OLS estimates of the effect of ownership status of hospital of admission on individuals' Medicare expenditures and health outcomes, controlling for individual characteristics, other characteristics of hospital of admission, zip-code fixed effects, and time fixed effects (allowed to vary in differently populous areas). Table III shows that patients admitted post-1990 to either for-profit or public hospitals have similarly lower levels of expenditures than do patients admitted to nonprofit hospitals, without any significant or substantial consequences for outcomes; this suggests that the nonprofit form leads to lower levels of medial productivity. Teaching hospitals post-1990, similarly, deliver much more costly care without offering correspondingly significant health benefits. However, each of these hospital characteristics may be correlated with different changes in market competitiveness or in patient selection, biasing the estimated effects of ownership. Moreover, these estimates do not account for spillover effects of changes in ownership.

Tables IV and V show that such effects are important. The Tables present estimates from equations (2) and (2a) of area effects of the density of different hospital ownership types, holding constant the density of other hospital characteristics, hospital market structure, and characteristics of patients and geographic areas. Estimates of the impact of ownership structure η from equations (2) and (2a) are a combination of the average direct effect of the ownership of the hospital of initial admission (incorporating subsequent transfers) and the strategic interaction effects of hospitals within a residential zip code.

Table IV presents estimates of equation (2), and shows that above-median density of for-profit/non-profit hospitals leads to statistically significantly lower levels of total expenditures for area patients compared to below-median density, both before and after 1990 -- although this difference is declining over time, from approximately 6.1 percent pre-1990 to approximately 3.2

percent post-1990. Patients from areas with above-median relative density of public/non-profit hospitals have slightly lower expenditures pre-1990, but significantly higher expenditures post-1990 (approximately 4.2 percent higher).

The presence of for-profit hospitals in an area does not have a significant effect on patient health outcomes from AMI, although the point estimates suggest that areas with above-median relative density of probabilistic patient admissions to for-profits have slightly higher mortality (.15 percentage points post-1990). Coupled with the estimated expenditure effects above, this implies that the additional treatment delivered in an area with essentially no admissions to for-profit hospitals has an expenditure/outcome effect ratio of $411,900 per additional AMI survivor to one year in 1993 dollars; using the upper bound of the 95-percent confidence intervals for the mortality effects leads to an estimated expenditure/effect ratio of $65,000 per additional AMI survivor (the difference arises out of the imprecision of the estimated mortality effects).[3] In contrast, greater presence of public hospitals (fewer than 30 (= 1/.033) times as many expected admissions to non-profit hospitals versus public hospitals) in an area leads to significantly higher mortality levels post-1990 (at the 10 percent level).

Other hospital characteristics also affect health care expenditures and health outcomes. Before 1990, neither large hospitals, teaching hospitals, nor system hospitals had significant effects on medical productivity. But after 1990, above-median densities of large and teaching hospitals lead to more intensive area practice patterns, as measured by expenditures, and above-median densities of system hospitals lead to substantially lower costs on average. A greater presence of teaching hospitals post-1990 led to substantial mortality improvements (significant at the 10 percent level) – using the point estimates of expenditure and mortality effects, the additional treatment for AMI delivered in areas with above-median density of probabilistic admissions to teaching hospitals had an expenditure/benefit ratio of $62,400 per year of life saved[4] – with no increase in cardiac complications rates, indicating that the additional survivors were not in markedly worse health.

Although the estimated effects of competition among hospitals on medical productivity are similar to those presented in Kessler and McClellan (2000), the estimated effect of two other area characteristics – hospital bed capacity per patient and area managed care enrollment -- are quite different. Although the estimates in Kessler and McClellan (2000) control for above-median area densities of hospital sizes, teaching status, and public-ownership status, they do not control for the density of for-profit versus nonprofit hospitals or for the density of hospital systems. Controlling for the above-median presence of these additional area characteristics drastically reduces the estimated effect of hospital bed capacity on expenditure levels, leaving it insignificantly different from zero (although high bed capacity does continue to lead to higher

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[3]Given a mean level of 1994 expenditures, .032*$19,301/.0015 ≈ $411,800; evaluated at the upper bound of the mortality confidence interval .032*$19,301/.0095 ≈ $65,000.

[4].032*$19,301/.0065 ≈ $62,400.

mortality and lower complication rates even after detailed ownership controls are included). Similarly, the absolute value of the magnitude of the effect of managed care enrollment on expenditures declines substantially, from approximately 7 percent (Table VII, Kessler and McClellan (2000)) to approximately 2 percent after detailed ownership controls are included. The difference between these estimates suggest that part of the detrimental effects of bed capacity, and part of the beneficial effects of managed care spillovers, can be attributed to differences in hospital ownership and system membership across areas.

The right panel of Table IV presents estimates of the effect of being above versus below the 75th percentile of the probabilistic-admission weighted density of different hospital characteristics. At least post-1990, the effect of each of each of the hospital characteristics declines in absolute value. Indeed, the effect of for-profit ownership on expenditure levels becomes insignificant. This indicates that the incremental spillover effects identified in the left panel of the Table diminish at higher densities of hospital characteristics. The 75th percentile results also suggest one possible source of the difference between our results and those presented in Silverman, Skinner and Fisher (1999), who find significantly more rapid growth of Medicare expenditures between 1989-95 in "hospital service areas" characterized by complete for-profit ownership by the end of the period.

Table V presents estimates of η from equation (2a): the impact of the interactions between ownership density and market competitiveness, holding constant area density of other hospital characteristics. Table V shows that, post-1990, a mixture of ownership types always improves medical productivity in uncompetitive areas, compared to productivity in an analogous competitive area. According to the first row of the bottom panel of the Table, a very competitive area that gains a presence of for-profit hospitals shows essentially no expenditure declines, but shows a statistically significant .68 percentage point increase in readmissions for subsequent AMIs. In contrast, according to the second row of the bottom panel of the Table, a very uncompetitive area that gains a presence of for-profit hospitals shows an approximately 6 percent decline in expenditures with no significant increases in rates of adverse outcomes (although the standard errors are sufficiently large to preclude powerful rejections of the null of no effect). Similarly, although a very competitive area that gained a presence of public hospitals would have higher expenditures, a very uncompetitive area that gained a presence of public hospitals would not. Put another way, regardless of the effect of a presence of for-profit or public hospital ownership on the absolute levels of expenditures and outcomes, the effect of a presence of for-profit or public ownership is always more socially favorable in uncompetitive versus competitive areas. This finding may be due to the fact that uniformity of ownership in an area facilitates collusion.

The second key finding presented in Table V is that the effect of hospital systems differs dramatically in competitive versus uncompetitive areas. Based on area effect estimates, hospital systems are uniformly productivity-enhancing, but much more so in competitive areas. The effect of living in an area with an above- versus a below-median density of hospital systems leads to a reduction in inpatient expenditures that is approximately twice as large in very competitive

versus very uncompetitive areas. This suggests that hospital systems may be vehicles both for enhancing efficiency and for facilitating anticompetitive practices. However (in results not presented in Table V), the effect of above versus below 75th percentile density of hospital system membership does not have a statistically significant interaction effect with market competitiveness, suggesting that there are not substantial additional anticompetitive effects of systems beyond the median (which corresponds to a predicted share of about half of the admissions in the area).

VI. Conclusion

What is the impact of hospital ownership status on medical productivity and social welfare? The theoretical literature on this question has generally focused on differences in behavior between not-for-profit and for-profit organizations: non-profits might address contract failures in the presence of informational asymmetries between consumers and producers. Nonprofit hospitals may offer consumers the advantage that physicians and hospital managers either do not or can not pursue pure profit maximization, and so have less of an incentive and/or ability to engage in socially nonoptimal, opportunistic behavior. On the other hand, because nonprofit hospitals do not have a well-defined residual claimant with legally enforceable property rights, they may be less responsive to consumers than for-profits, or more prone to inefficient and/or opportunistic behavior by managers and physicians.

However, in the hospital industry, the policy importance of differences in behavior between for-profits and non-profits is limited by the quite small share of the for-profit market. Even if for-profit hospitals were much more efficient, barring major changes in patient flows, they could hardly have much of a direct overall impact on the efficiency of the hospital industry. Few theoretical studies have addressed a potentially more important effect of for-profit ownership: the effects of an increasing presence of for-profit ownership on the behavior of other hospitals. For-profit hospitals may still have a significant overall effect on welfare, if their presence leads to significant changes in the behavior of not-for-profit hospitals in the market.

Estimating the magnitude of the direct and spillover effects of hospital ownership on productivity and welfare is complicated by many features of markets for health care. First, reaching conclusions about welfare effects requires measures of both resource use and patient health outcomes, which are generally difficult to obtain. Second, methods that seek to estimate the impact of ownership by direct comparisons of patients treated at different types of hospitals are likely to suffer from biases due to both patient selection and changes in market competitiveness and other market characteristics that may be correlated with the ownership changes and that also affect hospital behavior. Third, even if the studies overcome these problems, they will not have estimated the spillover effects of hospital ownership; without considering such market-level implications, any welfare analysis of hospital ownership is incomplete.

Finally, other characteristics of hospitals may have market effects. For example, a greater

presence of teaching hospitals may lead to more intensive styles of practice in an area, both as a result of direct effects or (because the share of teaching hospital beds in most areas is also relatively small) spillovers of practice styles among the physicians practicing in area hospitals. Hospital system membership may also have both direct and spillover effects, if systems result in more efficient management practices and more opportunities for collusion. More large hospitals in an area may also lead to both more efficient care and more opportunities for collusion, and may have spillover effects as well because they are more likely to receive transfer patients from other area hospitals. All of these other hospital market characteristics may be associated with differences in ownership, complicating the estimation of ownership effects. For all of these reasons, the effect of hospital ownership on social welfare is an incompletely resolved empirical question.

To address this question, we use longitudinal data on nonrural elderly Medicare recipients hospitalized for a treatment of a new heart attack over the 1985-94 period, matched with comprehensive data on all nonrural U.S. hospitals over the same period. This enables us to examine both the financial costs and the health benefits of hospital treatment, in order to evaluate welfare effects more completely. We use zip-code fixed effects to control for all time-invariant heterogeneity across small geographic areas, hospitals, and patient populations. We model individual patients' hospital choice decisions as a function of exogenous patient, area, and hospital characteristics, particularly the relative travel distances between patients' residences and hospitals of different types. Estimates from these models provide for each patient the probability of admission to every nearby hospital, based only on exogenous factors, and therefore the relative probability of admission to hospitals of different ownership types. Based on these estimates, we construct area-based measures of the "density" of hospitals of different ownership types -- that is, the probability that a patient residing in an area will be admitted to a hospital of a given ownership type, based only on exogenous determinants of hospital demand. This allows us to avoid the problem of patient selection into different types of hospitals on the basis of unobservable characteristics.

Focusing on area-level effects of ownership and other market characteristics also allows us to capture potentially important spillover effects. Because we measure the market-level consequences of changes in market composition, our methods do not allow us to identify the contribution of direct and spillover effects to these overall market effects separately. However, the total impact of a change in ownership composition will generally be the more relevant empirical estimate for evaluating policy proposals that may influence the ownership composition of hospital markets. In addition, we develop indirect evidence on the relative importance of direct and spillover effects. All else equal, if direct effects are relatively important, for-profit ownership should have minimal consequences at low levels of for-profit market penetration, and should become more important in proportion to market penetration. In contrast, spillover effects may be large when for-profit ownership penetration is small, if the presence of for-profit hospitals induces significant changes in non-profit behavior. Moreover, the area-level effect may not increase and could potentially decrease as for-profit penetration rises.

Thus, it is not too surprising that our analysis yields substantially different conclusions about the effects of ownership composition on market performance than least-squares estimates of the direct effects of ownership would imply. Higher market density of for-profit hospitals results in significantly lower hospital expenditures for AMI patients. This effect appears to be predominantly due to spillovers. Significant expenditure savings are achieved when the for-profit presence increases from near zero to only a small fraction of admissions in the area; a share of admissions of less than 10% is simply not substantial enough to lead to the large direct effects on area expenditures that we observe. Additional penetration of for-profits to higher market shares does not lead to additional savings, also arguing against important differences between for-profit and not-for-profit behavior within a market. We generally observe these expenditure effects of changes in for-profit presence in both the 1980s and 1990s, though the magnitude of the effect is significantly smaller in the 1990s. As we also demonstrated in previous work, hospital competition became cost-reducing in the 1990s, suggesting that competition may be achieving some of the productivity-enhancing effects that were more strongly associated with for-profit presence in the 1980s. Our results in models that account for potential interactions between ownership effects and competition confirm this conclusion: in the 1990s, a change in for-profit ownership reduced expenditures substantially in noncompetitive areas, and had little effect in the most competitive areas. The effects on expenditures are not associated with any consequential effects on the mortality of elderly AMI patients, and only a slight adverse effect on their cardiac health only in the most competitive markets.

Our results on other types of market composition changes were also consistent with important spillover effects. An increase in the presence of public hospitals or teaching hospitals leads to higher expenditures, particularly in less competitive areas. An increase in the presence of hospital systems leads to lower expenditures, particularly in more competitive areas. After 1990, public and teaching hospitals were associated with slightly (and insignificantly) worse and better mortality outcomes, respectively. For virtually all of the market characteristics that we analyzed, there was little additional incremental effect of moving from the 50^{th} to the 75^{th} percentile of penetration of the characteristic. Taken together, these results suggest that ownership differences and other differences in market composition mediate the effects of competition, but that the effects are largely threshold in nature. For example, holding constant market competitiveness and other features of a market, there is little additional effect from moving from one to two for-profit hospitals in a market beyond that achieved by moving from zero to one such hospitals.

The effects of these other aspects of market composition also differ, depending on the extent of competition. For example, in the 1990s, a larger presence of teaching and public hospitals is associated with higher expenditures in competitive areas. But in noncompetitive areas, expenditures are higher whether or not these types of hospitals have a relatively large presence. The effects of hospital systems on expenditures are also notable. A greater system presence leads to significantly lower hospital expenditures, whatever the level of competitiveness. But in contrast to the effects of a greater for-profit market presence, the effect of systems is greatest in the most competitive markets and smallest in the least competitive markets. Thus, increasing system membership in a market appears to have two somewhat

countervailing effects, perhaps because system management is associated with both greater efficiencies in production and also a greater ability to collude.

We have focused on expenditure effects in this discussion because in general, the effects of differences in market composition on outcomes are insignificant. Overall in the 1990s, greater teaching hospital presence is associated with lower mortality, and a greater public hospital presence is associated with slightly higher mortality. But these effects are not generally significant, and because the effects appear to differ (insignificantly) depending on the extent of competition, we cannot reach very precise conclusions about welfare effects. However, the effect estimates are precise enough to conclude that the health effects are not large. Even in our most comprehensive models of market competition and composition effects, the standard errors of our estimates are almost always no bigger than 1 percentage point, i.e., less than 3% of the average one-year mortality rates of 36 percentage points.

Our analysis has certainly not resolved all of the critical empirical questions in evaluating hospital ownership effects. We have focused on only one condition; effects may be different for other types of health problems. We have evaluated only hospital expenditure effects. Consistent with the theoretical prediction that for-profits are more responsive to economic incentives, other work has suggested that for-profits may have been more aggressive in exploiting Medicare's complex regulated price system, by moving care from the acute inpatient setting to alternative settings - including rehabilitation hospitals, outpatient departments, and home care - all of which qualify for additional reimbursement. In this regard, it is interesting that the association we observed in our previous work between market bed capacity and higher hospital expenditures both before and after 1990 is in fact an ownership phenomenon: higher bed capacity does not lead to higher hospital expenditures once we account for its correlation with ownership. This may be a confirmation of theoretical predictions (Newhouse, 1970; Pauly and Redisch, 1973): not-for-profits prefer larger size, and so will tend to invest in excess bed capacity especially when competition is weak. However, it might also reflect the fact that for-profits are simply more apt to convert bed capital to more profitable (i.e., reimbursable) uses, such as rehabilitation services, with unclear implications for overall expenditures. Investigating whether market competition effects differ for these other types of utilization, and whether for-profit spillover effects are as great on the behavior of not-for-profits, is an important question for further work. Evaluation of market competition and composition effects for stroke, which involves much more post-acute care than heart attacks, might be a good condition for such an analysis.

Finally, while we have focused on *market-wide* effects, we have done so only for Medicare beneficiaries. It is possible that the apparently favorable productivity spillovers of for-profits for Medicare beneficiaries may be offset by less provision of public goods in the form of undercompensated care for uninsured or poorly-insured patients. With suitable data, our techniques could be extended to examine effects on these other market segments as well. These extensions of our work seem unlikely to alter our fundamental conclusions about the fundamental importance of spillover effects of ownership differences and market composition more generally, particularly in less competitive areas.

Table I: Descriptive Statistics for Elderly AMI Patients, by Ownership Status of Hospital of Admission, 1985-94

	Full Sample	Public	Non-Profit	For-Profit	% diffs between ownership status FP -NP/NP	FP-P/P	NP-P/P
Inpatient Expenditures, year after AMI (93$)	16,546	15,079	16,716	16,695	-0.1%	10.7%	10.9%
365 Day Mortality Rate	36.7%	36.8%	36.7%	36.7%	0.0%	-0.3%	-0.3%
365 Day AMI Rate	5.5%	5.2%	5.7%	5.0%	-12.3%	-3.8%	9.6%
365 Day CHF Rate	6.8%	6.5%	7.0%	6.4%	-8.6%	-1.5%	7.7%
Age	76.2	75.9	76.2	76.5	0.4%	0.8%	0.4%
Black	6.1%	10.1%	5.4%	7.0%	29.6%	-30.7%	-46.5%
Female	50.2%	49.5%	50.4%	49.2%	-2.4%	-0.6%	1.8%
MSA Size <100,000	1.9%	2.4%	1.8%	2.1%	16.7%	-12.5%	-25.0%
MSA Size 100,000 - 250,000	14.6%	22.5%	13.3%	16.3%	22.6%	-27.6%	-40.9%
MSA Size 250,000 - 500,000	14.1%	18.4%	13.9%	10.8%	-22.3%	-41.3%	-24.5%
MSA Size 500,000 - 1,000,000	21.7%	33.2%	21.4%	12.2%	-43.0%	-63.3%	-35.5%
MSA Size 1,000,000 - 2,500,000	25.7%	11.1%	25.6%	41.1%	60.5%	270.3%	130.6%
MSA Size >2,500,000	22.0%	12.3%	23.8%	17.5%	-26.5%	42.3%	93.5%
Above median FP/NP [median = .012]	49.8%	60.4%	42.2%	99.0%	134.6%	63.9%	-30.1%
Above median Pub/NP [median = .033]	48.5%	76.9%	42.3%	67.8%	60.3%	-11.8%	-45.0%
Above median System [median = .512]	48.4%	67.0%	43.0%	72.1%	67.7%	7.6%	-35.8%
Above median Teaching [median = .136]	57.4%	42.9%	61.5%	40.0%	-35.0%	-6.8%	43.4%
Above median Large [median = .231]	58.6%	53.5%	59.0%	60.8%	3.1%	13.6%	10.3%
Above 75^{th} Percentile FP/NP [75^{th} pct = .208]	23.7%	50.4%	15.6%	78.2%	401.3%	55.2%	-69.0%
Above 75^{th} Percentile Pub/NP [75^{th} pct = .164]	21.9%	33.1%	15.1%	46.4%	207.2%	40.2%	-54.4%
Above 75^{th} Percentile System [75^{th} pct = .727]	22.8%	41.1%	18.6%	37.4%	101.1%	-9.0%	-54.7%
Above 75^{th} Percentile Teaching [75^{th} pct=.369]	34.2%	22.4%	39.2%	6.6%	-83.2%	-70.5%	75.0%
Above 75^{th} Percentile Large [75^{th} pct = .459]	30.7%	29.4%	31.5%	25.6%	-18.7%	-12.9%	7.1%
N	571247	58485	454715	58047	-87.2%	-0.7%	677.5%

Table IIa: One-year Inpatient Expenditures for Elderly AMI Patients from Areas with Above and Below-Median Relative Density of For-profit and Public Hospitals, 1985-94

For-profit/non-profit density	Public/non-profit density				
	above to below, 85-94	below in 85 and 94	above in 85 and 94	below to above, 85-94	total
above to below, 85-94	1985 $14,539 (N = 2,515) 1994 $18,420 (N = 1,040) 26.69% change	1985 $13,178 (N = 3,648) 1994 $19,049 (N = 3,077) 44.55% change	1985 $14,091 (N = 4,659) 1994 $18,756 (N = 4,494) 33.11% change	1985 $13,518 (N = 314) 1994 $19,020 (N = 307) 40.70% change	1985 $13,877 (N = 11,136) 1994 $18,827 (N = 8,918) 35.67% change
below in 85 and 94	1985 $14,679 (N = 7,957) 1994 $19,626 (N = 7,052) 33.70% change	1985 $13,867 (N = 42,961) 1994 $19,112 (N = 43,632) 37.82% change	1985 $13,293 (N = 10,850) 1994 $18,965 (N = 10,802) 42.67% change	1985 $13,379 (N = 1,924) 1994 $18,207 (N = 2,738) 36.09% change	1985 $13,856 (N = 63,692) 1994 $19,105 (N = 64,224) 37.88% change
above in 85 and 94	1985 $14,251 (N = 4,314) 1994 $20,049 (N = 3,627) 40.68% change	1985 $15,850 (N = 17,118) 1994 $19,449 (N = 14,519) 22.71% change	1985 $14,436 (N = 41,162) 1994 $20,346 (N = 36,093) 40.94% change	1985 $12,467 (N = 1,124) 1994 $17,856 (N = 1,085) 43.23% change	1985 $14,769 (N = 63,718) 1994 $20,042 (N = 55,324) 35.70% change
below to above, 85-94	1985 $15,311 (N = 801) 1994 $18,002 (N = 1,011) 17.58% change	1985 $16,077 (N = 2,220) 1994 $18,424 (N = 4,820) 14.60% change	1985 $15,125 (N = 4,014) 1994 $17,005 (N = 4,123) 12.43% change	1985 $15,639 (N = 744) 1994 $17,292 (N = 4,534) 10.57% change	1985 $15,465 (N = 7,779) 1994 $17,637 (N = 14,488) 14.04% change
total	1985 $14,570 (N = 15,587) 1994 $19,519 (N = 12,730) 33.97% change	1985 $14,418 (N = 65,947) 1994 $19,133 (N = 66,048) 32.70% change	1985 $14,250 (N = 60,685) 1994 $19,701 (N = 55,512) 38.25% change	1985 $13,550 (N = 4,106) 1994 $17,713 (N = 8,664) 30.72% change	1985 $14,340 (N = 146,325) 1994 $19,302 (N = 142,954) 34.60% change

Table IIb: One-year Inpatient Expenditures for Elderly AMI Patients from Areas with Above and Below-75th Percentile Relative Density of For-profit and Public Hospitals, 85-94

For-profit/non-profit density	Public/non-profit density				
	above to below, 85-94	below in 85 and 94	above in 85 and 94	below to above, 85-94	total
above to below, 85-94	1985 $14,735 (N = 2,274) 1994 $19,039 (N = 1,289) 29.21% change	1985 $13,681 (N = 3,026) 1994 $19,458 (N = 2,386) 42.23% change	1985 $13,603 (N = 1,420) 1994 $17,132 (N = 1,263) 25.94% change	1985 $16,186 (N = 5) 1994 $22,369 (N = 11) 38.20% change	1985 $14,023 (N = 6,725) 1994 $18,761 (N = 4,949) 33.79% change
below in 85 and 94	1985 $13,905 (N = 9,436) 1994 $20,229 (N = 8,272) 45.48% change	1985 $14,183 (N = 87,177) 1994 $19,555 (N =85,321) 37.88% change	1985 $14,247 (N = 8,688) 1994 $19,245 (N = 7,919) 35.08% change	1985 $15,319 (N = 2,530) 1994 $19,320 (N = 2,810) 26.12% change	1985 $14,191 (N = 107,831) 1994 $19,579 (N = 104,322) 37.97% change
above in 85 and 94	1985 $13,534 (N = 2,735) 1994 $17,631 (N = 2,750) 30.27% change	1985 $16,063 (N = 12,294) 1994 $19,934 (N = 9,749) 24.10% change	1985 $14,292 (N = 9,587) 1994 $18,515 (N = 9,545) 29.55% change	1985 $14,518 (N = 1,754) 1994 $18,695 (N = 1,700) 28.77% change	1985 $15,054 (N = 26,370) 1994 $19,008 (N = 23,744) 26.27% change
below to above, 85-94	1985 $13,779 (N = 607) 1994 $17,186 (N = 433) 24.73% change	1985 $14,590 (N = 2,951) 1994 $17,577 (N = 5,703) 20.47% change	1985 $14,271 (N = 1,337) 1994 $18,069 (N = 1,259) 26.61% change	1985 $12,711 (N = 504) 1994 $16,555 (N = 2,544) 30.24% change	1985 $14,244 (N = 5,399) 1994 $17,361 (N = 9,939) 21.88% change
total	1985 $13,958 (N = 15,052) 1994 $19,445 (N = 12,744) 39.31% change	1985 $14,399 (N = 105,448) 1994 $19,479 (N = 103,159) 35.28% change	1985 $14,226 (N = 21,032) 1994 $18,689 (N = 19,986) 31.37% change	1985 $14,752 (N = 4,793) 1994 $18,179 (N = 7,065) 23.23% change	1985 $14,340 (N = 146,325) 1994 $19,302 (N = 142,954) 34.60% change

Table IIc: One-year Mortality for Elderly AMI Patients from Areas with Above and Below-Median Relative Density of For-profit and Public Hospitals, 1985-94

For-profit/non-profit density	Public/non-profit density				
	above to below, 85-94	below in 85 and 94	above in 85 and 94	below to above, 85-94	total
above to below, 85-94	1985 40.91% (N = 2,515) 1994 34.62% (N = 1,040) -6.29% change	1985 40.49% (N = 3,648) 1994 31.10% (N = 3,077) -9.39% change	1985 41.15% (N = 4,659) 1994 31.49% (N = 4,494) -9.66% change	1985 37.90% (N = 314) 1994 34.20% (N = 307) -3.70% change	1985 40.79% (N = 11,136) 1994 31.81% (N = 8,918) -8.98% change
below in 85 and 94	1985 41.05% (N = 7,957) 1994 33.01% (N = 7,052) -8.04% change	1985 39.07% (N = 42,691) 1994 32.08% (N = 43,632) -6.99% change	1985 40.80% (N = 10,850) 1994 33.16% (N = 10,802) -7.64% change	1985 38.98% (N = 1,924) 1994 30.83% (N = 2,738) -8.15% change	1985 39.61% (N = 63,692) 1994 32.31% (N = 64,224) -7.30% change
above in 85 and 94	1985 41.05% (N = 4,314) 1994 33.72% (N = 3,627) -7.33% change	1985 40.80% (N = 17,118) 1994 33.60% (N = 14,519) -7.20% change	1985 40.67% (N = 41,162) 1994 33.87% (N = 36,093) -6.80% change	1985 43.86% (N = 1,124) 1994 35.02% (N = 1,085) -8.84% change	1985 40.79% (N = 63,718) 1994 33.18% (N = 55,324) -7.61% change
below to above, 85-94	1985 39.95% (N = 801) 1994 32.15% (N = 1011) -7.80% change	1985 39.64% (N = 2,220) 1994 33.63% (N = 4,820) -6.01% change	1985 40.61% (N = 4,014) 1994 33.66% (N = 4,123) -6.95% change	1985 41.53% (N = 744) 1994 32.71% (N = 4,534) -8.82% change	1985 40.35% (N = 7,779) 1994 33.25% (N = 14,488) -7.10% change
total	1985 40.97% (N = 15,587) 1994 33.28% (N = 12,730) -7.69% change	1985 39.62 % (N = 65,947) 1994 32.48% (N = 66,048) -7.14% change	1985 40.73% (N = 60,685) 1994 33.52% (N = 55,512) -7.21% change	1985 40.70% (N = 4,106) 1994 32.46% (N = 8,664) -8.24% change	1985 40.25% (N = 146,325) 1994 32.96% (N =142,954) -7.29% change

Table IId: One-year Mortality for Elderly AMI Patients from Areas with Above and Below-75th Percentile Relative Density of For-profit and Public Hospitals, 1985-94

For-profit/non-profit density	Public/non-profit density				
	above to below, 85-94	below in 85 and 94	above in 85 and 94	below to above, 85-94	total
above to below, 85-94	1985 39.67% (N = 2,274) 1994 32.27% (N = 1,289) -7.40% change	1985 41.04% (N = 3.026) 1994 32.65% (N = 2,386) -8.39% change	1985 41.13% (N = 1,420) 1994 35.47% (N = 1,263) -5.66% change	1985 40.00% (N = 5) 1994 27.27% (N = 11) -12.73% change	1985 40.59% (N = 6,725) 1994 33.26% (N = 4,949) -7.33% change
below in 85 and 94	1985 40.68% (N = 9,436) 1994 33.50% (N = 8,272) -7.18% change	1985 40.05% (N = 87,177) 1994 32.66% (N = 85,321) -7.39% change	1985 39.76% (N = 8,688) 1994 33.88% (N = 7,919) -5.88% change	1985 41.42% (N = 2,530) 1994 31.74% (N = 2,810) -9.68% change	1985 40.11% (N = 107,831) 1994 32.79% (N = 104,322) -7.32% change
above in 85 and 94	1985 40.73% (N = 2,735) 1994 34.58% (N = 2,750) -6.15% change	1985 40.66% (N = 12,294) 1994 33.83% (N = 9,749) -6.83% change	1985 41.08% (N = 9,587) 1994 33.45% (N = 9,5451) -7.63% change	1985 39.68% (N = 1,754) 1994 31.18% (N = 1,700) -8.50% change	1985 40.75% (N = 26,370) 1994 33.57% (N = 23,744) -7.18% change
below to above, 85-94	1985 39.04% (N = 607) 1994 34.18% (N = 433) -4.86% change	1985 40.97% (N = 2,951) 1994 33.23% (N = 5,703) -7.74% change	1985 38.37% (N = 1,337) 1994 33.44% (N = 1,259) -4.93% change	1985 41.27% (N = 504) 1994 32.23% (N = 2,544) -9.04% change	1985 40.14 % (N = 5,399) 1994 33.04% (N = 9,939) -7.10% change
total	1985 40.47% (N = 15,052) 1994 33.63% (N = 12,744) -6.84% change	1985 40.17% (N = 105,448) 1994 32.80% (N = 103,159) -7.37% change	1985 40.36% (N = 21,032) 1994 33.75% (N = 19,986) -6.61% change	1985 40.77% (N = 4,793) 1994 31.78% (N = 7,065) -8.99% change	1985 40.25% (N = 146,325) 1994 32.96% (N =142,954) -7.29% change

Table III: OLS Estimates of the Effect of Hospital Ownership Status and Other Characteristics of Hospital of Admission on Expenditures, Costs, and Outcomes for Elderly Acute Myocardial Infarction Patients, 1985-94

	Dependent Variable			
	ln(Inpatient Expenditures)	1-Year Mortality	1-Year AMI Readmit	1-Year HF Readmit
Pre-1991 effects of ownership status and other characteristics of hospital of admission (omitted group =nonprofit)				
For profit	-0.36	-0.03	-0.06	0.01
	(0.83)	(0.52)	(0.25)	(0.28)
Public	0.97	0.06	-1.06	-0.15
	(0.85)	(0.53)	(0.26)	(0.29)
System member	0.29	-1.83	0.24	0.28
	(1.49)	(0.93)	(0.45)	(0.50)
Large size	7.23	0.18	-0.34	-0.32
	(0.81)	(0.51)	(0.25)	(0.27)
Teaching status	-7.47	-0.37	0.53	0.26
	(0.90)	(0.56)	(0.27)	(0.30)
Post-1991effects of ownership status and other characteristics of hospital of admission (omitted group=nonprofit)				
For profit	-5.33	0.33	-0.24	-0.12
	(0.70)	(0.44)	(0.21)	(0.24)
Public	-4.64	-0.20	-0.01	-0.32
	(0.81)	(0.51)	(0.25)	(0.27)
System member	-5.91	-1.47	0.63	0.51
	(1.64)	(1.03)	(0.50)	(0.55)
Large size	0.40	-0.15	0.06	0.39
	(0.82)	(0.51)	(0.25)	(0.28)
Teaching status	5.42	-0.21	-0.10	-0.35
	(0.81)	(0.51)	(0.25)	(0.27)

Notes: standard errors in parentheses. Hospital Expenditures in 1993 dollars. Coefficients from expenditures and costs models *100 from regressions in logarithms; Coefficients from outcome models in percentage points.

Table IV: Effects of Area Density of Hospital Ownership, System Membership, and other Hospital and Market Characteristics on Expenditures and Outcomes for Elderly AMI Patients, 1985-94

	High density = above-median density				High density = above 75th percentile density			
	1-Year Hospital Expenditures	1-Year Mortality	1-Year AMI Readmit	1-Year HF Readmit	1-Year Hospital Expenditures	1-Year Mortality	1-Year AMI Readmit	1-Year HF Readmit
Pre-1990 effects of ownership status and other market characteristics (omitted category = very low HHI)								
High density of for-profit/non-profit	-6.06	0.31	-0.05	0.10	0.48	-1.09	-0.08	0.28
[median = .012, 75th pct = .208]	(0.65)	(0.41)	(0.20)	(0.22)	(0.77)	(0.48)	(0.24)	(0.26)
High density of public/non-profit	-1.63	0.49	-0.03	0.06	-2.85	-0.94	0.02	-0.33
[median = .033, 75th pct = .164]	(0.61)	(0.38)	(0.19)	(0.21)	(0.63)	(0.39)	(0.19)	(0.21)
High density of system members	0.08	0.06	-0.07	0.09	-1.33	0.34	-0.08	-0.08
[median = .512, 75th pct = .727]	(0.47)	(0.30)	(0.15)	(0.16)	(0.55)	(0.34)	(0.17)	(0.19)
High density of teaching hospitals	-0.19	-0.40	0.14	0.20	-2.35	-1.09	0.06	0.20
[median = .136, 75th pct = .369]	(0.57)	(0.36)	(0.17)	(0.19)	(0.59)	(0.37)	(0.18)	(0.20)
High density of large hospitals	-0.60	0.14	0.01	0.01	-1.73	-0.18	-0.30	-0.20
[median = .231, 75th pct = .459]	(0.54)	(0.34)	(0.17)	(0.18)	(0.48)	(0.30)	(0.15)	(0.16)
Very high HHI	-1.62	-0.05	0.81	0.51	-2.10	-0.37	0.91	0.52
	(1.06)	(0.66)	(0.32)	(0.36)	(1.04)	(0.65)	(0.32)	(0.35)
High HHI	-0.65	0.12	0.48	0.51	-0.41	-0.11	0.56	0.55
	(0.89)	(0.56)	(0.27)	(0.30)	(0.89)	(0.56)	(0.27)	(0.30)
Low HHI	0.38	0.70	-0.07	0.32	0.59	0.58	-0.01	0.35
	(0.67)	(0.42)	(0.21)	(0.23)	(0.67)	(0.42)	(0.21)	(0.23)
High HMO enrollment in state	-10.17	0.45	0.06	-0.10	-10.52	0.48	0.06	-0.09
	(0.47)	(0.29)	(0.14)	(0.16)	(0.47)	(0.29)	(0.14)	(0.16)
Bed capacity / AMI patient	3.12	0.32	-0.08	-0.06	3.46	0.34	-0.09	-0.05
	(0.23)	(0.15)	(0.07)	(0.08)	(0.23)	(0.14)	(0.07)	(0.08)

Table IV (continued): Effects of Area Density of Hospital Ownership, System Membership, and other Hospital and Market Characteristics on Expenditures and Outcomes for Elderly AMI Patients, 1985-94

	High density = above-median density				High density = above 75th percentile density			
	1-Year Hospital Expenditures	1-Year Mortality	1-Year AMI Readmit	1-Year HF Readmit	1-Year Hospital Expenditures	1-Year Mortality	1-Year AMI Readmit	1-Year HF Readmit
Post-1990 effects of ownership status and other market characteristics (omitted category = very low HHI)								
High density of for-profit/non-profit	-3.20	0.15	0.30	0.32	-0.90	-0.46	-0.37	0.11
[median = .012, 75th pct = .208]	(0.66)	(0.41)	(0.20)	(0.22)	(0.78)	(0.49)	(0.24)	(0.26)
High density of public/non-profit	4.20	0.68	0.05	0.26	1.45	-0.48	0.12	0.03
[median = .033, 75th pct = .164]	(0.64)	(0.40)	(0.19)	(0.21)	(0.68)	(0.43)	(0.21)	(0.23)
High density of system members	-7.66	0.33	0.09	0.01	-5.73	0.47	-0.04	-0.13
[median = .512, 75th pct = .727]	(0.47)	(0.30)	(0.15)	(0.16)	(0.50)	(0.31)	(0.15)	(0.17)
High density of teaching hospitals	2.11	-0.65	0.12	0.12	-1.77	-0.48	-0.38	-0.07
[median = .136, 75th pct = .369]	(0.54)	(0.34)	(0.16)	(0.18)	(0.58)	(0.37)	(0.18)	(0.20)
High density of large hospitals	3.14	0.34	0.05	0.15	6.45	-0.27	-0.07	0.07
[median = .231, 75th pct = .459]	(0.49)	(0.31)	(0.15)	(0.17)	(0.52)	(0.33)	(0.16)	(0.18)
Very high HHI	5.43	0.58	0.82	0.22	4.40	0.57	0.67	0.09
	(1.06)	(0.66)	(0.32)	(0.36)	(1.05)	(0.65)	(0.32)	(0.35)
High HHI	2.70	0.16	0.40	0.34	2.04	0.16	0.29	0.24
	(0.90)	(0.56)	(0.28)	(0.30)	(0.89)	(0.56)	(0.27)	(0.30)
Low HHI	1.82	0.37	0.13	0.01	1.29	0.37	0.06	-0.05
	(0.67)	(0.42)	(0.21)	(0.23)	(0.67)	(0.42)	(0.21)	(0.23)
High HMO enrollment in state	-2.20	0.42	0.19	0.20	-2.70	0.48	0.15	0.21
	(0.62)	(0.39)	(0.19)	(0.21)	(0.62)	(0.39)	(0.19)	(0.21)
Bed capacity / AMI patient	-0.02	0.38	-0.25	-0.27	0.58	0.37	-0.17	-0.23
	(0.25)	(0.16)	(0.08)	(0.08)	(0.24)	(0.15)	(0.07)	(0.08)

Table V: Effects of Above-Median Density of Hospital Ownership, System Membership, and other Hospital Characteristics on Expenditures and Outcomes for Elderly AMI Patients, by the Extent of Competition in the Market, 1985-94

	1-Year Hospital Expenditures	1-Year Mortality	1-Year AMI Readmit	1-Year HF Readmit
Pre-1990 effects of ownership and other hospital and market characteristics (omitted category = very low HHI)				
High density of for-profit/non-profit	-5.77	0.22	-0.34	0.06
	(1.01)	(0.63)	(0.31)	(0.34)
High for-profit/non-profit*Very High HHI	1.85	1.06	0.74	-0.14
	(1.52)	(0.95)	(0.47)	(0.51)
High for-profit/non-profit*High or Low HHI	-0.18	-0.11	0.34	0.14
	(1.15)	(0.72)	(0.35)	(0.39)
High density of public/non-profit	-5.54	1.05	0.24	0.14
	(0.88)	(0.55)	(0.27)	(0.30)
High public/non-profit*Very High HHI	7.50	-1.62	-0.88	-0.08
	(1.38)	(0.86)	(0.42)	(0.47)
High public/non-profit*High or Low HHI	5.97	-0.65	-0.41	-0.13
	(1.06)	(0.66)	(0.32)	(0.36)
High density of system hospitals	0.50	-0.22	0.07	0.14
	(0.76)	(0.48)	(0.23)	(0.26)
High system*Very High HHI	-3.11	0.80	-0.03	0.06
	(1.29)	(0.81)	(0.39)	(0.44)
High system*High or Low HHI	-0.84	0.33	-0.30	-0.08
	(0.96)	(0.60)	(0.29)	(0.33)
High density of teaching hospitals	-0.29	0.01	0.41	0.64
	(0.94)	(0.59)	(0.29)	(0.32)
High teaching*Very High HHI	1.14	-1.21	-0.77	-1.10
	(1.55)	(0.97)	(0.48)	(0.52)
High teaching*High or Low HHI	0.23	-0.46	-0.26	-0.52
	(1.13)	(0.71)	(0.35)	(0.38)
High density of large hospitals	-2.61	-0.03	0.19	-0.23
	(0.91)	(0.57)	(0.28)	(0.31)
High large*Very High HHI	4.22	-0.02	0.13	0.92
	(1.42)	(0.89)	(0.43)	(0.48)
High large*High or Low HHI	2.26	0.38	-0.47	0.11
	(1.11)	(0.69)	(0.34)	(0.37)
Very high HHI	-8.62	0.35	1.39	0.72
	(1.86)	(1.16)	(0.57)	(0.63)
High HHI	-5.92	0.43	1.21	0.84
	(1.70)	(1.07)	(0.52)	(0.58)
Low HHI	-5.23	1.02	0.68	0.64
	(1.66)	(1.04)	(0.51)	(0.56)
High HMO enrollment in state	-9.85	0.42	0.04	-0.06
	(0.48)	(0.30)	(0.15)	(0.08)
Bed capacity/AMI patient	3.01	0.30	-0.07	-0.15
	(0.23)	(0.15)	(0.07)	(0.16)

Table V (continued): Effects of Above-Median Density of Hospital Ownership, System Membership, and other Hospital Characteristics on Expenditures and Outcomes for Elderly AMI Patients, by the Extent of Competition in the Market, 1985-94

	1-Year Hospital Expenditures	1-Year Mortality	1-Year AMI Readmit	1-Year HF Readmit
Post-1990 effects of ownership and other hospital and market characteristics (omitted category = very low)				
High density of for-profit/non-profit	-0.21	0.18	0.68	0.33
	(1.06)	(0.66)	(0.32)	(0.36)
High for-profit/non-profit*Very High HHI	-5.80	0.80	-0.71	0.10
	(1.50)	(0.94)	(0.46)	(0.51)
High for-profit/non-profit*High or Low HHI	-3.82	-0.41	-0.50	-0.02
	(1.17)	(0.73)	(0.36)	(0.40)
High density of public/non-profit	6.18	0.96	-0.13	0.42
	(1.01)	(0.63)	(0.31)	(0.34)
High public/non-profit*Very High HHI	-5.79	-0.21	0.28	-0.33
	(1.42)	(0.89)	(0.44)	(0.48)
High public/non-profit*High or Low HHI	-2.54	-0.54	0.21	-0.17
	(1.14)	(0.71)	(0.35)	(0.38)
High density of system hospitals	-11.10	0.03	0.25	0.34
	(0.83)	(0.52)	(0.25)	(0.28)
High system*Very High HHI	6.25	-0.00	-0.07	-0.35
	(1.24)	(0.78)	(0.38)	(0.42)
High system*High or Low HHI	5.84	0.58	-0.34	-0.55
	(1.00)	(0.62)	(0.30)	(0.34)
High density of teaching hospitals	5.22	-0.52	0.44	0.39
	(0.95)	(0.60)	(0.29)	(0.32)
High teaching*Very High HHI	-4.24	-0.35	-0.88	-0.86
	(1.43)	(0.90)	(0.44)	(0.48)
High teaching*High or Low HHI	-3.69	-0.21	-0.30	-0.19
	(1.12)	(0.70)	(0.34)	(0.38)
High density of large hospitals	6.20	0.15	0.15	0.41
	(0.80)	(0.50)	(0.25)	(0.27)
High large*Very High HHI	-3.18	0.12	-0.01	0.00
	(1.33)	(0.83)	(0.41)	(0.45)
High large*High or Low HHI	-5.20	0.37	-0.19	-0.48
	(0.99)	(0.62)	(0.30)	(0.34)
Very high HHI	11.98	0.35	1.59	1.04
	(1.91)	(1.20)	(0.58)	(0.64)
High HHI	8.50	0.15	1.14	1.21
	(1.75)	(1.10)	(0.54)	(0.59)
Low HHI	7.79	0.41	0.87	0.91
	(1.69)	(1.06)	(0.52)	(0.57)
High HMO enrollment in state	-2.67	0.39	0.18	0.14
	(0.62)	(0.39)	(0.19)	(0.21)
Bed capacity/AMI patient	-0.04	0.35	-0.28	-0.27
	(0.25)	(0.16)	(0.08)	(0.09)

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