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WHAT DO NONPROFITS MAXIMIZE? NONPROFIT HOSPITAL SERVICE PROVISION AND MARKET OWNERSHIP MIX

Jill R. Horwitz
Austin Nichols

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What Do Nonprofits Maximize? Nonprofit Hospital Service Provision and Market Ownership Mix

Jill R. Horwitz and Austin Nichols

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ABSTRACT

Conflicting theories of the nonprofit firm have existed for several decades yet empirical research has not resolved these debates, partly because the theories are not easily testable but also because empirical research generally considers organizations in isolation rather than in markets. Here we examine three types of hospitals – nonprofit, for-profit, and government – and their spillover effects. We look at the effect of for-profit ownership share within markets in two ways, on the provision of medical services and on operating margins at the three types of hospitals. We find that nonprofit hospitals' medical service provision systematically varies by market mix. We find no significant effect of for-profit market share on the operating margins of nonprofit hospitals. These results fit best with theories in which hospitals maximize their own output.

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I. Introduction

Economists have proposed and debated conflicting theories of the nonprofit firm for several decades. Related empirical research -- which has mainly concerned the hospital industry where mixed markets have persisted for over half a century -- has done little to resolve these debates. This indeterminacy persists, in part, because the theories have not generated testable predictions (Abraham, Gaynor et al., 2005) and because of the inherent difficulties of estimation in health care markets which are rife with failures (Arrow, 1963). It also persists because the vast empirical research on hospital ownership is incomplete. Studies typically consider hospital behavior in isolation, rather than in markets that have varied population, competitive, and ownership characteristics.

Given this background, we have three goals for the paper: 1) producing new facts regarding the interaction between hospital ownership and market structure, thus constraining future theoretical research, 2) making progress to appropriately define hospital markets and address endogeneity, and 3) using the results to help differentiate among extant theories of the nonprofit firm.

Here we examine the interaction between hospital ownership and market mix in two ways. We first examine whether medical service provision by nonprofit, government, and for-profit hospitals varies with for-profit market share. Investigating service offerings is particularly useful because, in a highly regulated industry in which managers are constrained in their attempts to maximize profits (e.g., it is difficult and sometimes illegal to turn away low-paying patients), managers have some freedom to open or close a service as a way to increase profits. This explains why many researchers find little difference among ownership types among many dimensions, but along dimensions where administrators can influence profitability there are large differences (Horwitz, 2007). We also investigate whether hospital operating margins depend on the interaction between ownership and market mix.

We find that service provision systematically varies both by firm type and market mix. Nonprofits in markets with relatively high concentrations of for-profits are more likely to offer more profitable and less likely to offer less profitable services than those in

markets with relatively low concentrations of for-profits. Government hospitals demonstrate a similar pattern, although the results are somewhat weaker than those for nonprofits. Among for-profit hospitals, we identified no systematic and significant relationship in service provision by market type (high or low for-profit market share).

The possible endogeneity of location makes it difficult to rule out models in which different types of firms locate in different types of markets. We find, however, similar results among multiple models 1) including many pooled cross-sections and some fixed-effect models, 2) using various definitions of for-profit market share, including a new distance-weighted approach, and various cut-offs for high and low for-profit market share, and 3) identifying hospitals by their current market type (high for-profit share or low for-profit share) in some specifications and their market type during the first year of the study period in others. These results suggest the findings are not artifacts of endogenous location.

We also apply the results to differentiate among theories of the nonprofit firm. We find most convincing a model where nonprofit hospitals maximize their own output (Baumol and Bowen, 1965; Newhouse, 1970) or a mixed objectives model in which at least some nonprofits are output-maximizing (Hirth, 1999). If nonprofits were welfare-maximizing, as other theories suggest, they should exhibit increased provision of unprofitable services in markets where for-profits have a greater presence; similarly, if nonprofits were maximizing economic profits and distributing rents disguised as increased costs, we would expect to see no effect of increased for-profit presence on their output. Additional results, which show that increased for-profit market share has a positive effect on for-profit hospitals' operating margins are also consistent with the model that nonprofits maximize output, though we cannot rule out a model in which some maximize outputs and others maximize profits.

II. Background, Previous Research, and Empirical Predictions

Slightly fewer than two-thirds of U.S. general hospitals within metropolitan statistical areas (MSAs) are nonprofit, with for-profit and government hospitals making up roughly equal shares of the remainder; of rural hospitals, about one half are nonprofit

and 40 percent are government.[1] Despite active hospital market consolidation, particularly during the late 1990s, ownership shares have remained relatively stable (Abraham, Gaynor et al. 2005). There has been some growth in the number and size of for-profit hospitals, but the proportion of for-profit hospitals has increased only modestly. Hospital ownership statistics from 1988 through 2005 are reported in Table 1.

A. Theoretical Background and Predictions

Despite many studies explaining why firms adopt nonprofit status and a few studies explaining why ownership mix within markets persists, there is no generally accepted theory of the nonprofit firm. First, this may be because competing explanations are incomparable. Only a few scholars attempt to identify a nonprofit objective function directly, while most only suggest the mechanisms by which such an objective function might constrain corporate behavior.

Second, there is no comprehensive theory of oligopoly or entry deterrence where firms have different objective functions because developing one is so hard. It is hard to specify the problem in a way that generates a soluble model, even in the case where firms offer a homogenous good in a standard Walrasian market. It is harder still to conceptualize the problem in a market where firms offer different kinds of bundled goods and where many of the consumption decisions are made without observing prices (in either the pecuniary sense of how much is charged for a particular medical intervention, or in terms of more comprehensive notions of price including psychic costs or opportunity costs).

Further, there is no theory of equilibrium in these markets where neither prices nor quantities are observed, and the producer and consumer are not typically clearly identified. Although we cannot base our predictions on a comprehensive theory, we can offer some rough predictions based on an informal discussion of the various theories of nonprofits and hospital behavior in the existing literature. For the purposes of this discussion, we will assume that entry and exit of types of hospitals is "sprinkled

[1] Here we focus on non-rural hospitals. Although almost half of all general hospitals are rural, they account for only 1/6 of admissions. We will examine rural hospitals in future work.

randomly" around markets, so that there is exogenous variation in numbers of hospitals and the proportion of each type in various markets.

Finally, there is no agreement on the theory of a nonprofit firm because the various theories have not been effectively tested. These theories tend to generate similar, sometimes identical, predictions about firm behavior. Observing whether the medical services offered by hospital ownership types (nonprofit, for-profit, and government) depends on the mix of firm-types in the market offers some traction on this problem. Here we discuss how our findings regarding ownership, market mix, and service provision help either rule out or narrow four major categories of nonprofit firm theories. These categories are: 1) firm output maximization theories, 2) market output maximization theories, 3) "for-profit in disguise" theories, and 4) a combination of the firm output maximization and disguise theories. We summarize these theories and predictions in Table 6.

1. Firm Output Maximization Theories

In the first theory, Newhouse (1970), where nonprofits maximize own output (some weighted average of various measures of quantity and quality of care), the nonprofit will offer more health care until profits are driven to zero (in expectation, at least, since the data suggest that hospitals lose money one year and make money the next). It may seem that managers of nonprofit hospitals should be relatively indifferent to the mix of hospitals around them, since their neighbors cannot dictate output decisions. Some theorists have sought to explain that this is the case because certain kinds of actors control nonprofits: managers with particularly altruistic goals (Rose-Ackerman 1996) or consumers who control the mission of nonprofit organizations institution directly (Ben-Ner 1983; James and Rose-Ackerman 1986; Ben-Ner and Gui 1993).

A nonprofit's neighbors, however, will take some of its "customers" and thereby affect its patient pool. If their neighbors are driven more by profit motives, then the nonprofit will tend to treat less profitable patients who seek less profitable types of care. In this case, the nonprofit's behavior will be affected through the binding constraint on profits—in the absence of the profit-seeking competitors "cream-skimming" patients, they would have offered a mix of services (and served a mix of patients), call it X, that

generated zero profit, but in the presence of the profit-seekers, the mix *X* will lose money, so they must alter their behavior to generate additional profits. Thus a nonprofit will be induced to look more like a profit-seeker in an environment where there are more profit-seekers, by both being less likely to offer unprofitable services and more likely to offer profitable ones.

2. Market Output Maximization Theories

In the second theory, Weisbrod (1988) suggests that nonprofits maximize total market output, meeting community health care needs where market and government failures leave them unmet. Salamon (1987) models government, rather than the voluntary sector, as the residual sector. Frank and Salkever's (1991) model includes total industry output as a maximand. In a theory of nonprofits that maximize market output, nonprofit hospitals may attempt to generate more revenue by adding more profitable services, but they also will react to a mix of neighbors that is more profit-seeking by increasing their propensity to offer less profitable services or to serve less profitable patients to offset the more mercenary behavior of their neighbors. Thus a nonprofit will be induced to look *less* like profit-seekers in an environment where there are more profit-seekers, in at least one way, by being more likely to offer unprofitable services, and *more* like profit-seekers in that it may also become more likely to offer profitable services.

3. For-Profits in Disguise

Researchers have suggested that both nonprofit and for-profit hospitals maximize profits, but profits go to shareholders in the case of for-profits and privileged employees in the case of nonprofits. Pauly and Redisch (1973) develop a set of three models in which staff physicians capture all rents from nonprofit hospitals. While some distortions may arise from operating hospitals to benefit a subset of physicians, two of their models imply that such hospitals would be essentially identical to for-profit hospitals in equilibrium, with economic profits counted as costs (salaries or perks accruing to staff physicians).

Many empirical findings have demonstrated that nonprofit and for-profit hospitals are substantially alike in important ways (cost, revenue, profits, etc.) (for a literature

review see Sloan 2000). Evidence that nonprofits and for-profits are similar along many dimensions tends to support the theory that nonprofit hospitals maximize economic (if not accounting) profits. We therefore hypothesize that if both nonprofits and for-profits are maximizing profits, nonprofits should not act differently depending on the proportion of for-profits in their markets.

4. Mixed Objectives Theories

A fourth class of theories combines the first and third, with the same predictions regarding service provision in different types of markets. Hirth (1997, 1999) develops a theory based on competition over quality under which competition from non-profit-maximizing nonprofits causes positive spillover effects on the performances of both for-profits and "for-profits in disguise" (i.e., nonprofits that are solely motivated by profits). According to the theory, nonprofits drive out low-quality for-profits (that charge high quality prices) and increase the utility of the uninformed consumers who continue to seek care at for-profits. Hirth concludes that quality differences can disappear in markets with a sufficiently high proportion of nonprofits. Even under this fourth model (Hirth), where only some nonprofits are profit-seekers, an increase in for-profit penetration (holding constant numbers and sizes of neighbors) should only affect behavior to the extent that the nonprofits displaced are not profit-seekers. Thus the hybrid model offers a hybrid prediction, somewhere between the Pauly-Redisch model that predicts that nonprofits will look essentially like for-profits, and the Newhouse model that predicts that nonprofits may look more like for-profits in the presence of more for-profits. Still, we would be unlikely to find differences among ownership types if the variation within the nonprofit form was greater than the variation between nonprofits and other types.

5. Mixed Oligopoly

A complete theory needs to specify the objective functions of firms *and* the mechanism by which the market mix is maintained. A fully developed theory would also explain why some industries, such as health and education, support government, for-profit, and nonprofit production, while others industries exhibit only one or two types of producers. A start has been made on models of mixed oligopoly incorporating public (either welfare or revenue maximizing) and for-profit agents (see e.g., Cremer, Marchand

et al., 1989, De Fraja and Delbono, 1989). However, there is no theory incorporating the three types of producers, so we rely on intuition as to how these different species of nonprofits should be expected to respond to shifts in the composition of their competitors.

Several theories explain how nonprofits and for-profits can continue to occupy the same market. The first and most common one is that where there are informational asymmetries between providers and recipients of health care (Arrow 1963), quality of care cannot be fully contracted, and consumers are heterogeneous in their preferences and/or informational disadvantage (See, e.g., Hansmann 1980; Ben-Ner and Hoomissen 1991; Hirth 1999; Glaeser and Shleifer 2001). Therefore, for-profits and nonprofits offer different quality services and possibly price them differently (where price should be construed as including various nonpecuniary compensation mechanisms, e.g., how much emphasis is placed on the nature of conversations with patients). This type of model underlies many other discussions in health economics, including discussions of insurance or regulation. It is unclear, however, how much control over quality providers exert or the power of these incentives — some studies show no, or only very small, responses to large incentives, with rewards going to those who already exhibited high quality before the incentives were implemented (See e.g., Rosenthal, Frank et al. 2005; Rosenthal and Frank 2006; Epstein 2007).

The second idea about how ownership mix is maintained is that nonprofits (who are assumed to enjoy a cost advantage over for-profits) are in short supply; the number of altruists who found and run nonprofits is fixed, while for-profit entrepreneurs are in abundance (Lakdawalla and Philipson 2005). In this type of model, the marginal firm is a for-profit, so equilibrium is determined by for-profit behavior, with some constraints imposed by the presence of nonprofits. This is the only model that does not require some heterogeneity in patients. However, it imposes a very stringent constraint on hospital managers, dividing them into two types with one in infinite abundance and one with a finite population.

The third is the Hirth (1997; 1999) model in which two types of firms – one with for-profit objectives, the other with altruistic objectives – both adopt nonprofit status. That both types incorporate under the same status reduces the signal quality of

organizational type. This situation creates an equilibrium where customers cannot be sure of receiving higher quality care at a nonprofit, though it may be higher in expectation, and for-profits offering a "price" advantage over nonprofits. Patients who differ in risk aversion or information sets choose one type of hospital over another, and both types are present in equilibrium.

The fourth is that there are different financial advantages enjoyed by the two types, where for-profits have access to equity and nonprofits may have lower tax expenses, so that one type may be more or less advantaged in different places or different times (See e.g., Hansmann 1987). If in some markets the financial advantage switches between the organizational forms over time, both types may be observed at a point in time if the future expected return to each justifies their continuous operation.

A similar pattern of fluctuating fortunes is implied by Pauly and Redisch, in that there is no difference in objectives between for-profits or nonprofits, but there are costs and benefits associated with each type (a physicians' cooperative organized as a nonprofit that cannot distribute profits *per se* may be forced to "pay" doctors in perquisites or other non-cash compensation). If there is heterogeneity in doctors' preferences, or differences in costs and benefits in different places or different times, both types of profit-seeking firms will be observed.

Finally, if nonprofits exist because they offer different goods than other types (Rose-Ackerman 1996), then they are actually in different markets and the puzzle of why different hospital types co-exist within markets dissolves. There is some evidence for this explanation in hospital markets. Horwitz (2005a; 2007), for example, has found that medical service provision varies significantly by ownership type. This finding implies two distinct types of product differentiation. First, for example, hospital types specialize in various services (e.g., some government hospitals offer psychiatric emergency care and for-profits in the market do not). One could also consider the different bundles of services offered at hospitals to be different goods. Second, one could understand the product offered by hospitals as health care, a multidimensional commodity. Different patients, or their doctors and insurers, have different preferences over the mix of services

and service attributes offered by hospitals. Consumers may sort by hospital type based on their preferences for quality, quantity, and hotel services.

These notions of product differentiation lead one to think of a model of monopolistic competition, in which the interaction between for-profits and nonprofits is concentrated in the arena of defining a hospital's unique position in the product space. This model does not, however, address the central question of why nonprofits and for-profits would compete in this way. Nor does it suggest the optimal level of quality and quantity of medical services, a particularly difficult question where there is imperfect information as in medical services markets. But the idea of product differentiation does suggest that nonprofit output decisions would not depend on market mix. Nonprofits would simply specialize in the some types of services and *not i*n other types of services, regardless of the number of for-profit competitors.

We prefer the first of these models of self-sustaining market mix, relying on the heterogeneity of preferences among consumers, though each probably captures important elements of the interactions among hospitals in a market. Another model which should not be neglected is simple inertia—regardless of the relative advantages of various organizational forms, or large negative profit margins, many hospitals are slow to close. Nonprofits may see perpetual operation as part of their mission, even if times have changed irrevocably. Hansmann, Kessler et al. (2003) have found that secular nonprofits are less responsive to declines in demand than government or religious nonprofits; for-profits are the most responsive. There are likely other behavioral economics stories at play, including a process of institutional isomorphism that induces nonprofits and for-profits in the same market to behave much the same regardless of their true objectives, which complicate interpretation of these results as tests of competing theories of rational behavior.

B. Previous Empirical Research on Ownership Mix

Related empirical research focuses on two questions: 1) Does firm behavior depend on the ownership of its competitors? 2) What is the primary direction of influence between for-profit and nonprofit firms? Although few studies examine the relationship among firm type, market mix, and medical service provision, the available

evidence suggests that the presence of for-profit hospitals in a market is associated with greater responsiveness to financial incentives among nonprofits in the same market. Nonprofits in relatively high for-profit hospital penetration markets are more likely than other types to provide profitable services (Hughes and Luft 1990; Horwitz 2007), to avoid unprofitable patients (Schlesinger, Bentkover et al. 1987; Schlesinger, Dorwart et al. 1997a), and to spend less on admitted cardiac patients (Ettner and Hermann 1987; Kessler and McClellan 2002). They are also more responsive to profit-making opportunities (Cutler and Horwitz 2000; Duggan 2000; Silverman and Skinner 2004).

Some scholars, however, explain these differences as evidence of market selection rather than ownership. For example, Norton and Staiger (1994) find that conditional on location, nonprofits provide similar amounts of charity care to for-profits, but for-profits differentially locate where there is less demand for such care. Similarly, studying three markets, McClellan and Staiger (2000) find that for-profits systematically locate in markets with lower total quality.

Scholars also consider the direction of influence among firm types within mixed markets. Some claim that nonprofits influence for-profits. Hirth (1999), described above, shows that competition from altruistic nonprofits can raise quality among competing for-profit and nonprofits that adopt for-profit objectives alike. Several others have argued, without systematic evidence in support, that nonprofits influence for-profit competitors through some form of standard setting. They may, for example, define consumer and community expectations regarding service provision such as charity care, or stimulate non-price competition such as competing over reputation for contribution to the community (Marsteller, Bovberg et al. 1998; Clement, White et al. 2002). Hansmann (1980) reasons that a nonprofit culture in older, established industries such as the hospital industry deters profiteering among nonprofits, immunizing them from for-profit influence.

Other scholars identify the opposite relationship—for-profits influencing nonprofits. Hughes and Luft (1990) predict that nonprofit hospitals with for-profit neighbors will feel competitively threatened and, therefore, be more likely than other nonprofits to offer profitable services and less likely to offer unprofitable services. They

also predict that nonprofits view local government hospitals both as complementary institutions, allowing the nonprofit to avoid unprofitable services, and as uncompetitive, thus allowing them to offer profitable services. Their results, albeit for only two medical services, support their predictions. Based on two case studies, Cutler and Horwitz (2000) hypothesize that nonprofit and government hospitals copy the behavior of new for-profit entrants in a hospital market. Finally, Clement and co-authors (2002) show that as nonprofits provide more charity care, for-profits provide less in mixed markets.

Still others contend that there should be no influence of for-profits on nonprofits or *vice versa.* According to Lakdawalla and Philipson (2005) because for-profits have higher operating costs and no endowments, they are the marginal firms and, therefore, the only firms responding to market changes. This result depends on several strong assumptions, such as a finite supply of altruistic entrepreneurs and an infinite supply of profit-seeking entrepreneurs. Further, the result is not robust to changes in the theoretical model, such as allowing the supply of both profit-seeking and altruistic entrepreneurs to vary with market characteristics or fixing the supply of both entrepreneurial types.

Finally, Santerre and Vernon (2005) attempt to identify the efficient ownership mix. Relying on Grabowski and Hirth (2002), they assert that nonprofits encourage for-profits to become more trustworthy and for-profits encourage nonprofits to become more efficient. Thus, they assume that ownership influences run in both directions. They further assume that nonprofits face relatively high demand because they have higher quality, but offer relatively low supply because their relatively low efficiency leads to higher costs. To identify which effect dominates, they regress quantity (e.g., admissions, surgeries, emergency visits, and others) on nonprofit and government hospital market share, and other variables that influence demand. Finding negative coefficients on nonprofit ownership in almost all tests, they conclude that the quality benefit is less than the inefficiency cost associated with nonprofit ownership and, therefore, there are too many nonprofit hospitals. This conclusion, however, is not supported by their theory – if consumers value quantity and quality, then lower quantity and higher quality could generate greater consumer surplus, and there could well be an inefficiently low number of nonprofits.

III. Data and Empirical Strategy

A. Data

Annual data (1988 through 2005) on hospital characteristics (e.g., beds, admissions, ownership status, teaching status, and medical services) are from the American Hospital Association's Annual Surveys of Hospitals (AHA). We include all non-rural, non-federal general medical and surgical hospitals in the United States. We examine every acute and post-acute medical service reported in the surveys. The AHA surveys include approximately 80 service questions from which we excluded questions about facilities, non-medical services, and duplicate questions. Included services and summary statistics are listed in Tables 2 and 3.

The AHA data have some limitations. First, they are self-reported and not independently verified. However, there is no *a priori* reason to suspect that the data reliability is correlated with ownership or market type. Further, general medical and surgical hospitals exhibit a high response rate; in 2003, for-example, it was 86.3 percent. Second, the survey format has changed slightly over the years. From 1988-1993, the survey asked hospitals to choose whether a service (e.g., open heart surgery) was offered at the hospital, another hospital, or not available (allowing the hospital three possible answers), and from 1993-2005 to answer "yes" to each question if the service was offered at a 1) hospital or subsidiary, 2) another system location, 3) network, or 4) joint venture (allowing for 16 possible answers). To ensure that the coding is consistent over time, we compared the responses in 1993, when the surveys included both question types. For all years we converted the answers into a dichotomous variable representing whether the hospital itself offered the service.

Third, the data suffer from missing values, particularly in the later years, and the non-respondents were disproportionately for-profit. Of the roughly 46,075 observations in the sample, before filling in missing values, approximately three percent of nonprofit, five percent of government, and 17 percent of for-profit hospitals did not report whether they offered open-heart surgery in 1988. By 2005, those percentages were about 12 percent for nonprofit, 11 percent for government, and 26 percent for for-profit hospitals. The numbers, however, are considerably lower for nonprofit and government hospitals

after weighting by annual admissions. We imputed missing values using data from the years surrounding the missing year. Generally fewer than five percent of observations were imputed for each service.

Fourth, in approximately 350 hospitals, the self-reported variable for whether a hospital is a general medical and surgical or other type of hospital was inconsistent across years. We conducted additional research on about 100 of these hospitals by searching the hospital website, local newspapers, state government reports, and contacting the hospital directly to determine which value was correct; we excluded 48 of these hospitals from the sample because they were not general hospitals. We recoded the remaining 267 hospitals with varying designations (approximately five percent) by using the modal response during all years, therefore only using those hospitals that report being a general medical and surgical hospital in the majority of study years.

We constructed demographic controls using tract-level data from the 1990 and 2000 U.S. Census. HMO penetration data (1990 through 2001) are derived from the National Directory of HMOs (published annually by the Group Health Association of America) and Interstudy. Baker (1997) provides details on the construction of HMO market share estimates. We constructed the hospital system membership variable from three sources: the AHA and databases constructed by Madison (2004) for 1988-1998 and by Dafny and Dranove (2006) for 1988-2000.

We constructed hospital operating margins using the Centers for Medicare and Medicaid Services' Healthcare Cost Report Information System (HCRIS). The HCRIS data are updated quarterly and we used data from the March 2006 version for years 1988 through 2004, excluding 2005 from the analysis because the data were incomplete. There are some limitations to the data, suggested by the fact that within a single hospital operating margins vary considerably over time. We excluded nearly one percent (330) of the observations because they showed contractual allowances – the difference between hospital charges and amounts realizable from third party payers under contractual agreements – to be larger than total patient revenues. We also excluded an additional five percent (2,297) of the observations because they were missing at least one variable necessary to calculate the operating margin.

We developed a database of precise hospital locations from several sources, starting with addresses from the AHA database, filling in missing addresses through internet searches and telephone calls to the hospital or the current resident of the building that housed the closed hospital. We then used geocoding software to match the addresses to precise longitudes and latitudes, matching 77 percent during the first run and slightly over 10 percent more after resolving name conflicts or hand-matching the addresses with the software. We identified the remaining locations by employing various methods including using Federal Aviation Administration databases to identify hospital heliports and iterating between topographic maps to locate the hospital visually and mapping programs to find the street location.

B. Empirical Strategy and Models

1. Overview and Service Profitability

Examining medical services provision is useful for several reasons. Service provision decisions suggest the type of patients, doctors, and payers whom hospitals wish to attract. By examining multiple services, rather than concentrating on one, we are able to establish the patterns by which hospitals decide to provide services. Comparing services also allows us to identify hospitals' relative responsiveness to financial incentives. Interactions between medical providers and their patients may also be influenced less directly by a hospital's ownership form or market environment than by whether and how those factors determine the services that hospitals offer, particularly since hospital administrators can more readily control service offerings than ownership status or market environment.

In total, we examine 45 individual medical services to test whether offerings differ by the interaction between hospital ownership and market type (i.e., high and low for-profit hospital market penetration). We then sort those services into three profitability categories – those with relatively high, relatively low, and variable profitability. Our main method, following Horwitz (2007), assigns relative profitability based on several sources including peer-reviewed research, interviews (with, e.g., hospital administrators, doctors, and policymakers), analyses of patients' socioeconomic or insurance status, Medicare payment reports, physician salaries for related services, and

trade publications. Although we summarize some of the designations in Table 2, a detailed report explaining the profitability sorting is available online (Horwitz 2005b).

Second, as a check on the first method, we categorize relative profitability from the data itself. We assume that for-profits are more likely than government hospitals to offer relatively profitable services and less likely to do otherwise. Using results from equation (1) below, including all the listed control variables, we classify services as profitable if for-profit hospitals are more likely to offer a service than government hospitals in more than 10 percent of the study years and less likely to do so in no more than 10 percent of the study years. We similarly categorize services as unprofitable if for-profit hospitals are less likely to offer a service than government hospitals in more than 10 percent of the study years and more likely to do so in no more than 10 percent of the study years. If for-profits are both more likely to offer a service in more than 10 percent of the study years and less likely to do so in 10 percent of the study years, we classify the service as variable. Otherwise, we classified the service as indeterminate. For services that the first method identifies as unprofitable, the second method quite consistently also identifies them as unprofitable. The approaches are less consistent for services identified as profitable by the first method (See, Table 2, Column 2).

Here we report in detail on representative services for each of three categories – relatively profitable, relatively unprofitable, and variably profitable services. In the relatively profitable category, we consider open-heart surgery, which was among the most consistently and unambiguously profitable services over the study period partly because of the well-insured nature of the patient pool (Cutler, McClellan et al. 2000) and the fact that as the real price of bypass surgery increased during the 1980s and 1990s, the costs were either flat or fell during the same period (Cutler, McClellan et al. 2001; Cutler and Huckman 2003). We also include magnetic resonance imaging technology (MRI) because it is representative of an elective unit that is often provided by free-standing, for-profit businesses independent of hospitals.

We report on two relatively unprofitable services, HIV/AIDS treatment and psychiatric emergency care. During the 1980s and 1990s, HIV-positive and AIDS patients were unprofitable patients to treat because almost all community health insurers

rated them as uninsurable, although some states forbade HIV antibody testing for underwriting purposes (Pascal, Cvitanic et al. 1989). Further, Medicaid reimbursement, the largest source of AIDS/HIV treatment payments in the 1990s (Westmoreland 1999), did not typically cover the cost of treatment. (Pascal, Cvitanic et al. 1989) Psychiatric services were generally unprofitable over the entire study period, and have become more unprofitable in the latter years, as insurers cut back reimbursement. Hospital-based, psychiatric emergency services are relatively unprofitable for several reasons including the emergency room setting, the uncertain and often low level of reimbursement, and the poor, poorly insured, and sick nature of the patient pool (Shwed 1980; Melnick, Serrato et al. 1989; Deloitte & Touche 1990; Woodward, Epstein et al. 1997; Dhossche and Ghani 1998; Gentry and Penrod 2000; Tye 2001).

Finally, home health care and skilled nursing facilities exhibited variable profit-making opportunities over the study period, being relatively profitable in roughly 1993 through 1997, but neither unambiguously profitable nor unprofitable before or after this heyday. Legal challenges ensuring Medicare would reimburse these services were resolved by the early 1990s, and they became quite profitable for hospitals that newly entered the post-acute market and hospitals that unbundled acute and post-acute services. With passage of the 1997 Balanced Budget Act, Medicare payments were reduced and spending on post-acute care fell by a factor of two (Liu, Gage et al. 1999; Newhouse 2001; Newhouse 2002).

2. Market Definitions

There are several conventional methods for defining market boundaries and market share. Because each has strengths and weaknesses, we perform numerous analyses using both alternative measures of hospital market and for-profit market share. We summarize the approaches here and provide details, including comparisons of the methods, in Appendix A and Appendix B. Our main results use a new "distance-weighted" measure of the percent of other hospitals that are for-profit, averaging across all hospitals in the country. For each hospital in our sample in each year, we assign a weight to each other hospital in the country, weighting by its admissions divided by the square of one plus a constant times the distance squared. This method places more reasonable relative weights on points of different distances from the hospital than does

the more conventional reciprocal of squared distance. We fix the constant used in the weighting such that the method yields similar results to those of actual patient markets as reported by Gresenz (2004).[2]

We then identify a hospital as being in a high for-profit (HiFP) market if its market is more than 15% for-profits, and in a low for-profit (LoFP) market if it faces less than a 10% for-profit market share. Roughly 60-65 percent of the hospitals in the sample are in low for-profit penetration markets and 25-30 percent are in high for-profit penetration markets in the years under study. The median of for-profit market share is close to 10 percent for each definition of for-profit share, and more than a quarter of hospitals have more than a 15 percent for-profit share in their market, but different definitions of for-profit market share produce different classifications. We experimented with alternative cutoffs, including the top third and bottom third of for-profit market shares, and the results were insensitive to specification differences.

In the first set of alternative market tests, we identified a hospital's market as a disk with an approximately 15-mile radius centered on the hospital's location. This "fixed-radius" approach puts a weight on potential competitors that decays smoothly to zero at 30 miles (i.e., when the distance from the central hospital to its competitor is twice the radius of the disk, the overlap is zero). Because we identify the hospital location by its longitude and latitude, rather than situating it at the centroid of the zip code in which it operates, we avoid some of the imprecision commonly found in the hospital ownership research. Neither the distance-weighted nor the fixed-radii measure of for-profit share accounts for barriers to travel such as mountains or rivers.

We use a third market definition often used in health economics research, MSA (Chernew 1995; Santerre and Vernon 2005). This approach incorporates a notion of

[2] We chose not to use measures of market that depend on the hospital's choice variables, such as by varying the potential geographic area from which a hospital draws its admissions. While such measures have the benefit of better identifying the area from which a hospital draws its actual patients, the actual patients served are not identical to a hospital's market, which is conceptually closer to the potential pool of patients faced by each hospital. If a hospital changes its product mix, discontinuing one service and instituting another, the actual patients served might change radically, and the geographic area might shift suddenly. The potential patient pool is unchanged in this hypothetical example, and the reaction functions of hospitals in competition, and their behavior in real markets, are determined by characteristics of potential patients as much as by actual patients.

topographical features and travel time because MSAs are defined by the Census to encompass an area within which individuals are likely to commute to work. Further, MSAs are fairly similar to Hospital Referral Regions (HRR), which represent regional health care markets for tertiary medical care as defined by the Dartmouth Atlas of Healthcare. Over 65 percent of HRRs include only 1 MSA and 88 percent include 1 or 2 MSAs. The results were not sensitive to these three alternative market definitions.

We also vary the definition of for-profit market share, by using the first observed market share (which is not sensitive to entry and exit by other hospitals over the 18 years of data in our sample), and find similar results. Further, we alternatively include and exclude each individual hospital from its own market to construct each of the for-profit market penetration variables. Results are somewhat sensitive to whether a hospital's own ownership and admissions are included in its market definition, in the sense that patterns of predicted probabilities look qualitatively noisier and less sensible, but here we report only results using *not-i* market definitions, i.e., those that do not allow a hospital's own ownership and admissions from defining the hospital's market type.

3. Primary Econometric Model

(a) Hospital Level Specification

We ask whether hospital types offer different types of services in different market types measured by for-profit penetration, modeling the effect of ownership mix on service provision by hospital type as follows:

(1) $E(\text{ServiceProvided})_{it} = \Phi[\ \beta_o + \beta_1 F_{it} + \beta_2 Y_t + \beta_3 Y_t * F_{it} + \beta_4 \text{FPMarket}_{it} + \beta_5 F_{it} * \text{FPMarket}_{it} + \beta_6 Y_t * F_{it} * \text{FPMarket}_{it} + \beta_7 H_{it} + \beta_8 D_{it} + \beta_9 \text{HMO}_{it} + \beta_{10} \text{HHI}_{it}]$

where F is a vector of indicator variables for nonprofit, for-profit, or government ownership; and Y is a vector of indicator variables for year. FPMarket is a dummy variable that identifies high for-profit markets. H is a vector of hospital characteristic variables including hospital size (measured by quintiles of total hospital admissions), and teaching status (measured by two variables: 1) whether the hospital has a residency training approval by Accreditation Council for Graduate Medical Education, and 2) whether the hospital is a member of the Council of Teaching Hospitals of the Association of American Medical Colleges).

We include system membership because individual hospital service provision depends on system decisions, and the probability of system membership is greater for for-profit and religious hospitals than others (Madison 2004). System membership may also be correlated with the measures that we test, such as offering cardiac care, although the direction of the correlation is unclear (Madison 2004). Finally, systems may acquire hospitals that provide profitable services so we introduce another endogeneity problem. Therefore, H includes a binary variable for whether a hospital is a member of a hospital system, defined as the maximum of two indicator variables based on AHA data: whether the hospital has a non-missing system identification number and whether the hospital reports belonging to a system. In some cases, we impute system membership for hospitals based on corrected system membership data assembled by Madison (2004) or Dafny and Dranove (2006).

D is a vector of demographic variables measuring the characteristics of a hospital's potential patients. These include population size, ten categories of age, seven categories of education, five categories of race, sex, marital status by sex, employed persons by eleven categories of industry (as a proxy for insurance status), ten categories of household income, income per capita, and twelve categories of travel time to work (as a proxy of willingness to drive various distances to the hospital). Because the demographic data are from the years 1990 and 2000 only, we filled the missing years by linearly interpolating and extrapolating the natural log of each control variable, amounting to imposing a constant percentage change per year in each population type within each hospital's market.

We compiled these data from the 1990 and 2000 Censuses by averaging across all tracts in the states and DC, using weights that vary inversely with the distance squared from hospital *i* to the centroid of each census tract. All distances are calculated using an accurate ellipsoidal model of the Earth's surface (Nichols 2007). The results are not sensitive to the specifics of weighting choices. This is a general feature of averaging demographic characteristics across fairly large geographical areas. Goody (1993) notes that in a study of rural hospital markets varying the market definition did not affect mean socioeconomic variable values at the zip code level.

HMO is market penetration of health maintenance organizations, a measure commonly used as a proxy for financial pressure in a market. We include this variable because competitive pressure has been found to explain some variation in nonprofit behavior such as charity care provision by general hospitals (Gruber 1994; Mann, Melnick et al. 1995) and psychiatric hospitals (Schlesinger, Dorwart et al. 1997b). Further, areas with more for-profits have slightly lower HMO enrollment than areas with fewer for-profit hospitals (Kessler and McClellan 2002).

During our study period, there was considerable hospital market consolidation, with many markets reduced to monopolies, duopolies, or triopolies (Gaynor 2006). To ensure that we estimate the effects of ownership mix rather than market concentration, we include two measures of market concentration. First, we include a variable (HHI) that measures market concentration using the Herfindahl-Hirschman Index which is the sum of squares of each hospital's share of total admissions within each MSA in each year. Although we hypothesize that ownership of a hospital affects the service provision of its competitors, we do *not i*nteract ownership type with HHI because there is no *a priori* reason to believe that the incentive to exploit market power differs by form. In theory, although the particular motivation for exploiting market power may vary by ownership type (e.g., earning profits to distribute to owners or furthering nonprofit goals), both types of firms benefit from exploiting market power (Philipson and Posner 2006). In a simulation, Gaynor and Vogt (2003) show no difference in the propensity of nonprofit and for-profit hospitals to exploit market power. Abraham, Gaynor et al. (2005) find that entry of a second or third hospital in a market leads to a convergence in competitive conduct, including an increase in the quantity of admissions in a market, but find no effect of further entry. We therefore include three indicator variables measuring whether the MSA has 2, 3, 4, or 5 hospitals or more (the excluded category). [3]

Because the probability of a hospital offering a service is not independent from one year to the next, we correct standard errors by clustering at the hospital level so they are robust to arbitrary serial correlation (Arellano 1987; Kézdi 2004; Stock and Watson

[3] We drop the few MSAs with only one hospital because the MSA-level, for-profit market share cannot be calculated for these MSAs.

2006). Test statistics on joint tests when clustering at the MSA level were generally greater in absolute magnitude, and standard errors on individual coefficients generally smaller, indicating that errors may be negatively correlated within MSA. Estimating standard errors, at the hospital level, therefore, is conservative. These cluster-robust standard errors are also robust to heteroskedasticity in errors.

By varying only the corporate form and market type of each hospital while holding the independent variables constant (at 1994 levels), we predict the probabilities that each hospital in each year would offer a given service. Then we average the individual predicted probabilities to obtain the probability that a hospital type offers a service each year. The thought experiment is, in short, what if all hospitals were for-profits in high for-profit markets in every year? What if all hospitals were non-profits in high for-profit markets in every year? What if all hospitals were non-profits in low for-profit markets in every year? How would the behavior of hospitals differ under each of these counterfactuals in different types of markets? Conducting the empirical tests in this manner allows us to hold constant non-ownership hospital characteristics, thus yielding more accurate predictions of how hospitals would behave if they changed form and no other attributes.

(b) Service Level

Instead of modeling the effect of ownership mix on provision by hospital for each of 45 services separately, we reformat the data so that each observation is of a service-hospital-year combination, rather than a hospital-year combination, and regress provision on hospital, market and service characteristics:

(1b) $E(\text{ServiceProvided})_{ijt} = F[\ \beta_o + \beta_1 F_{it} + \beta_2\ P_{jt} + \beta_3\ F_{it}*P_{jt} + \beta_4 \text{FPMarket}_{it} + \beta_5\ F_{it}*\text{FPMarket}_{it} + \beta_6\ P_{jt}*F_{it}*\text{FPMarket}_{it} + \beta_7 H_{it} + \beta_8 D_{it} + \beta_9 \text{HMO}_{it} + \beta_{10}\text{HHI}_{it} + \beta_{11} Y_t]$

where j indexes services and i indexes hospitals, P_{jt} is an indicator of profitability (0 for an unprofitable or 1 for a profitable service in each year), and other variables are the same as in equation 1. The coefficients in the vector β_6 are of primary interest, since they measure the differential impact of profitability for a hospital of a given type between low and high for-profit markets. In this model, we have included all 39 services classified as either profitable or unprofitable, excluding the six services we classified as

indeterminate. We coded services with variable profitability as profitable in some years (1993 through 1997) and unprofitable in others.

We correct standard errors by clustering at the hospital level so they are robust to arbitrary intraclass correlation. These cluster-robust standard errors are also robust to heteroskedasticity in errors, and are larger on average than standard errors clustered at the hospital-year (smaller classes) or MSA (larger classes) level, i.e. they are conservative.

4. Fixed-effects Model

We also implement an analogous model that includes fixed-effects for each MSA. In this model, for-profit market share enters linearly and is interacted with hospital ownership, making year effects common to all hospital types but allowing the effect of for-profit share on hospitals to differ by nonprofit, for-profit, and government ownership. Applying the fixed-effects approach using the disk-overlap or distance-weighted methods to define for-profit market share, the model controls for any unobserved heterogeneity at the MSA level that is fixed over time. In this model we also cluster at the hospital level.

Because of the limitations to this model, we do not include a variable for market fixed-effects in the primary specification. In a model with MSA-level fixed-effects, using the MSA-level definition of for-profit market share to identify high for-profit markets, the effect of market share is identified solely off changes within an MSA over time. These changes are small and non-randomly distributed. Furthermore, much of the interesting variation in market share is cross-sectional, and most of that cannot affect behavior in the fixed-effect model. Finally, the demographic characteristics of a city's population are accounted for by MSA fixed-effects and, therefore, only changes in composition can be included in the model. However, we estimated changes across years in composition of the population from two Census years and interpolated to all 18 study years, so the change in composition would be a noisy measure and hard to interpret in the estimated model. Therefore, we exclude the Census controls to account for changing composition of the potential patient population. Including various subsets of Census controls made little difference to the overall pattern of estimated coefficients, but did further inflate the variability of estimates.

5. Operating Margins

We constructed hospital operating margins from the HCRIS by dividing net income from patient services (total patient revenue less contractual allowances less total operating expenses) by net patient revenues (total patient revenues less contractual allowances). We employed the following model

(2) $\text{Operating Margin}_{it} = \beta_o + \beta_1 F_{it} + \beta_2 Y_t + \beta_3 Y_t * F_{it} + \beta_4 \text{FPMarketPenetration}_{it} + \beta_5 F_{it} * \text{FPMarketPenetration}_{it} + \beta_7 H_{it} + \beta_8 D_{it} + \beta_9 \text{HMO}_{it} + \beta_{10} \text{HHI}_{it} + e$

where the variables in (2) are the same as described above in equation (1) except we use a continuous measure of for-profit market share rather than a dichotomous variable to measure the impact of for-profit market share. In sensitivity tests we exclude from D the controls based on characteristics of Census tracts. We estimated the model both in the pooled cross-section and using a fixed-effects specification analogous to the tests for medical service provision described above. In this model we cluster at the MSA level (Kézdi 2004; Stock and Watson 2006). Test statistics on joint tests when clustering at the hospital level were generally greater in absolute magnitude, and standard errors on individual coefficients generally smaller, indicating that errors may be positively correlated within MSA, and our estimated standard errors are conservative.

IV. Results

A. Medical Services

Here we present findings from the basic specification (i.e., using the distance-weighted market measure to construct high and low for-profit penetration markets) for three service types: relatively profitable, relatively unprofitable, and variably profitable (Figures 1-3). We summarize the results for all 45 services in Table 4 and provide graphs for all results in Appendix C.

Nonprofit hospitals in high for-profit markets are more likely to offer profitable services than those in low for-profit penetration markets. This can be seen best in Figure 1. The regression results confirm the intuition provided by the figures, showing that, on

average over the study period, nonprofits in high for-profit markets were 4.8 percentage points more likely to offer open heart surgery than those in low for-profit penetration markets (ave p=0.000, joint p=0.021).[4] Government hospitals followed a similar pattern (4.8 percentage points, ave p=0.158, joint p=0.603). For-profit hospitals show a different pattern, although the results were largely insignificant and, therefore, could indicate no difference at all. For-profits were *less likely* to offer open heart surgery in highly for-profit markets (-1.7 percentage points, ave p=0.556, joint p=0.519). The results for MRI provision were similar. Nonprofits in high for-profit markets were more likely to offer MRI services than those in low for-profit penetration markets (5.8 percentage points, ave p=0.000, joint p=0.001). The results for government (7.1 percentage points, ave p=0.032, joint p=.194) and for-profit (1.1 percentage points, ave p=0.474, joint p=0.070) hospitals were similar.

Nonprofit hospitals were systematically *less* likely to provide unprofitable services in for-profit markets than in other markets. Figure 2 for psychiatric emergency care and HIV/AIDS treatment illustrates the results. On average over the study period, nonprofits in high for-profit markets were *less* likely to offer HIV/AIDS treatment (-5.9 percentage points, ave p=0.002, joint p=0.016) and psychiatric emergency care (-6.0 percentage points, ave p=0.001, joint p=0.009) than those in low for-profit penetration markets. Nonprofit hospitals were more likely to offer only one of the unprofitable services – burn care – in for-profit markets than in others and the results for this service were statistically insignificant. For-profit and government hospitals followed a similar pattern in high for-profit markets, but the results were insignificant.

These findings are confirmed by the results for services in which profitability varied dramatically during the study period, the post-acute services home health and skilled nursing. When the services were most profitable, from 1993 through 1997, nonprofit hospitals were more likely to offer them in the high than the low for-profit penetration markets (Home Health: ave p=0.0302, joint p=.0427; Skilled Nursing: ave p=0.0005, joint p=0.0048). Yet when these services became less profitable, nonprofits

[4] We present results from two types of hypothesis tests, whether 1) the coefficients on hospital type*market type are different on average over the study period and 2) these coefficients are jointly different.

reduced their likelihood of providing post-acute services more dramatically in high than low for-profit penetration markets. The results for for-profit hospitals, although weaker, are similar. The results for government hospitals are ambiguous. As can be seen in Table 4, these patterns are quite strongly confirmed by results for the other services using the Horwitz (2005b) classification of relative profitability and, particularly for the relatively unprofitable services, using the data-generated classification of relative profitability described above.

We also attempted to produce a single coefficient to represent the effect of the ownership-market interaction on service provision. These specifications, estimated at the service level, strongly support the findings in which we estimated each service at the hospital level separately. The effect of service profitability on the likelihood of a nonprofit hospital offering a service in a low for-profit market is large and significantly negative (see Table 5b, row 4); the effect of profitability on the likelihood of a nonprofit hospital offering a service in a high for-profit market is positive and significantly different from zero (see Table 5b, sum rows 4 & 10).

Consistent with our findings that nonprofit hospitals are more likely to offer profitable services in high than in low for-profit markets, we estimate a large positive coefficient on "High for-profit market X nonprofit X profitable service" (Table 5b, row 10), which measures the differential probability of a nonprofit offering a profitable service (relative to an unprofitable one) in a high for-profit market. Using the distance-weighted measure of market share, the coefficient 0.432 corresponds to an odds ratio of 1.54, suggesting that the average estimated effect of a higher for-profit share on a nonprofit hospitals' propensity to offer profitable services or avoid unprofitable services is quite large (Table 5b, column 3, row 10).

B. Operating Margins

Estimates from both pooled and fixed-effects regressions of profit margins on hospital characteristics, with various definitions of for-profit market penetration, show no effect of market type on nonprofit hospital margins (Table 5). This is unsurprising given that every theory we discuss predicts this result. The point estimate on the effect of increased for-profit share on the profit margins among for-profit hospitals, however, is

uniformly positive across all specifications we have run, including those not shown in Table 5.

For-profit hospitals having higher profits where there are fewer nonprofit competitors is more consistent with nonprofit hospital output maximization than profit maximization. Because nonprofit presence is lower when for-profit presence is higher, if nonprofits are maximizing output and producing more than the profit-maximizing oligopoly output, a greater for-profit presence results in higher profits for profit maximizers; conversely, if nonprofits are profit-maximizers in disguise, the for-profit market share should have no effect on the profits of for-profit hospitals. Using the nonprofit market share as a measure of market structure produces similar findings; nonprofit profits are unaffected, but for-profit hospitals' profits are driven down by increased nonprofit presence. We cannot, however, rule out the possibility that only some nonprofits maximize output and others maximize profits.

C. Alternative Explanations, Specifications, and Sensitivity Tests

These results from the main specification may not differentiate between two possible reasons for observed differences: 1) as we suggest, nonprofit hospitals may offer different services in markets with relatively high or low for-profit penetration or, alternatively, 2) unobserved characteristics about particular markets may both disproportionately attract for-profit hospitals and cause a relatively high level of profitable service provision.

There are good reasons to suspect that the former, rather than the latter, is the better explanation. If the unobserved characteristic explaining both higher levels of for-profit hospital market share and profitable service offerings is related to differences in demand that are correlated with population characteristics – as it is, for example, in the case of demand for charity care (Clement, White et al. 2002) – the extremely detailed demographic control variables address some of this concern. Further, there is some research suggesting that medical service provision does not drive the mix of hospitals in a market. Santerre and Vernon (2005), for example, note that market shares change little from year to year; Grabowski and Hirth (2002) claim that the share of nonprofit hospitals

is primarily related to historical factors such as the age of the city and to characteristics of its populace, such as levels of charitable activity.

A prominent thread in the empirical research, however, suggests that for-profit hospitals choose location differently from nonprofit hospitals. Norton and Staiger (1994) demonstrate that nonprofits are more likely than for-profits to serve disadvantaged populations, both in terms of types of health services demanded and ability to pay for health services based on income and insurance coverage. Kessler and McClellan (2002) show "that market and other hospital characteristics are correlated with hospital ownership status. For example, for-profit areas are substantially more competitive than non-profit areas (less likely to be very concentrated, i.e., in the top HHI quartile), have higher rates of bed capacity, and slightly lower rates of HMO enrollment." They further argue that there is substantial selection by health status. Patients who go to public hospitals tend to be much sicker. This bias, however, is at odds with the finding that public hospitals differ from for-profit hospitals in the provision of profitable services; we would expect government hospitals to offer more high-tech, invasive services because they serve the patients who most need them. These services tend to be relatively profitable. Likewise, for-profit hospitals should be less averse to offering emergency services, since healthier patients make emergency rooms less unprofitable.

In addition to controlling for differences in the populations served by different hospital types by using the detailed Census controls described above, we employ three other approaches to dealing with possible endogeneity: 1) altering the market penetration definition, 2) altering the market definition, and 3) employing a fixed-effects model.

1. Market Penetration Definition

In an additional set of specifications, we define market type (high for-profit market v. other markets) based on the for-profit market share faced by the hospital in the first year it is observed. Since hospitals enter markets throughout the study period, the initial year market for-profit concentration faced by nonprofit hospitals differs from the current-year concentration, in some cases substantially. The results, however, differ only modestly in most specifications and for most services. This suggests that our basic specification does not suffer from endogeneity from selective entry by for-profit hospitals

(e.g., for-profits entering where existing provision of profitable services is low relative to other markets).

2. Alternative Market Definitions: Fixed Radii and MSAs

Instead of weighting the contribution of each hospital to market structure proportional to its total admissions, and inversely by its distance from hospital *i*, one can imagine weighting each hospital proportional to admissions within a given geographical area such as an MSA. One might also calculate disks of fixed radius, e.g., distances commonly found in the literature such as 10 or 15 miles, and weight nearby hospitals' contributions to market structure by proportion of overlap of its disk with hospital *i*'s disk. Analyses using the MSA-level and disk-overlap measures of for-profit market share produce notably similar results to our basic distance-weighted measure. The correlations in market share are also quite high, as shown in Appendices A and B.

3. Fixed-Effects Model

The fixed-effects model offers weak confirmation of the results in the basic specification. The results, reported in Appendix D, suggest that nonprofit hospitals are increasingly likely to offer cardiac services (angioplasty and cardiac catheterization labs, but not open heart surgery or cardiac intensive care beds) and MRIs as for-profit market share increases. On the contrary, they are decreasingly likely to offer certified trauma care and psychiatric emergency services as for-profit market penetration increases. However, almost none of these results are significant, perhaps because the within-MSA cross-time variation in market shares is minuscule compared with cross-sectional variation in market shares. The fixed-effects results for government hospitals are puzzling. Government hospitals seem more likely to offer *both* relatively profitable and unprofitable services as for-profit market penetration increases. Finally, for-profit hospitals show no discernable tendency.

VI. Conclusions

There is a strong and systematic relationship among hospital ownership, ownership mix in the market, and medical service provision. Nonprofit hospitals located in markets with high for-profit penetration are more likely to offer relatively profitable

services than those in low for-profit penetration markets. With the exception of one tested service (burn care), nonprofits are less likely to offer every unprofitable service in high, compared to low for-profit markets. Perhaps the most convincing evidence for the effect of market mix is the results for home health and skilled nursing, post-acute services that were first ambiguously profitable, then profitable, then less profitable again. During the most profitable period, nonprofits were more likely to offer them in high, compared to low for-profit markets. During less profitable periods, depending on the specification, there was either no discernable difference or more dramatic exit among nonprofits in for-profit markets.

We find no systematic effect of market mix on government and for-profit medical service offerings. Government hospitals may follow a similar pattern to nonprofits, but the effect is smaller than for nonprofits, and few results are statistically significant. Although for-profit hospitals are somewhat less likely to offer many of the tested services in markets with high, compared to low, for-profit market share, these results are generally insignificant as well.

That there is essentially no difference in for-profit or government hospital behavior in low versus high for-profit markets suggests that the differences we find in nonprofit hospital behavior are not entirely driven by unmodeled market differences. More specifically, these results can be interpreted as a difference-in-difference estimate of the effect of market mix on nonprofit service provision because the estimate of for-profit (or government) behavior to be subtracted from the nonprofit difference is essentially zero. These patterns are especially clear in the case of home health, where nonprofits were significantly more likely to offer the service in high for-profit markets in the profitable years (1993 to 1997) but the difference disappears after 1998, and for-profit and government (while clearly responding to incentives) exhibit no real differences by for-profit market share. The results for skilled nursing facilities are a bit more difficult to interpret this way since, while we find no effect of market mix on government hospitals, we find that for-profits in high for-profit markets are more likely than others to offer skilled nursing during the service's most profitable period.

The patterns we identify here cannot establish a causal effect, but they do suggest that the ownership mix in a market influences nonprofit behavior in important decisions about whether to offer a service. The thought experiment of exogenously changing the ownership of a typical for-profit to a nonprofit or *vice versa* cannot be duplicated in real data, so the relevant counterfactuals cannot be examined. Nonetheless, the observed patterns are more consistent with some theories of the nonprofit firm than others. Table 6 summarizes some intuitive interpretations of existing theories of nonprofit hospitals' objectives, suggesting what these theories would predict for hospitals operating in low for-profit and high for-profit markets.

Finding that firm types behave quite differently from each other, our examination implies that the Pauly-Redisch profit-maximization model does not accurately describe the hospital market. Identifying differences in behavior by ownership type alone, however, does not rule out a hybrid model, where some nonprofits are profit-seekers. Nor can they distinguish between models of own-output or market-output maximization. Our main empirical results concerning the interaction between ownership, market mix, and service provision help in this regard. Rather than compensating for any deficiencies in service provision by neighboring for-profits as a market-output model (Weisbrod) would predict, we observe that nonprofit behavior becomes more like for-profit behavior in the presence of a higher for-profit share. These results are most consistent with either an own-output model (Newhouse) or a model in which at least some nonprofits maximize own-output even while others are maximizing profits (Hirth).

Based on our results concerning hospital margins, that for-profits have higher profits in high for-profit markets (Table 5), we also favor a model where nonprofits maximize output (Newhouse or Hirth). Across many specifications, including those reported in Table 5, the effect of for-profit market share on the profit margins of for-profits is consistently positive. Other specifications not reported here confirm that a higher nonprofit market share is associated with no significant change in nonprofit margins, but lower profit margins at for-profits. If nonprofits are profit-maximizers in disguise, we would expect an increased share of nonprofits to have no impact on for-profits hospitals' margins; if they maximize output, more nonprofits in a market should

result in lower profits for for-profits. However, we cannot rule out that some nonprofits, perhaps quite a small number, are for-profits in disguise.

It is possible that the observed empirical patterns are simply the result of selection or some other source of spurious correlation. A commonly advanced alternative explanation is that ownership does not lead to differences in service provision but instead leads to different choices over location. According to this explanation, different hospital types pick markets based on the characteristics of potential patients and the characteristics of the other hospitals serving those potential patients. We find this hypothesis unconvincing. First, the explanation assumes low-cost entry and exit, and a complete space of possible location choices, when in practice for-profits have typically purchased nonprofits that were willing to sell or built new hospitals in areas with population growth. Second, our findings do not support this type of selection explanation. Coding individual hospitals by their initial for-profit market share or by their current year for-profit market share yields similar results, suggesting that location choice does not explain all relevant behavioral differences. If choice of location drives these results, we would expect the use of the initial-year variable to yield much weaker differences in the predicted directions, but if anything, the effect of market mix seems marginally stronger in most specifications.

Another alternative explanation is that patients choose hospital types based on the nature of their ailments and the transparency of care quality. This too seems unlikely. First, given the detailed demographic controls in our study, one needs a complicated story to explain why patients in locations with high for-profit penetration are more likely to demand their profitable services from nonprofits than in other locations. Second, patients are treated by their doctors and, even more often, their insurers restrict their ability to choose hospitals. Which hospitals accept a patient's insurance plan or where a patient's doctor has admitting privileges are decisions that are generally exogenous to the patients' illness. Third, to the extent that some patients, through their doctors, are able to match illnesses and hospitals, quality information is not readily available. Quality report cards, for example, only exist for a few treatments and cover few hospitals.

Even assuming a causal interpretation of the estimates, we cannot yet identify the most efficient market mix. Although high concentrations of for-profit markets could be shown to harm nonprofit service provision, other researchers have identified potential efficiency gains from for-profit ownership; these may outweigh the danger of inefficiently low provision of unprofitable services or inefficiently high provision of profitable services.

To identify an optimal mix within a market, one needs to know both the differences among ownership types and the market level implications of those differences. This work represents a first step in that direction. However, a comprehensive theory of nonprofit and for-profit coexistence in a market must be developed before the theoretical models we have discussed can be formally tested, and such a theory must take account of the non-Walrasian nature of many of these markets (neither prices nor quantities are observed, and the producer and consumer are not clearly identified in many of these markets). Such a theory must also explain why nonprofits and for-profits compete in only some markets. Finally, this theory will have to explain the empirical regularities we have described in this paper.

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Table 1. Hospital Ownership (1988-2005) By Year and Rural Status

	Non-Rural, Unweighted			Non-Rural, weighted by admissions			Rural, Unweighted			Rural, weighted by admissions		
Year	Gov	NFP	FP	Gov	NFP	FP	Gov	NFP	FP	Gov	NFP	FP
1988	17.91	64.46	17.63	17.39	73.12	9.49	43.17	47.63	9.20	32.00	58.37	9.62
1989	17.69	64.79	17.52	16.93	73.56	9.51	43.16	47.81	9.03	31.68	58.51	9.82
1990	17.67	65.22	17.10	16.80	73.74	9.46	43.13	48.02	8.85	31.63	58.53	9.83
1991	17.39	65.94	16.67	16.24	74.51	9.25	43.58	47.71	8.71	31.02	59.01	9.97
1992	17.83	65.62	16.54	16.27	74.43	9.29	43.73	48.41	7.85	31.16	59.84	9.00
1993	18.27	65.05	16.67	16.68	73.95	9.38	43.60	48.74	7.66	30.82	60.16	9.02
1994	18.11	64.51	17.37	16.80	73.03	10.18	42.05	50.35	7.60	26.55	65.74	7.72
1995	17.61	64.60	17.79	16.21	72.87	10.93	43.00	48.84	8.16	30.22	59.85	9.92
1996	17.64	64.36	18.00	15.75	72.54	11.71	42.83	48.94	8.23	29.54	60.18	10.28
1997	16.87	63.81	19.32	14.83	72.66	12.50	41.50	49.98	8.52	28.49	60.80	10.71
1998	16.28	64.89	18.83	14.00	73.54	12.46	40.68	50.67	8.65	27.82	61.57	10.62
1999	16.34	65.68	17.98	13.91	74.17	11.92	40.33	51.10	8.56	27.21	61.89	10.90
2000	15.72	66.01	18.27	13.25	74.43	12.31	39.76	51.83	8.41	26.83	61.98	11.19
2001	15.98	65.72	18.30	13.55	74.24	12.21	39.52	52.11	8.37	26.56	62.28	11.16
2002	15.93	65.69	18.38	13.67	73.95	12.37	38.76	52.67	8.57	25.70	62.89	11.41
2003	15.75	65.24	19.00	13.30	74.16	12.54	38.64	52.27	9.09	25.09	62.65	12.25
2004	15.79	64.58	19.63	13.54	73.69	12.77	38.43	52.00	9.57	25.33	62.11	12.56
2005	15.60	65.18	19.22	13.45	73.97	12.58	38.24	51.95	9.81	25.12	62.19	12.70
Avg. all years	16.91	65.08	18.01	15.14	73.70	11.16	41.34	50.06	8.60	28.49	61.03	10.48

Source: Authors' analysis of American Hospital Association Annual Surveys 1988-2005.
Notes: Includes all general, medical, and surgical hospitals except Veterans', Bureau of Indian Affairs, Department of Justice (prison), and other federal or restricted use hospitals.

Table 2. Medical Services, Profitability, and Percentage of Hospitals in Sample Offering Services

Service	Profit Status	FP>G	%
Adult Day Care Program	U*	U*	0.085
Alcohol/Chemical Dependency Care Beds (>0)	U	I	0.158
Alcohol/Drug Abuse or Dependency Outpatient Services	U	U	0.288
Angioplasty	P	P***	0.402
Birthing Room/LDR Room/LDRP Room	P	U	0.735
Burn Care Beds	U	U	0.047
Cardiac Catheterization Lab	P	P*	0.541
Cardiac Intensive Care Beds (>0)	P	P**	0.414
Certified Trauma Center	U	U*	0.284
Child Psychiatric Services	U	U*	0.246
Computed-Assisted Tomography Scanner (CT Scan)	P	U	0.924
Diagnostic Radioisotope Facility	P	P	0.813
Emergency Department	U	U	0.958
Extracorporeal Shock-Wave Lithotripter	P	P*	0.208
Fitness Center	P	V	0.258
HIV-AIDS Services	U	U***	0.604
Home Health Services	V	V**	0.411
Hospice	U†	U**	0.232
Magnetic Resonance Imaging (MRI)	P	P	0.533
Neonatal Intensive Care Beds (>0)	P	I	0.289
Neonatal Intermediate Care Beds (>0)	P	I	0.171
Obstetric Care Beds (>0)	?	U	0.756
Occupational Health Services	?	I	0.664
Open-Heart Surgery	P	P***	0.346
Outpatient Surgery	?	U	0.975
Patient Education Center	U†	U	0.756
Patient Representative Services	?	U	0.716
Pediatric Intensive Care Beds (>0)	P	I	0.116
Positron Emission Tomography (PET)	P	P	0.100

Table 2 (continued). Medical Services, Profitability, and Percentage of Hospitals in Sample Offering Services

Service	Profit Status	FP>G	%
Psychiatric Consultation/Liaison Services	U	I	0.432
Psychiatric Education Services	U	U	0.327
Psychiatric Emergency Services	U	U	0.455
Psychiatric Inpatient Beds (>0)	U	U**	0.421
Psychiatric Outpatient Services	U	U	0.336
Psychiatric Partial Hospitalization Program	U	U	0.276
Radiation Therapy	P	U	0.367
Rehab Services	?	U	0.771
Single Photon Emission Computed Tomography (SPECT)	P	U	0.451
Skilled Nursing Care Beds (>0)	V	V	0.315
Social Work Services	U†	U	0.911
Sports Medicine Services	P	U	0.352
Transplant Services	?	P	0.131
Ultrasound	P	U	0.951
Volunteer Services Department	U†	U	0.888
Women's Health Center/Services	P	P	0.501

Notes: All designations of profit status are from Horwitz (2005b) unless noted with † = authors' determination. P=relatively profitable; U=relatively unprofitable, V=variably profitable; ? = insufficient AHA description to categorize or, in the case of obstetric care because it draws from two distinct patient pools, one profitable, the other unprofitable. FP>G results are based on probit regressions using all control variables described in the text and predicting probability of offering a service for each year in sample at the mean for-profit market share for for-profit and government hospitals. Significance tests from hypothesis $\beta_{FP*Year}+\beta_{FP*Mkt*Year}E(Mkt)=\beta_{Gov*Year}+\beta_{Gov*Mkt*Year}E(Mkt)$. P= > 10% years show significant differences of FP>G and < 10% years show significant differences of G>FP; U= < 10% years show significant differences of FP>G and >10% years show significant differences of G>FP, V= > 10% years show significant differences of FP>G and > 10% of years show significant differences of G>FP; I=indeterminate. ***p<0.01, **p<0.05, *p<0.10.

Table 3. Summary Statistics

Variable	Mean	Std. Dev.	Median
Residency Program	0.290	0.454	0.000
Teaching Hospital	0.107	0.309	0.000
Admissions Lowest Quintile	0.202	0.402	0.000
Admissions Quintile 2	0.202	0.402	0.000
Admissions Quintile 4	0.197	0.398	0.000
Admissions Quintile 5	0.199	0.399	0.000
Only 2 hospitals in MSA	0.045	0.206	0.000
Only 3 hospitals in MSA	0.056	0.229	0.000
Only 4 hospitals in MSA	0.063	0.243	0.000
HHI index	0.183	0.178	0.115
HMO penetration	0.090	0.099	0.056
Hospital member of system	0.608	0.488	1.000
Population	8.327	0.247	8.347
Number female	7.664	0.244	7.682
Number married, male	6.745	0.366	6.809
Number married, female	6.746	0.370	6.810
Number with Travel time under 5 mins	4.066	0.491	4.097
Number with Travel time 5 to 9mins	5.311	0.427	5.325
Number with Travel time 10 to 14mins	5.624	0.361	5.649
Number with Travel time 15 to 19mins	5.660	0.332	5.692
Number with Travel time 20 to 24mins	5.515	0.385	5.564
Number with Travel time 25 to 29mins	4.550	0.490	4.632
Number with Travel time 30 to 34mins	5.395	0.484	5.457
Number with Travel time 35 to 39mins	3.680	0.673	3.804
Number with Travel time 40 to 44mins	3.934	0.730	4.068
Number with Travel time 54 to 59mins	4.761	0.637	4.867
Number with Travel time 60 to 89mins	4.417	0.704	4.495
Number with Travel time over 90mins	3.653	0.789	3.759
Number who work at Home	3.944	0.534	4.039
Number who work in Ag/For/Fish	2.922	1.052	3.165
Number who work in Mining	1.305	1.438	1.613
Number who work in Const	4.729	0.465	4.807
Number who work in Wholesale Trade	4.212	0.437	4.242
Number who work in Retail	5.493	0.358	5.489
Number who work in FIRE	4.861	0.450	4.894
Number who work in Ent/Rec	3.422	0.534	3.471
Number who work in Manuf	5.546	0.465	5.593
Number who work in Health/Ed	5.919	0.324	5.947
Number who work in Pub Admin	4.447	0.436	4.476
Number who have educ under 9 yrs	5.349	0.447	5.338
Number who have educ less than HS	5.816	0.339	5.817
Number who have educ equiv to HS grad	6.617	0.326	6.649

Table 3 (continued). Summary Statistics

Number who have educ of some college	6.077	0.334	6.088
Number who have educ associate's	5.082	0.387	5.126
Number who have educ bachelor's	5.949	0.463	6.011
Number who have educ graduate school	5.405	0.535	5.447
Number aged under1	4.000	0.366	4.033
Number aged 1 to 17	6.872	0.337	6.910
Number aged 18 to 21	5.466	0.373	5.457
Number aged 22 to 29	6.157	0.318	6.147
Number aged 30 to 39	6.475	0.282	6.488
Number aged 40 to 49	6.364	0.341	6.416
Number aged 50 to 59	6.030	0.347	6.079
Number aged 60 to 64	5.088	0.305	5.111
Number aged 65 to 79	5.966	0.314	5.972
Number aged 80 plus	4.891	0.398	4.888
Number white	7.898	0.435	7.968
Number black	6.066	0.859	6.152
Number Native American	3.029	1.065	3.134
Number Hispanic	5.884	1.173	6.014
Number other race	4.147	2.538	4.153
Income per capita	9.838	0.341	9.864
Number with HH income under 15k	5.662	0.407	5.628
Number with HH income 15~19	4.662	0.370	4.651
Number with HH income 20~29	5.360	0.324	5.358
Number with HH income 30~39	5.263	0.324	5.284
Number with HH income 40~49	5.070	0.373	5.115
Number with HH income 50~59	4.838	0.450	4.914
Number with HH income 60~74	4.901	0.564	5.012
Number with HH income 75~99	4.762	0.763	4.913
Number with HH income 100~149	4.371	0.981	4.525
Number with HH income above $150K	3.838	1.096	3.956

Notes: N=46,075. Population controls each represent the weighted average of linearly interpolated and extrapolated (using 1990 and 2000 Census data) logs of the number of relevant individuals in US Census tracts, with tracts weighted inversely by distance of their centroids from the hospital. Linear interpolation in logs is similar to assuming constant percentage rates of change in the size of subpopulations over 1988-2005.

Table 4. Summary of Results, Service in High v. Low For-Profit Markets, % points

Service	FP>G	NP	Gov	FP
Relatively Profitable Services				
Angioplasty (89-97)	P***	.068***/**	.017/**	-.024
Birthing Room/LDR Room/LDRP Room	U	.003	-.013	.009
Cardiac Catheterization Lab	P*	.012	.033/*	-.049***/***
Cardiac Intensive Care Beds (>0)	P**	.018	.060**/***	-.026
Computed-Assisted Tomography Scanner (CT)	U	.009	.015/**	.001
Diagnostic Radioisotope Facility	P	.004/**	.044*/	-.011
Extracorporeal Shock-Wave Lithotripter	P*	.014*/*	.016	-.015
Fitness Center	V	.010	.011	-.007
Magnetic Resonance Imaging (MRI)	P	.058***/***	.071**/	.011/*
Neonatal Intensive Care Beds (>0)	I	.066***/***	.041/**	.021/*
Neonatal Intermediate Care Beds (>0)	I	.021*/	.012/**	-.004
Open-Heart Surgery	P***	.048***/**	.049	-.017
Pediatric Intensive Care Beds (>0)	I	.051***/***	.008	.085***/**
Positron Emission Tomography (PET) (90-05)	P	-.003	-.009	.006***/
Radiation Therapy	U	.017	-.003	-.015
Single Photon Emission Computed Tomography	U	-.029	.026	-.034
Sports Medicine Services	U	-.081***/***	-.029	.005
Ultrasound	U	.004	.002	-.006/*
Women's Health Center/Services	P	-.006/**	-.028	-.034
Relatively Unprofitable Services				
Alcohol/Chemical Dependency Beds (>0) (89-05)	I	-.033**/	-.021	-.036*/
Alcohol/Drug Abuse Outpatient Serv	U	-.091***/***	-.071**/	-.029
Burn Care Beds	U	.009	.007	-.005/**
Certified Trauma Center	U*	-.023/**	.047	-.082***/***
Child Psychiatric Services	U*	-.075***/***	-.052*/	.001
Emergency Department	U	-.008/**	.002	-.009/*
HIV-AIDS Services (94-05)	U***	-.059***/**	.001	-.019
Psychiatric Consultation/Liaison Services	I	-.080***/**	-.058*/	-.066**/
Psychiatric Education Services	U	-.054***/	-.020	-.023
Psychiatric Emergency Services	U	-.060***/***	-.045	-.037
Psychiatric Inpatient Beds (>0) (89-05)	U**	-.060***/***	-.036	-.047
Psychiatric Outpatient Services	U	-.078***/***	-.018	-.006/**
Psychiatric Partial Hospitalization Program	U	-.038**/*	-.001	.000
Geriatric Adult Day Care Program†	U*	-.034***/**	-.029*/*	.008
Hospice†	U**	-.073***/***	.000	-.003
Patient Education Center†	U	-.048***/**	.005	-.060**/
Social Work Services†	U	-.029***/***	-.006/*	-.031/***
Volunteer Services Department†	U	-.016/**	-.050**/	-.031*/

Table 4 (continued). Summary of Results, Service in High v. Low For-Profit Markets, % points

Service	FP>G	NP	Gov	FP
Variably Profitable Services				
Home Health Services (1993-1997)	V**	.056**/**	.034	.029
Skilled Nursing Care Beds (>0) (1993-1997)	V	.087***/***	.046	.094**/**
Unknown (e.g., unclear definition, mixed patient pool)				
Obstetric Care Beds (>0)	U	-.004	-.021	.016
Occupational Health Services	I	-.030**/*	-.061**/	-.028
Outpatient Surgery	U	-.013	.005	-.020***/
Rehab Services	U	-.028/***	.024	-.002
Patient Representative Services	U	-.025/***	.009/*	-.015
Transplant Services	P	.007	0	-.025*/**

Notes: NP=nonprofit, FP=for-profit, Gov=government. Results are from all years 1988-2005 unless noted. Results for variably profitable services are for years 1993-1997, when the services were profitable. Profitability status in the first column is assigned according to Horwitz (2005b) except † where categorized according to authors' evaluation. Profitability status in the second column, FP>G indicates whether a service is U=relatively unprofitable, P=relatively profitable, I=indeterminate, V=variable based on tests, described in the text, of whether for-profit hospitals are more likely than government hospitals to offer the service. All results from basic specification described in text (market measure by distance, controls as described in the text. For the point estimates, we present results from two types of hypothesis tests, whether 1) the coefficients on hospital type*market type are different on average over the study period and 2) these coefficients are jointly different. ***p<0.01, **p<0.05, *p<0.10.

Table 5. Regressions of Hospital Operating Margin on Characteristics of Hospitals and Markets

	Discrete measure of high FP market (share>15%)				Continuous measure of FP market share			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Pooled	Pooled	FE	FE	Pooled	Pooled	FE	FE
Gov Hosp	-0.0473***	-0.0363***	-0.0537***	-0.0436***	-0.0506***	-0.0460***	-0.0560***	-0.0531***
	(-5.36)	(-3.19)	(-5.33)	(-3.46)	(-5.77)	(-4.24)	(-5.62)	(-4.39)
FP Hosp	0.0461***	0.0383***	0.0502***	0.0447***	0.0441***	0.0308***	0.0484***	0.0348***
	(9.29)	(6.93)	(7.97)	(6.39)	(8.71)	(5.12)	(7.55)	(5.00)
Hi-FP*NP		0.0000239		0.00860		-0.0111		-0.00214
		(0.01)		(1.42)		(-1.14)		(-0.18)
Hi-FP*Gov		-0.0286*		-0.0192		-0.0315		-0.0180
		(-1.84)		(-1.22)		(-1.07)		(-0.59)
Hi-FP*FP		0.0135**		0.0183**		0.0546***		0.0683***
		(2.09)		(2.21)		(4.16)		(4.21)
ln(admissions)	0.0640***	0.0646***	0.0655***	0.0658***	0.0647***	0.0649***	0.0667***	0.0666***
	(10.36)	(10.40)	(9.91)	(9.85)	(10.83)	(10.87)	(10.48)	(10.40)
ln(beds)	-0.0386***	-0.0389***	-0.0390***	-0.0393***	-0.0390***	-0.0389***	-0.0403***	-0.0403***
	(-5.96)	(-6.04)	(-5.72)	(-5.73)	(-6.14)	(-6.19)	(-6.09)	(-6.09)
Teaching	-0.0318***	-0.0321***	-0.0334***	-0.0336***	-0.0349***	-0.0357***	-0.0358***	-0.0361***
	(-4.56)	(-4.59)	(-4.61)	(-4.65)	(-5.17)	(-5.19)	(-5.04)	(-5.03)
Residency	-0.0340***	-0.0342***	-0.0361***	-0.0361***	-0.0344***	-0.0343***	-0.0369***	-0.0369***
	(-6.72)	(-6.79)	(-6.58)	(-6.62)	(-7.12)	(-7.11)	(-7.03)	(-7.05)
In System	0.00815**	0.00827**	0.00391	0.00396	0.00814**	0.00781**	0.00446	0.00420
	(2.48)	(2.52)	(1.15)	(1.16)	(2.42)	(2.33)	(1.28)	(1.20)
HMO Mkt Sh	-0.0843***	-0.0874***	-0.0377	-0.0389	-0.0810***	-0.0815***	-0.0410*	-0.0406*
	(-5.73)	(-5.90)	(-1.57)	(-1.63)	(-5.75)	(-5.75)	(-1.71)	(-1.69)
#hosp in Mkt	-0.0004***	-0.0004***	-0.0006**	-0.0006**	-0.0004***	-0.0003***	-0.0005*	-0.0005**
	(-5.63)	(-5.49)	(-2.13)	(-2.16)	(-5.38)	(-4.95)	(-1.88)	(-2.01)
HHI index	0.0289**	0.0304**	0.00704	0.00870	0.0305**	0.0341***	0.00576	0.00915
	(2.41)	(2.59)	(0.44)	(0.54)	(2.58)	(2.89)	(0.36)	(0.57)
N	37,388	37,388	37,388	37,388	39,891	39,891	39,891	39,891
r2	0.149	0.150	0.187	0.189	0.147	0.149	0.184	0.186

Notes: Dependent variable is hospital operating margin from patient services = (total patient revenue – contractual allowances – total operating expenses)/ (total patient revenues – contractual allowances) from HCRIS data. Observations with operating margins below negative 100% are dropped. All regressions use the distance-weighted measure of for-profit market share; results using other measures are comparable. ***t*** statistics in parentheses adjusted for clustering on MSA * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Decennial Census-based controls and year dummies are included in all specifications.

Table 5b. Logit Regressions of P(Offering a Service) on Hospital Ownership, Market Type, and Profitability Classification of Service (1988-2005)

	FP Market Share Defined by:		
	Share FP in MSA	Overlap-weighted	Distance-Weighted
Government	-0.00791	0.00253	-0.00155
	(-0.18)	(0.06)	(-0.04)
For-profit	-0.331***	-0.346***	-0.363***
	(-6.29)	(-6.75)	(-7.93)
Gov x profitable service	-0.0860	-0.0799	-0.0684
	(-1.61)	(-1.53)	(-1.33)
NP x profitable service	-0.0615***	-0.0523***	-0.0392**
	(-3.30)	(-2.81)	(-2.12)
FP x profitable service	0.291***	0.345***	0.340***
	(5.06)	(6.28)	(7.06)
Hi-FP Market x Gov	-0.208***	-0.238***	-0.206***
	(-3.75)	(-4.23)	(-3.58)
Hi-FP Market x NP	-0.321***	-0.296***	-0.298***
	(-9.72)	(-8.97)	(-8.57)
Hi-FP Market x FP	-0.175***	-0.158***	-0.133**
	(-2.92)	(-2.66)	(-2.42)
Hi-FP Market x Gov x profitable serv	0.286***	0.338***	0.316***
	(4.04)	(4.72)	(4.30)
Hi-FP Market x NP x profitable serv	0.476***	0.457***	0.433***
	(12.60)	(12.10)	(10.88)
Hi-FP Market x FP x profitable serv	0.146**	0.0903	0.101
	(2.09)	(1.32)	(1.58)
MSA-level HHI	0.255***	0.277***	0.298***
	(3.20)	(3.45)	(3.72)
HMO share	0.0178	0.0311	0.0190
	(0.35)	(0.61)	(0.37)
System Membership	0.0498***	0.0482***	0.0463***
	(3.25)	(3.14)	(3.02)
Year Fixed Effects	Yes	Yes	Yes
Hospital Fixed Effects	No	No	No
Census and Size Controls	Yes	Yes	Yes
N	1,496,424	1,500,623	1,500,023

Notes: NP=nonprofit, FP=for-profit, Gov=government. Results for all services, all years except as noted in Table 4. Profitability status determined according to Horwitz (2005b) as described in text. * p<0.05, ** p<0.01, *** p<0.001; t-statistics in parentheses, robust to clustering at the hospital level

Table 6. Nonprofit Hospitals in Low v. High Markets: Theoretical Predictions, Medical Services, and Profit Margins

Theories	NP Service Provision in Low v. High FP Markets		
	NPs Track FPs in Markets with more FP	NPs Balance FPs in Markets with more FP	No Difference by Market Type
1. Max Own Output: Newhouse (1970)	Yes, FPs will take profitable patients: NPs have to cross-subsidize	No	No
2. Max Market Output or Consumer Surplus: Weisbrod (1977)	No	Yes, offset mercenary behavior of FPs	No
3. For-Profits in Disguise, Doctors Cooperative: Pauly and Redisch (1973)	No: NPs follow FPs, but no difference by market type	No	Yes
4. Good and bad NP: Hirth (1999)	Maybe: NPs who are FPs in disguise would max profits, but good NPs might react as above	Maybe: good NPs might pursue maximum market output	Maybe: Depends on mix of good and bad NPs

Figure 1. Relatively Profitable Services

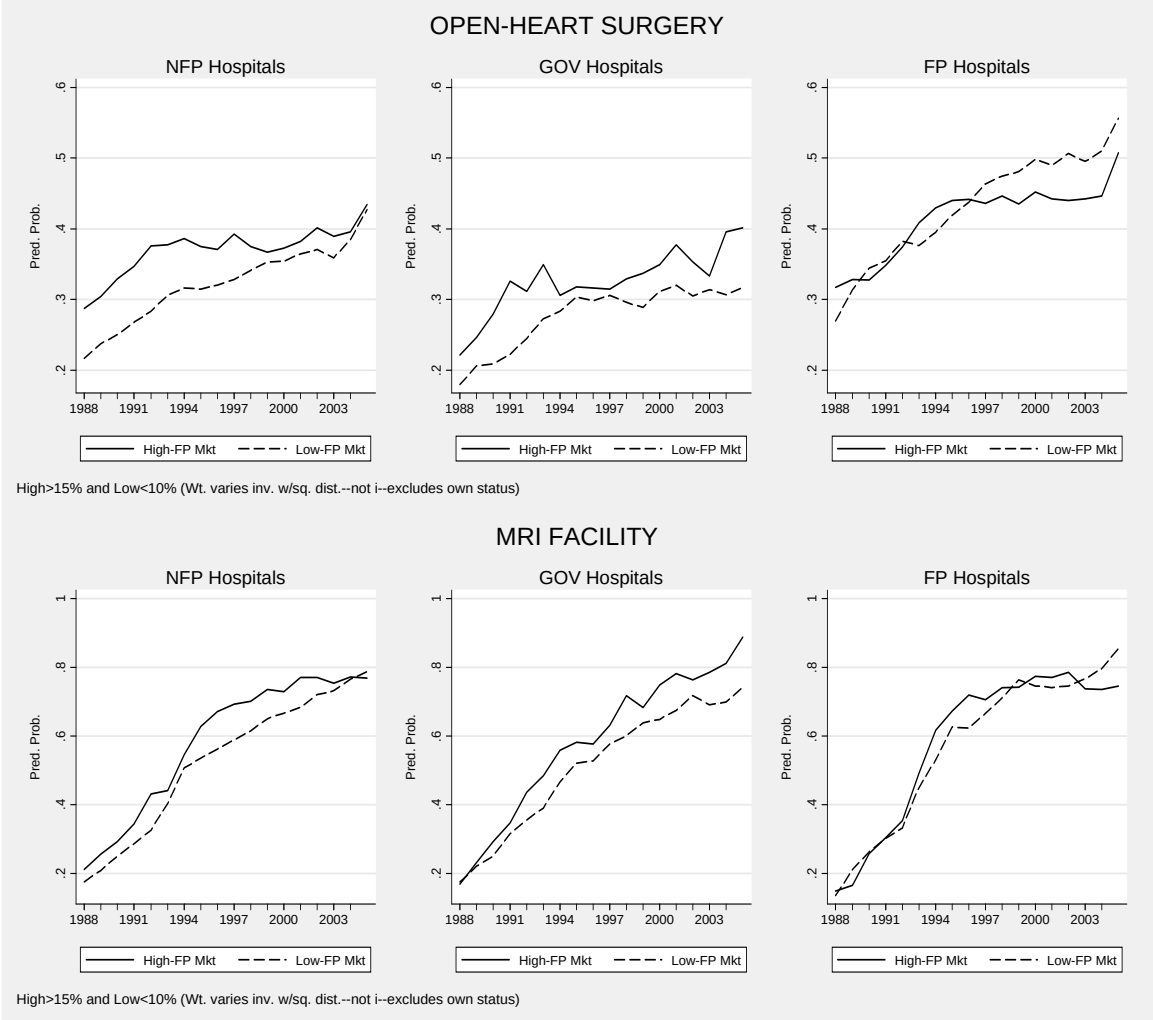


Figure 2. Relatively Unprofitable Services

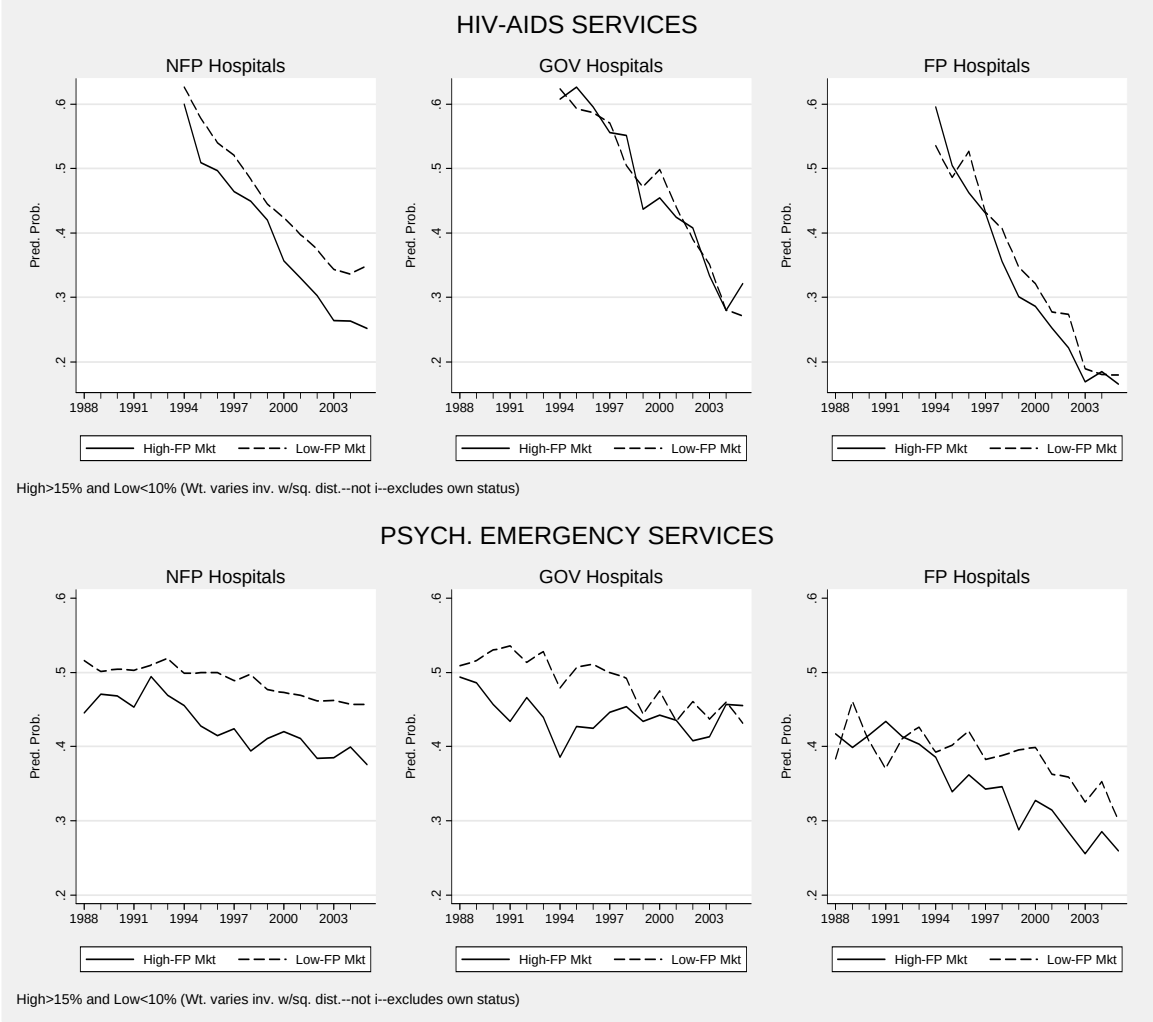
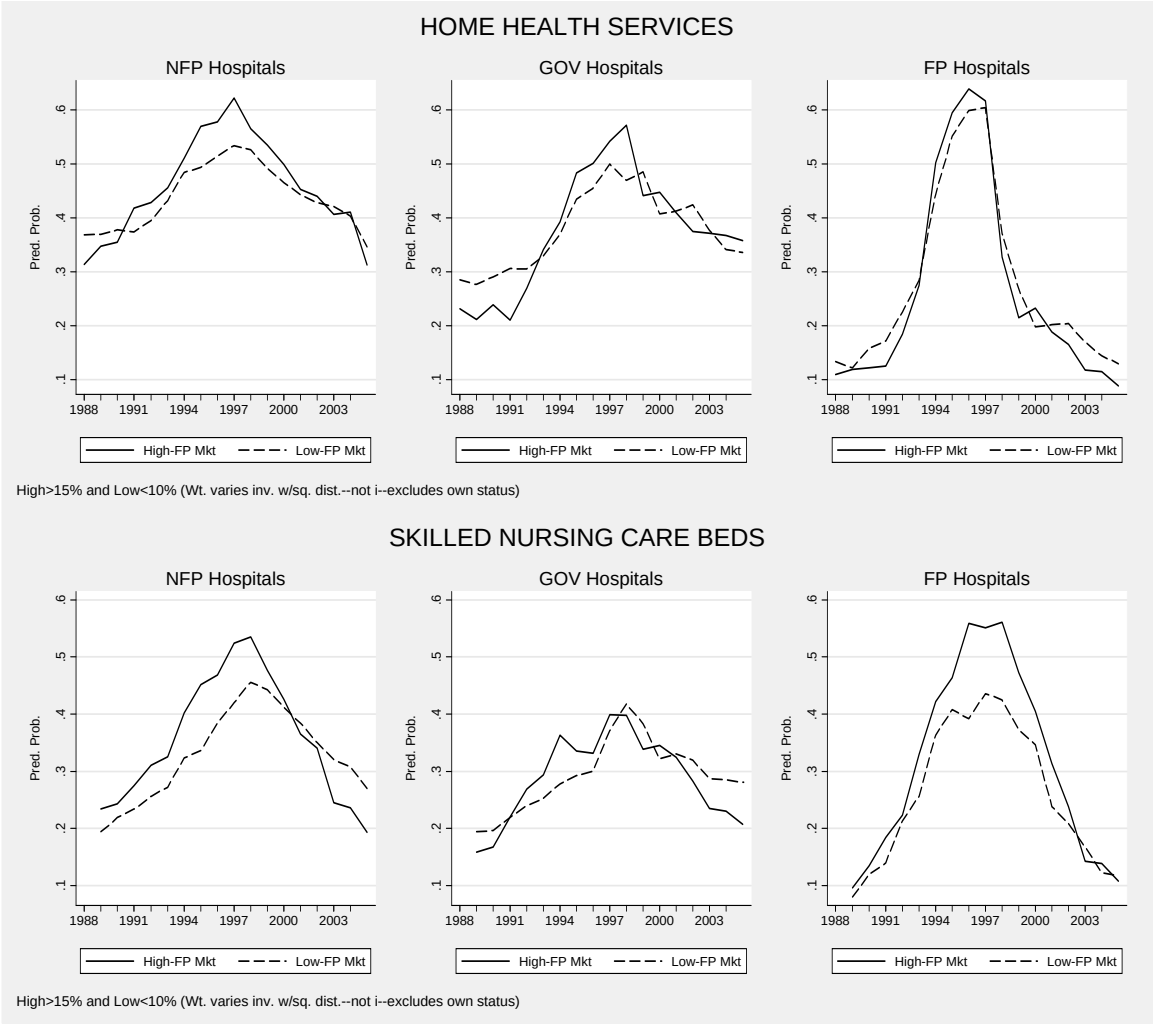


Figure 3. Services with Variable Profits



Appendix A. Hospital Market Definitions and Measures of For-Profit Share of Market

The idea of defining a hospital market is to capture the population of potential patients, most of whom live within an easy commute of the hospital, and identify the other hospitals competing for those patients. To measure the share of for-profit competition (the "for-profit share" below), these hospitals should be weighted according to the extent to which they can compete for patients, i.e., by the size of the hospital and by the potential patients who live within an easy commute of both hospitals.

We employ three methods to construct the for-profit market share facing each hospital. The simplest method is derived from each hospital's MSA. We propose two alternatives, both based on the distance between hospitals (as measured along the ellipsoidal "zero elevation" model[5] of the Earth), which we call the disk-overlap and distance-weighted measures. We prefer the distance-weighted method for reasons explained below.

1. MSA-level estimates of for-profit share

The least complicated measure of people who live within an easy commute is the MSA, defined by the Census Bureau so that a labor market is encompassed and individuals within the MSA are very likely to commute only within the MSA. We can easily calculate the proportion of hospitals that are for-profits, weighting by their annual admissions to adjust for capacity, within the MSA.

Two definitions are possible even restricting to MSA-level means of FOR-PROFIT status weighted by admissions. The market definition excluding a hospital's own ownership category and admissions will be referred to as *not-i,* and a definition including a hospital's own characteristics will be referred to as *also-i.* The *also-i* definition is the same for all hospitals in an MSA, and may be intuitively appealing, simple to calculate (being close to a count of for-profit hospitals divided by number of hospitals), and easily explained. However, it is also determined by the hospitals own behavior (both ownership and admissions are endogenously determined), and does not characterize the competition or environment a hospital faces any more than it does the hospital's own choices. Thus, we prefer the *not-i* definition (though results using the *also-i* definition are surprisingly similar—restricted to hospitals in MSA's with at least two hospitals).

However, hospitals *not i*n an MSA (which we call rural hospitals) are problematic in this formulation, as are groups of hospitals near an MSA boundary—the hospital just inside the boundary is seen as competing with distant central-city hospitals, and not with a hospital just outside the boundary. This can be seen as a problem with the weight assigned to a given hospital being discontinuous at the boundary of the MSA, which is one everywhere in the MSA, ignoring any variations in admissions, but drops abruptly to zero at the boundary of the MSA. Alternative definitions of markets that rely on geopolitical divisions, such as counties or zip codes (as are the Dartmouth health care referral regions), exhibit identical problems.

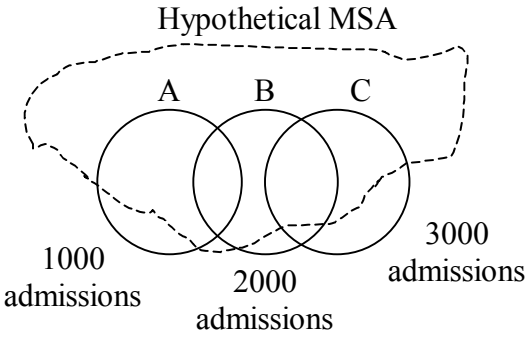
[5] For details of distance calculations, see http://www-personal.umich.edu/~nicholsa/stata/vincenty.ado

2. Disk-overlap estimates of for-profit share

In this specification, we identified a hospital's potential market as a disk with a fixed radius centered on the hospital's own location (10 or 15 miles are radii commonly used in the literature).[6] For-profit share can then be defined as the area overlap of the hospital's own disk with other hospitals' disks, weighted by total admissions in the calendar year. Luft and Maerki (1984) define markets based on the willingness of a physician to travel and conclude that 15 miles is the maximum distance.

Define a *circle of influence* as every point within 15 miles of a given hospital. Now define the market faced by the hospital as the total admissions for every other hospital whose circle of influence overlaps the circle of influence belonging to that hospital, weighted by the proportion of overlap. Note there are two possible implementations of this definition, depending on how one treats the hospital's own circle. The market definition excluding a hospital's own circle of influence will be referred to as *not-i,* and a definition including a hospital's own circle of influence will be referred to as *also-i*. The new definition of market for-profit concentration is the percentage of admissions in the market that are to a for-profit hospital. As a concrete example, consider the hypothetical MSA drawn in Figure A1, with an irregular dashed line indicating the boundary of the MSA, to emphasize that the boundary is irrelevant to the calculations that follow.

Figure A1



There are three hospitals, a hospital B in the central city, and two suburban hospitals A and C. The distance between hospitals A and B is twenty miles, and the distance between hospitals B and C is fifteen miles. Hospitals A and C have zero overlap, since all hospitals lie on a straight line in alphabetical order. The overlap area between any two hospitals as a proportion of the total land area of the market is

[6] 10.4 miles is the mean distance radius that captures 75 percent of discharges and 21.5 is the mean distance radius that captures 90 percent of discharges from acute care hospitals in non-rural settings. 14.2 miles is the mean distance radius that captures 75 percent of discharges and 25.2 is the mean distance radius that captures 90 percent of discharges from acute care hospitals in rural settings (Gresenz, Rogowski et al. 2004).

$$\text{Overlap} = [2\arccos(d/2r) - \sin(2\arccos(d/2r))] / \pi$$

where d is the distance between the hospitals and r is the radius of the circle of influence (both 10 miles and 15 miles were used to produce estimates). Thus the overlap between A and B is nearly 22% and the overlap between B and C is just over 39%. These percentages are the weights applied to admissions, which are assumed in this example to be 1000 in A, 2000 in B, and 3000 in C. Assume C is the only for-profit hospital in the MSA. Using the *not-i* market definition, the market for-profit concentration for A is zero, for B it is just under 73%, and for C it is zero. Using the *also-i* market definition, the market for-profit concentration for A is zero, for B it is about 32%, and for C it is over 79%. The *also-i* market definition corresponds more closely to an intuitive notion of market concentration, but it is endogenous to unilateral actions by the hospital. Although the disk-overlap measure of for-profit market share does not suffer from the sharp exclusion at the boundary, it also does not capture the possible influence of more distant but much larger hospitals.

3. Distance-weighted estimates of for-profit share

To address the limitations of the first two market methods, we employ a third method, the distance-weighted method. One can imagine a market with two hospitals, each of which has 1000 admissions annually, 25 miles apart, and a third hospital 30 miles from the first and 40 miles from the second, which has 10,000 admissions annually, which should clearly matter to the market that the first hospital faces, and yet this third hospital is irrelevant in the disk-overlap measure of for-profit market share. A more sensible method would weight by admissions and inversely by distance, so that distant hospitals have less importance relative to nearer hospitals, but may still play a role.

It might seem intuitive to use the reciprocal of distance squared, and its properties are invariant to the scale used for distance. Unfortunately, when calculating a weighted average of characteristics over a collection of discrete points using the reciprocal of distance squared as the weight, only the points that are very close to the central point (hospital ***i***'s own location) get any kind of weight. If there are 12 census tract centroids within 10 miles, and one that's a block away, only the close one matters. This problem arises because the weight on a point approaches infinity as the distance of that point from the hospital approaches zero.

The square of the reciprocal of one plus the distance squared places more reasonable relative weights on points of different distances from the hospital, but its *properties as a weight are not invariant to the units of distance*. However, a particular parameterization accords well with the observed distribution of patients. A disk around a non-rural hospital that encompasses 75% of the hospital's patients' residences has a mean radius of 10.4 miles, median radius 8.5 miles, standard deviation 8.5, and range [0.2, 78.4]. A disk around an non-rural hospital that encompasses 90% has a mean radius of 21.5 miles, median 15.7 miles, standard deviation 19.7, and range [0.4, 179.3].

Consider the family of weighting functions

$$w(x;b) = \left(\frac{1}{1+bx^2} \right)^2$$

where x is distance from hospital ***i***'s own location. Now choose *b* so that 75% of the weight lies within 10.4 miles of the center for an even distribution of potential patients over different distances, regardless of how distance is measured. Thus we choose *b* so that

$$\frac{\int_0^{10.4mi} \left(\frac{1}{1+bx^2} \right)^2 dx}{\int_0^{\infty} \left(\frac{1}{1+bx^2} \right)^2 dx} = 0.75 .$$

This weight function decays smoothly, does not put infinite weight on arbitrarily close points, and corresponds to the notion that 75% of the patients come from a disk of radius 10.4 miles.

Since we are working in 3 dimensions, we need to calculate the volume contained under the curve

$$w(x;b) = \left(\frac{1}{1+bx^2} \right)^2$$

rotated about the w-axis in (x1,x2,w) space, which is given by

$$V = \pi \int_0^{\infty} 2wxdx = \frac{\pi}{b} \int_0^{\infty} 2bx \left(\frac{1}{1+bx^2} \right) dx = \frac{\pi}{b}$$

using the shell method for integration of a volume of a rotational solid. The area from 0 to C miles, if x is measured in miles, is

$$V = \pi \int_0^{C} 2wxdx = \frac{\pi}{b} \int_0^{C} 2bx \left(\frac{1}{1+bx^2} \right) dx = \frac{\pi}{b} \left(1 - \frac{1}{1+bC^2} \right)$$

so the ratio of the weight within C=10.4 miles to the total weight is

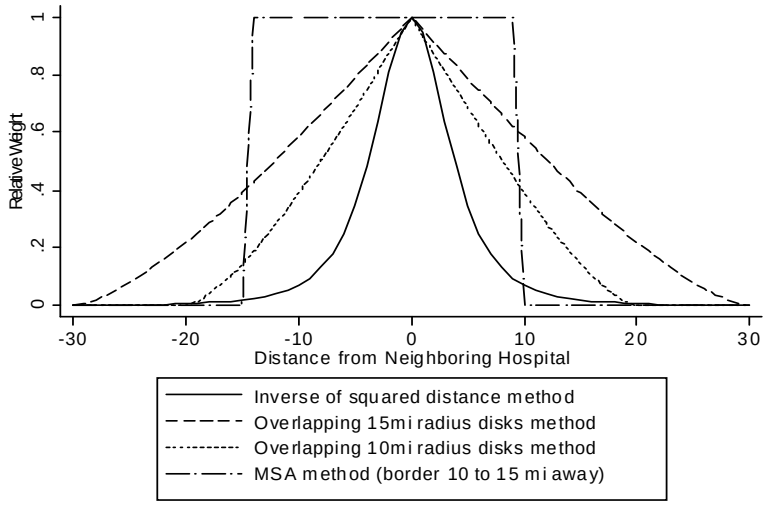
$$\left(1 - \frac{1}{1+b(10.4)^2} \right)$$

and this will be 0.75 when b=0.0277, in which case the weighted proportion of an evenly distributed population contained within *C*=21.5 miles is 0.928 (corresponding closely to the notion that the mean radius of a disk that encloses 90% of the weighted population is 21.5 miles).

4. Comparison of Three Market Definitions

The weight of a potential competitor relative to the weight of a competitor at the hospital's own address is shown in Figure A2 for the disk-overlap measures (both 10 and 15 mile radii), the distance-weighted measure, and a conceptualization of the MSA-level measure for comparison purposes (the actual space is three-dimensional, corresponding to a rotation of this figure around the vertical axis).

Figure A2. Comparison of Weighting Methods



Although there are major differences in the weight assigned to neighboring hospitals, a wide variety of results are very similar across these specifications. This may reflect the fact that many hospitals have a number of large neighbors within five miles, and relatively few five to twenty miles away. If the geographic distribution of hospitals is very concentrated, differences in weights attached to hospitals five to twenty miles away may make little difference.

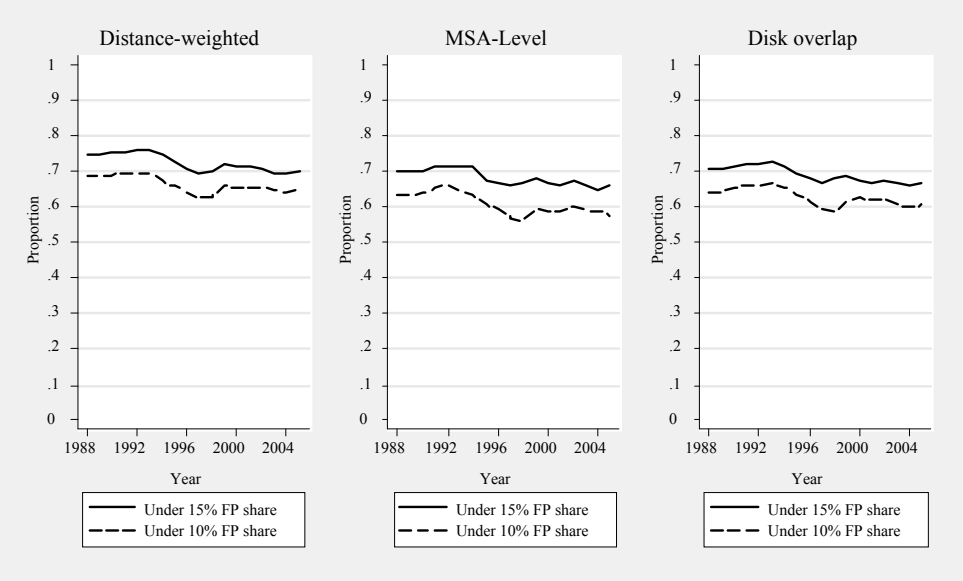
In sensitivity tests, we compute four different measures of for-profit hospital penetration for each definition of market (MSA, disk-overlap, and distance-weighted: weighted admission share including the observed hospital, and weighted admission share excluding the observed hospital, and both as observed in the first year the hospital appears in the data). We also define markets by using geopolitical boundaries analogous to the MSA method described above. The only apparent differences arise in comparing results excluding a hospital's own admissions and FP/NFP status, versus including it in the definition of market for-profit share. Otherwise, these alternative models of market share produce strikingly similar results.

All results in this paper compare only hospitals in MSA's (i.e., rural hospitals are excluded from the analysis and calculations of FP market share), and only those in MSA's that include at least two hospitals (since FP market share using the MSA method excluding a hospital's own admissions and FP/NFP status is otherwise undefined). Future work will include analyses that examine rural hospitals as well, and for these hospitals, the distance-weighted measure is the only viable alternative for defining the FP market share.

The distance-weighted measure has a clear intuitive appeal, and is calibrated to match the empirical distribution of potential patients. It is the only option for dealing with the rural hospitals currently excluded. For these reasons, we prefer the distance-weighted measure of FP market share.

Appendix B. Defining Market Share

Applying the three market methods described in Appendix A, approximately 60 to 65 percent of hospitals are "low" for-profit share, and 25 to 30 percent of hospitals are "high" for-profit share and very few are in the "middle." The graph below shows the share by year (the share of hospitals classified as being in "high" for-profit share markets is the distance from the top to the "High FP" line, and the share of hospitals classified as being in "high" for-profit share markets is the distance from the bottom to the "Low FP" line). The fact that all the lines are close indicates that few hospitals are excluded from the analysis due to being considered "middle for-profit share" and suggests that classifications are similar.

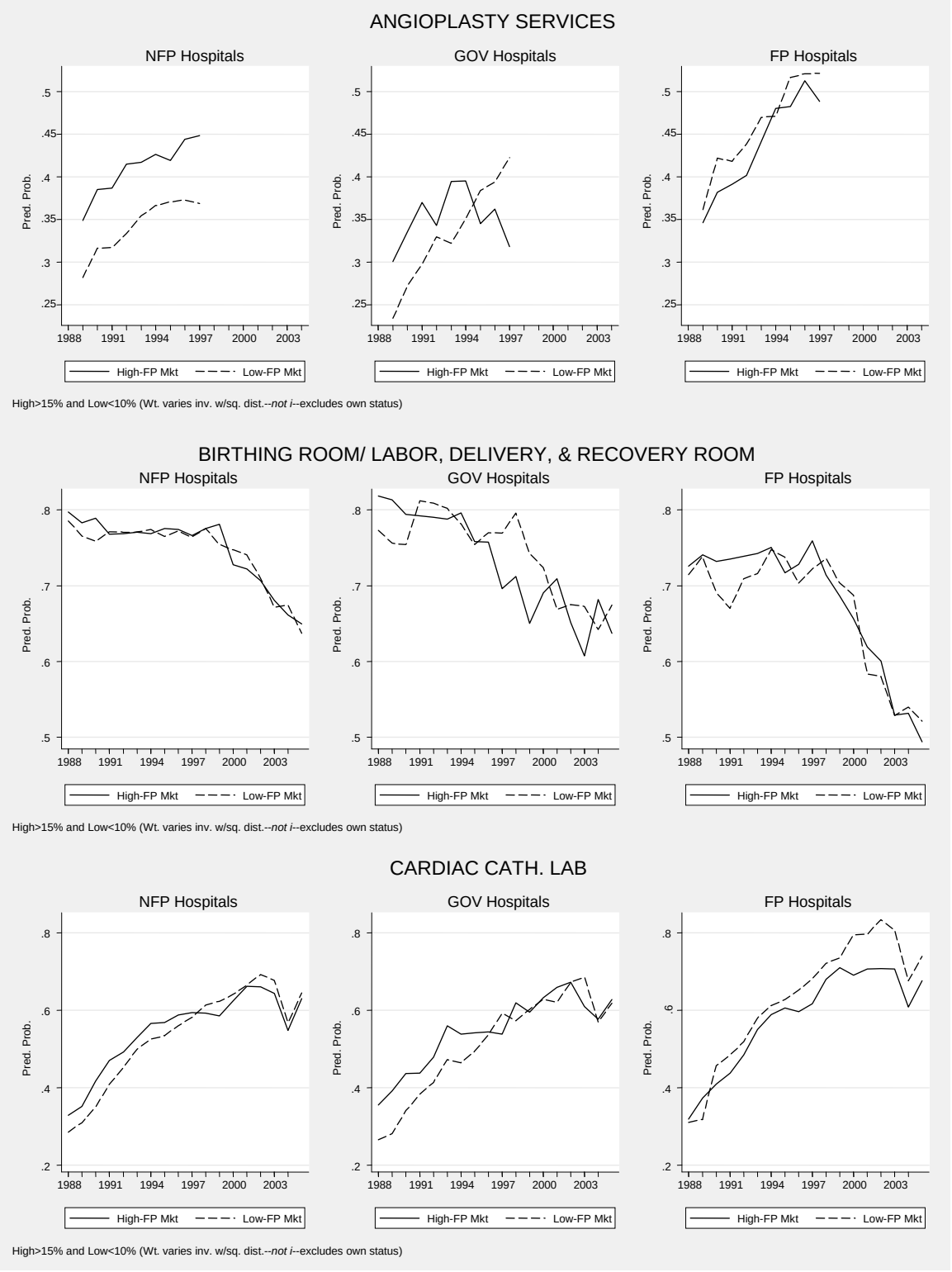


The correlations in for-profit share measures are quite high:

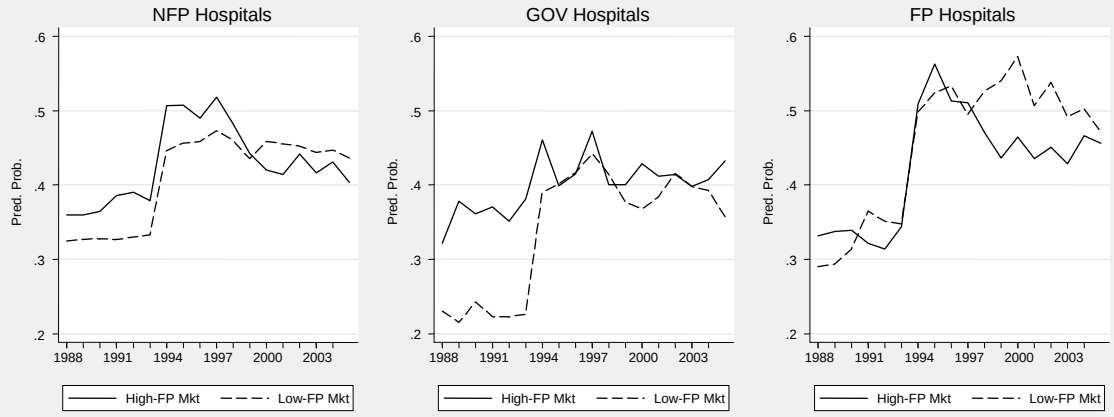
	Distance Weighted	Disk	MSA
Distance Weighted	1.0000		
Disk	0.9051	1.0000	
MSA	0.8280	0.9046	1.0000

Appendix C. Figures for All Medical Services

1. Relatively Profitable Services

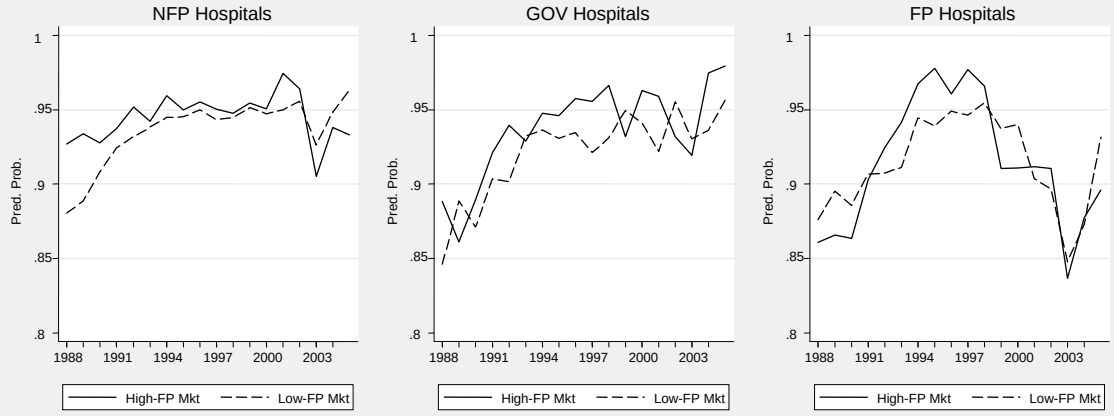


CARDIAC INTENSIVE CARE UNIT BEDS



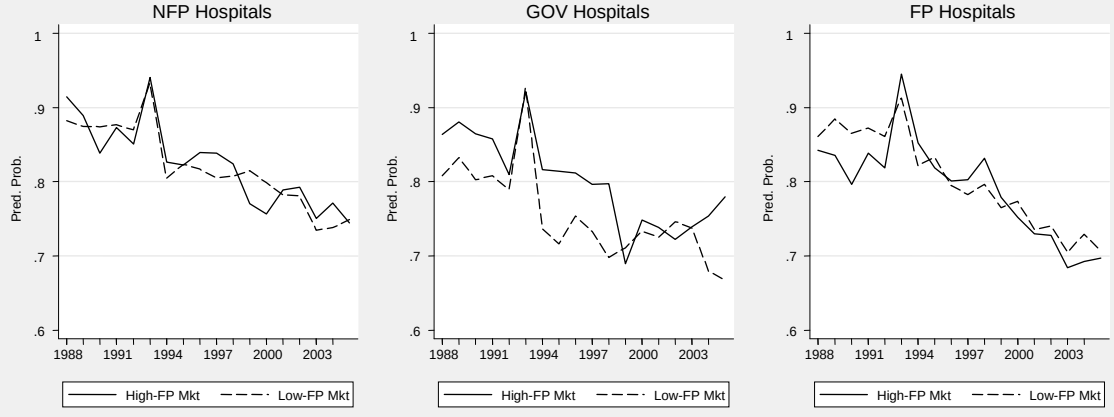
High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

CT SCAN FACILITY



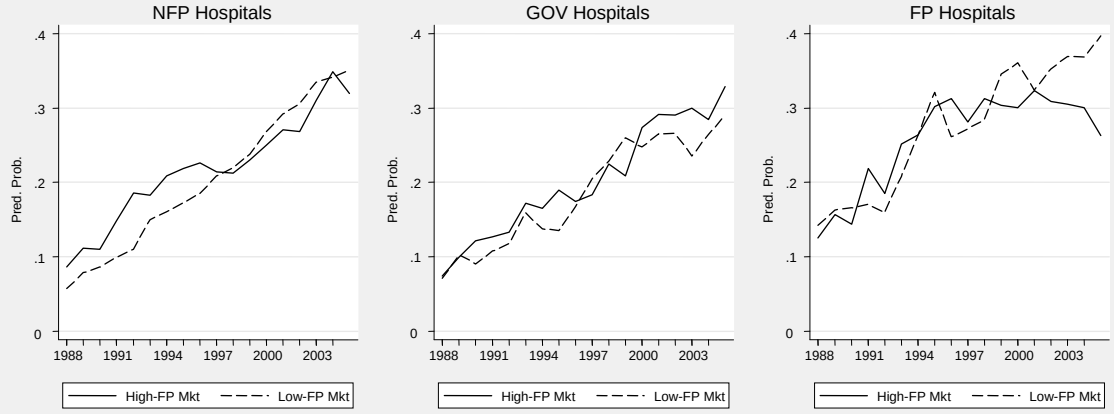
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DIAGNOSTIC RADIOISOTOPE FACILITY



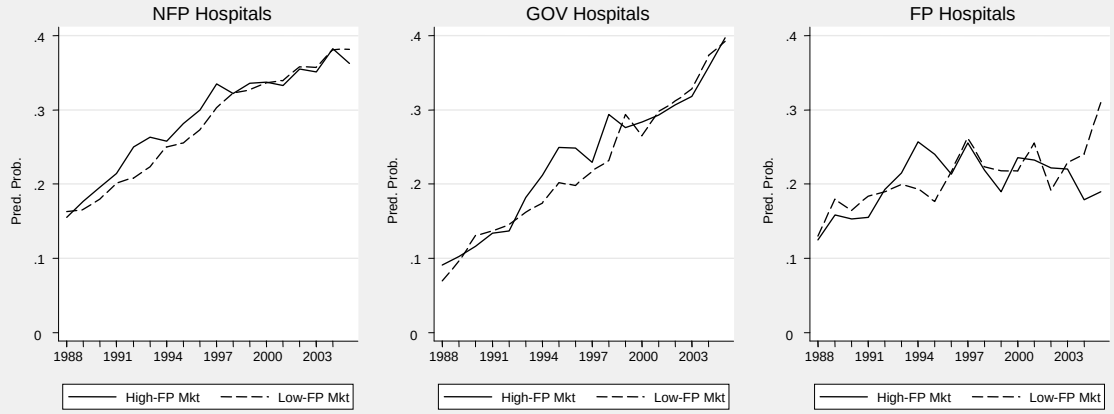
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ESWL SERVICES



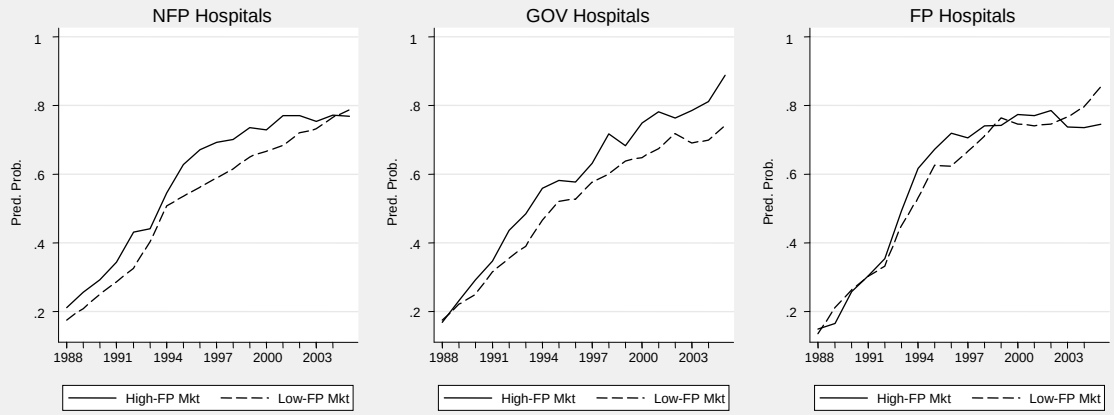
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FITNESS CENTER



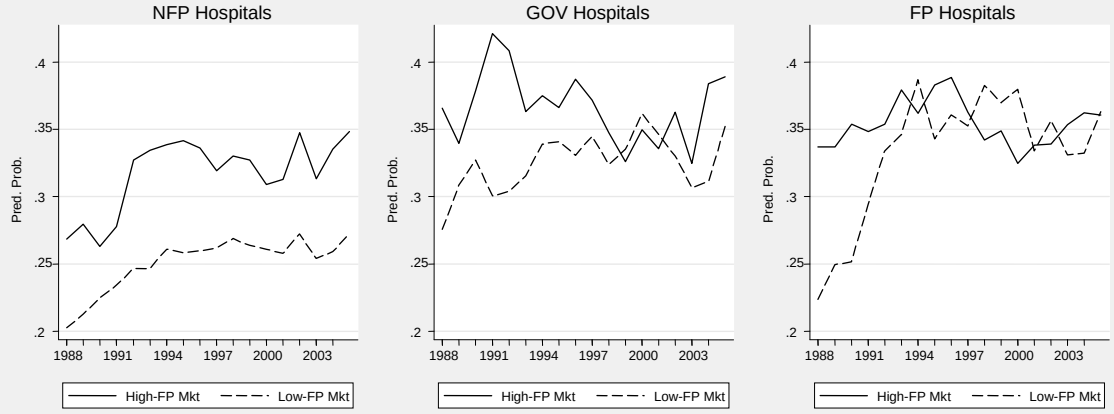
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MRI FACILITY



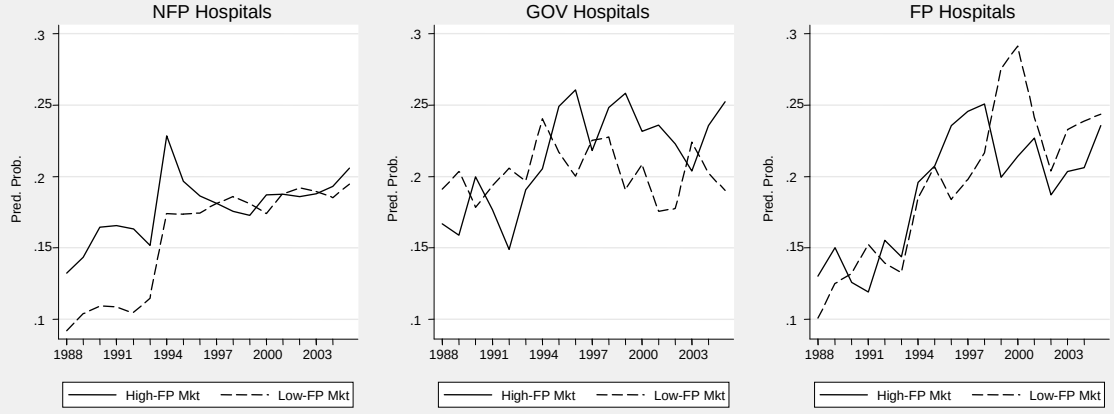
High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

NEONATAL INTENSIVE CARE UNIT BEDS



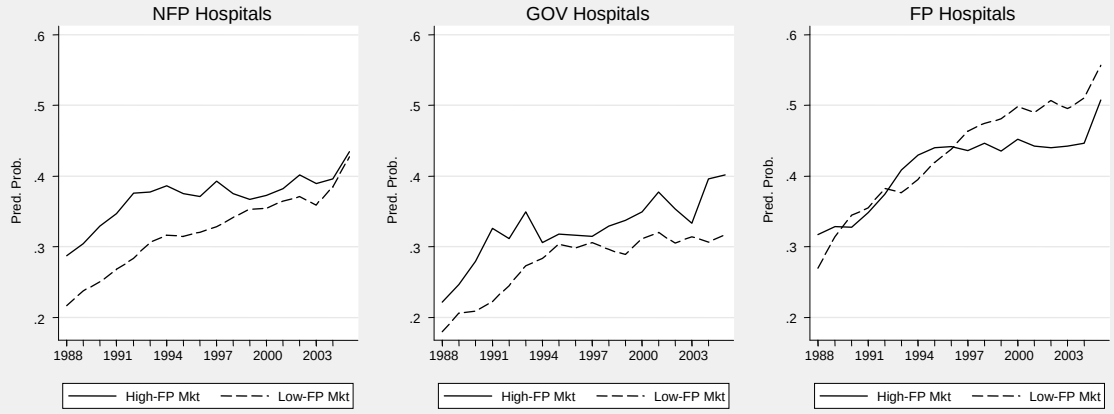
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NEONATAL INTERMEDIATE CARE BEDS



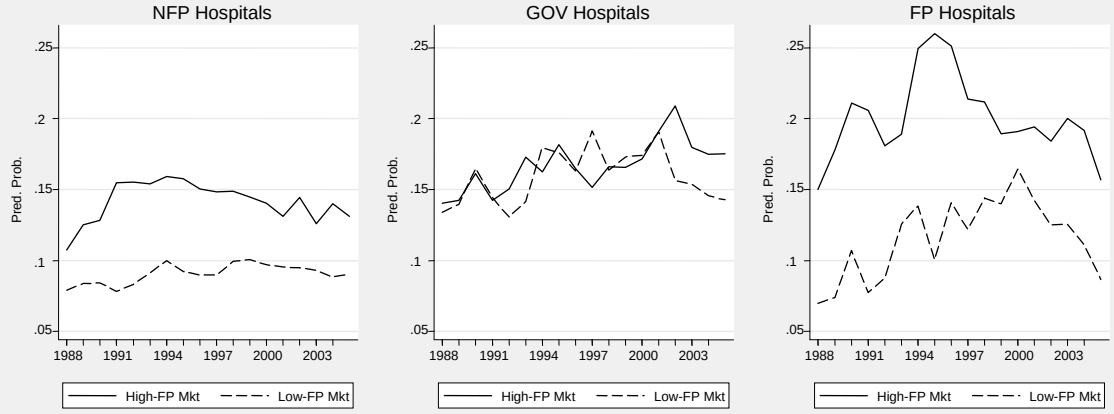
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OPEN-HEART SURGERY



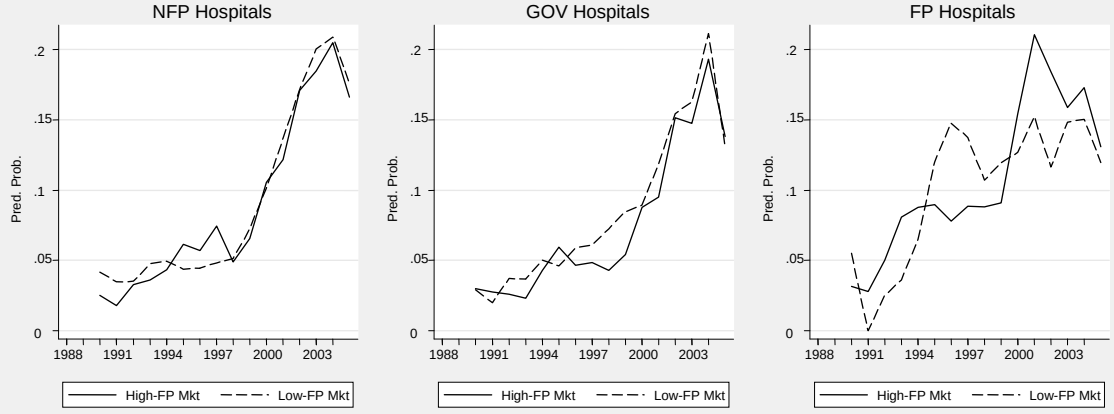
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PEDIATRIC INTENSIVE CARE UNIT BEDS



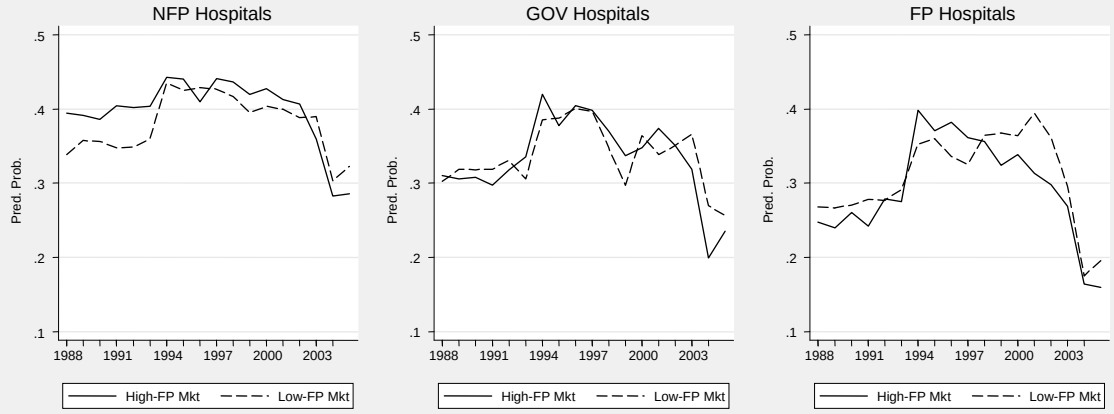
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PET SCAN FACILITY



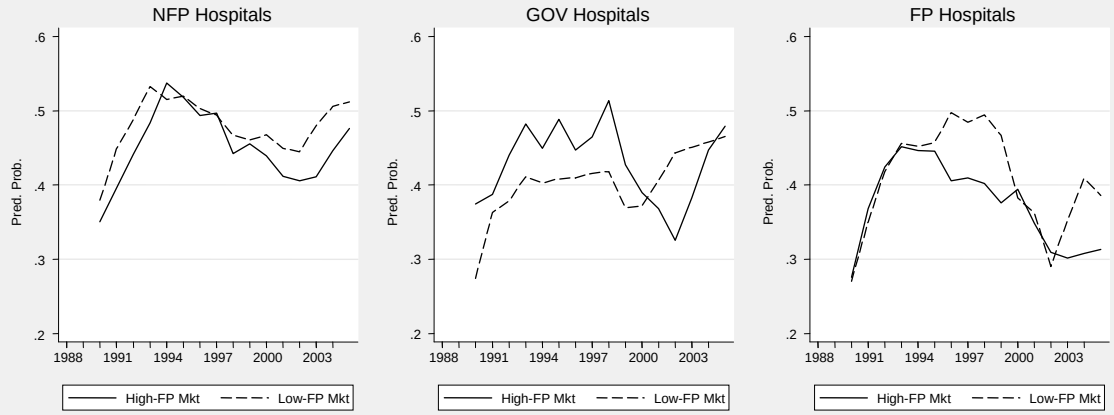
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RADIATION THERAPY



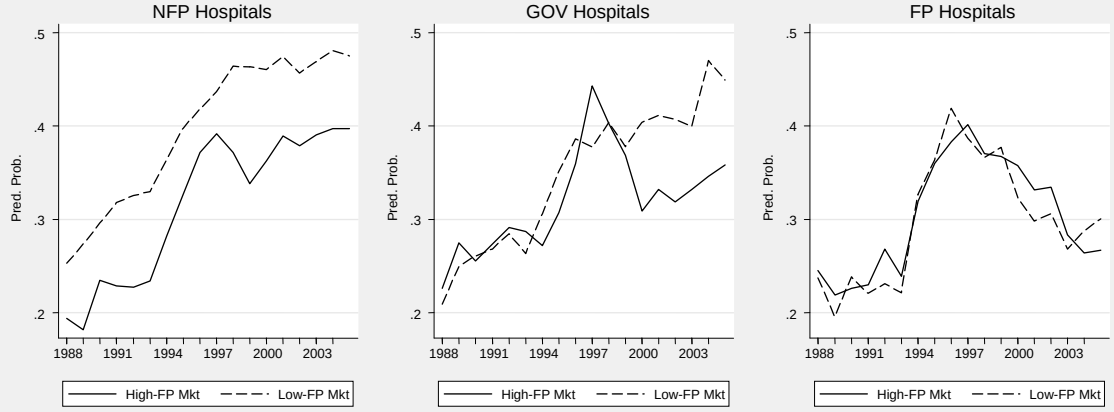
High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

SPECT SCAN FACILITY



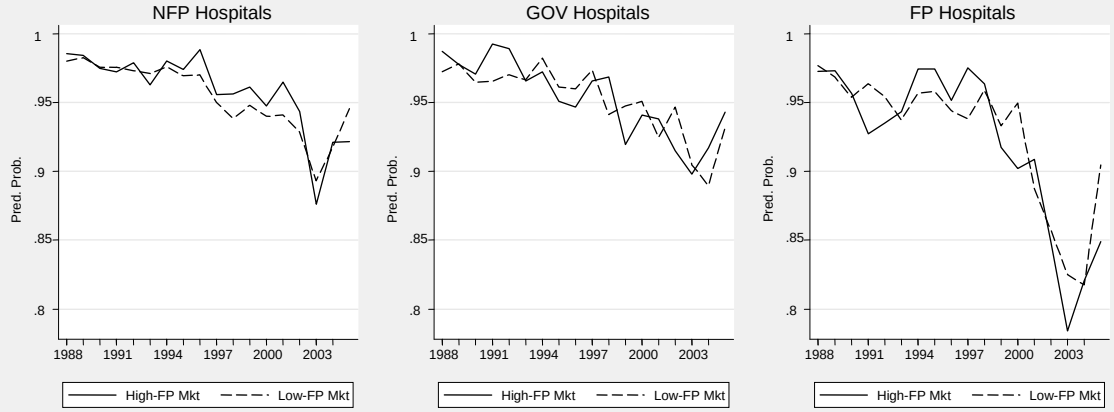
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SPORTS MEDICINE

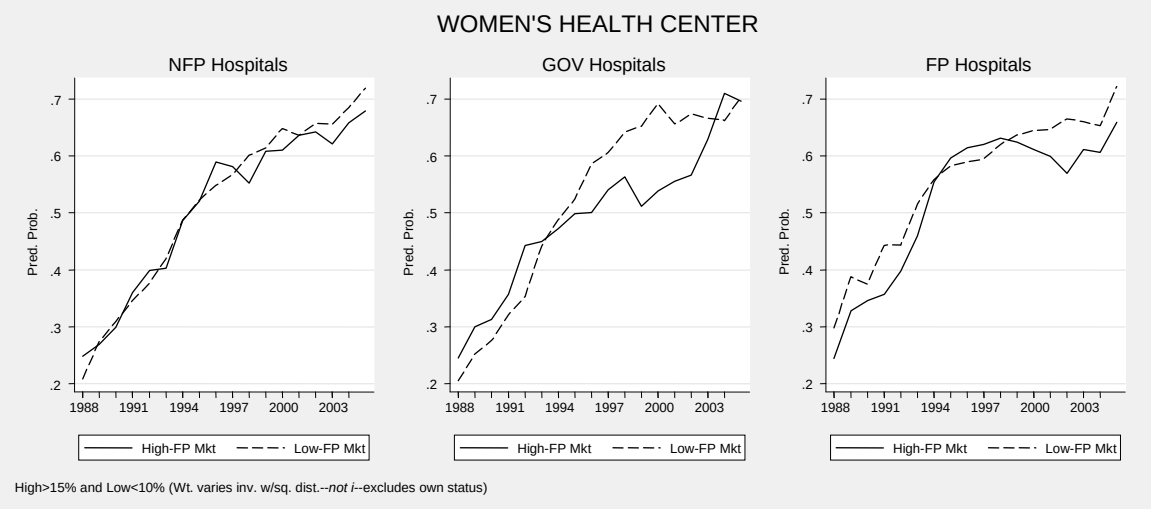


High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

ULTRASOUND

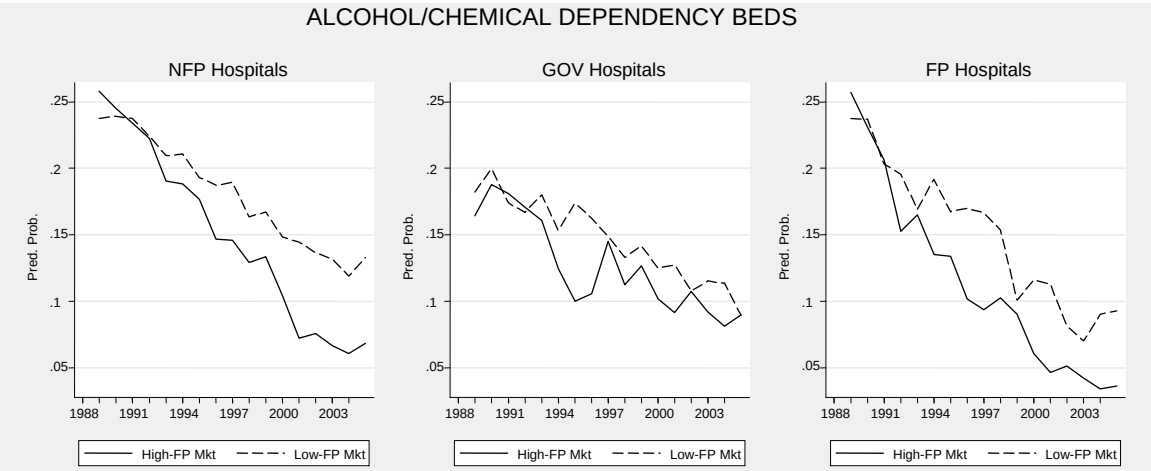


High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

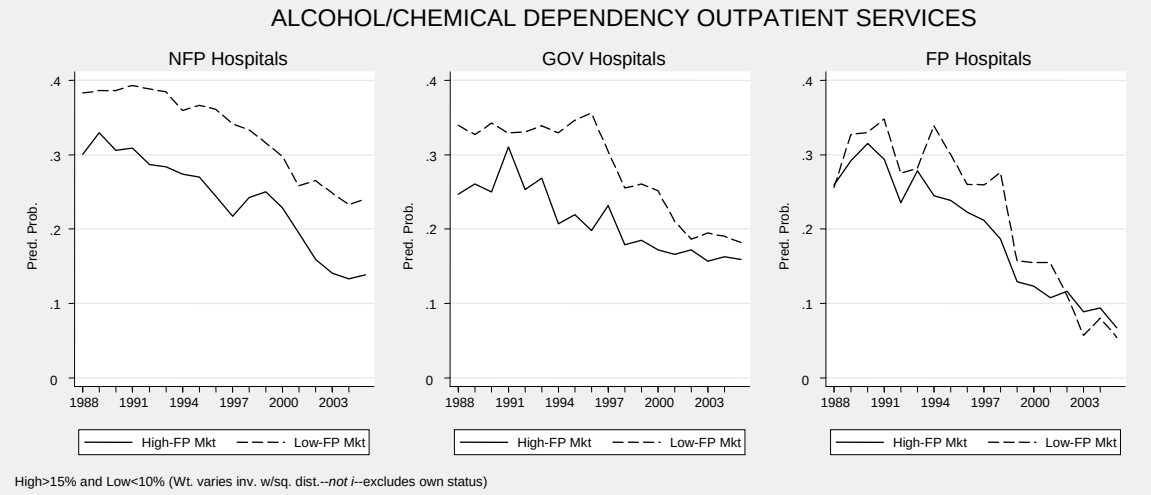


High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

2. Relatively Unprofitable Services

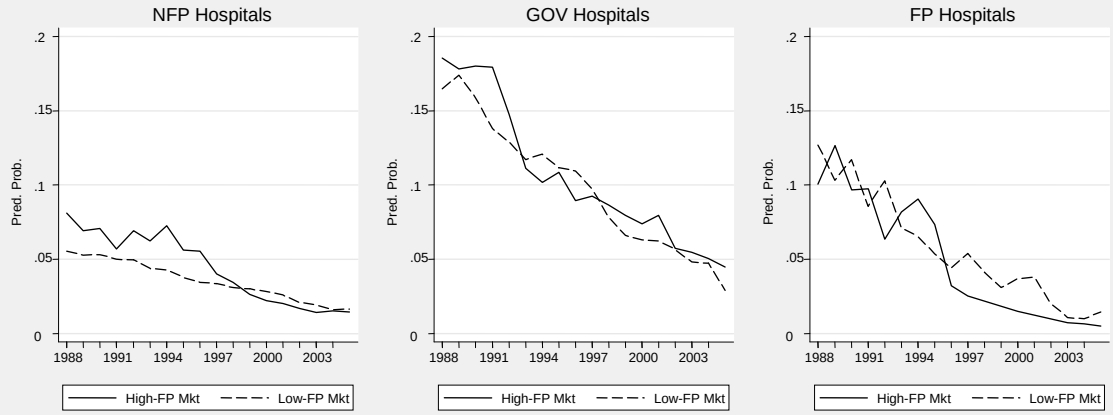


High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)



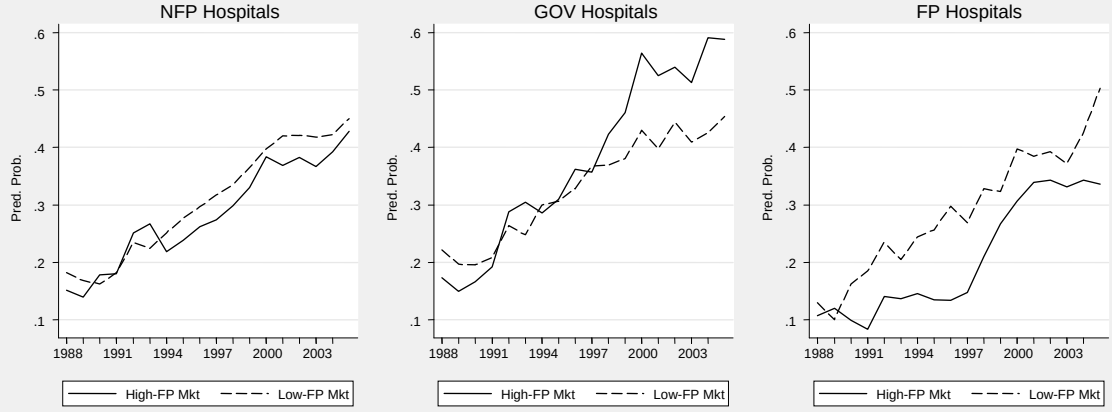
High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

BURN UNIT BEDS



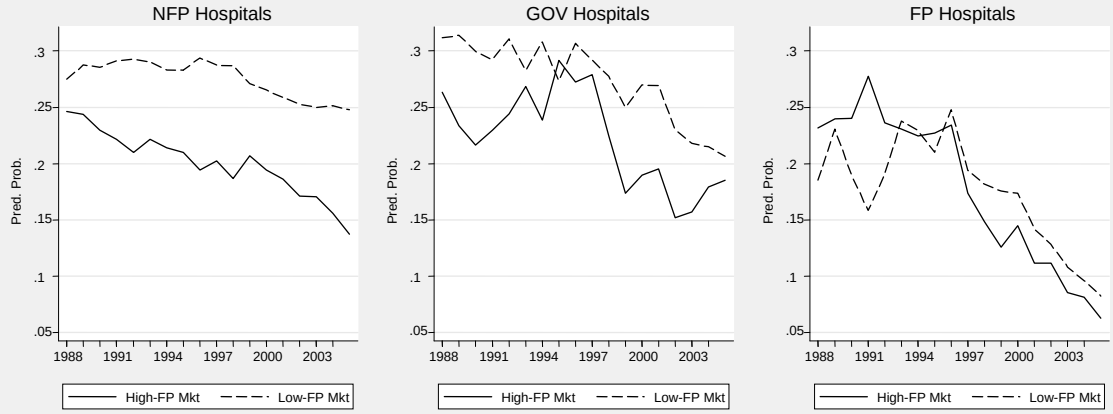
High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

CERTIFIED TRAUMA CENTER



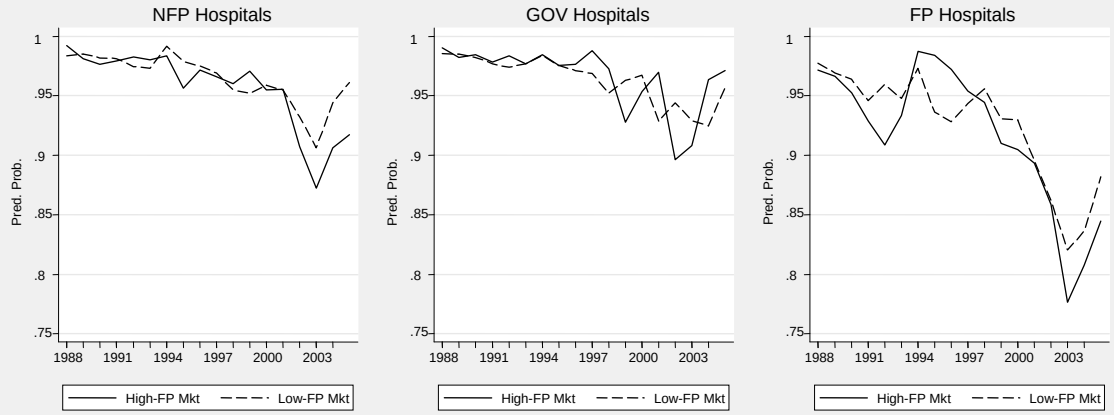
High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

CHILD PSYCH. SERVICES



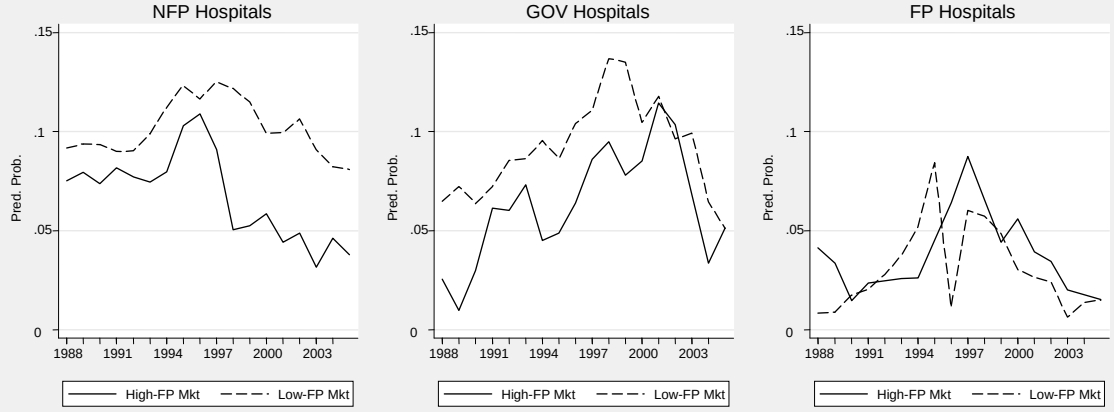
High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

EMERGENCY DEPT.



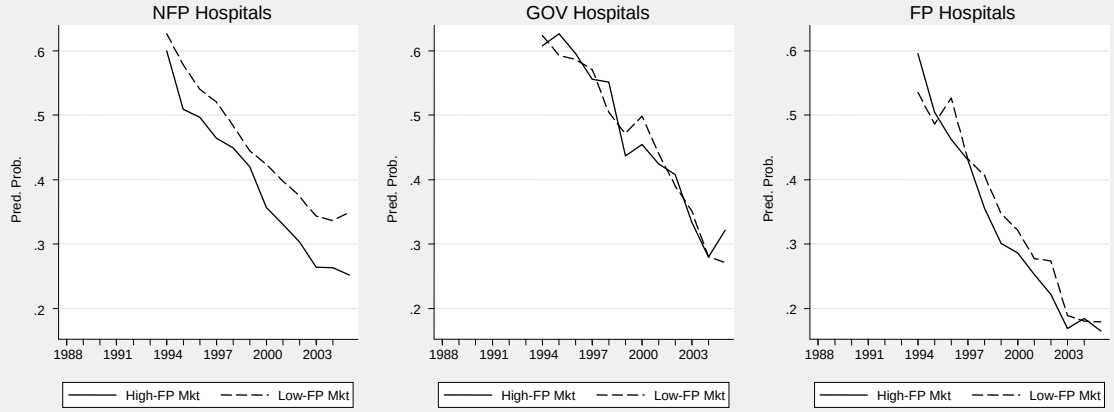
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GERIATRIC ADULT DAY CARE



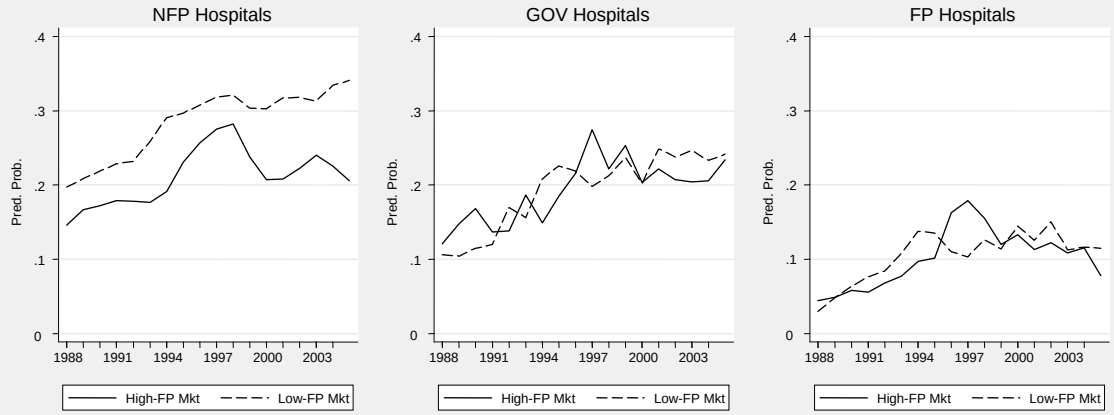
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HIV-AIDS SERVICES



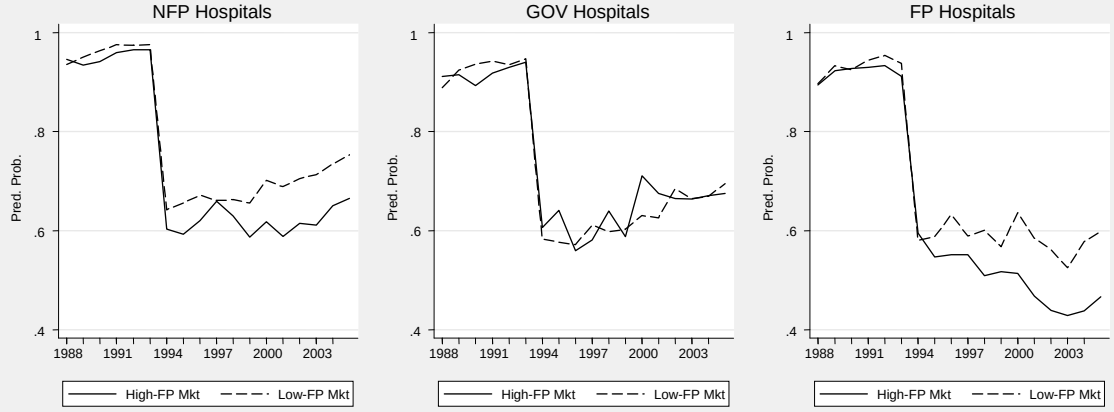
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HOSPICE CARE



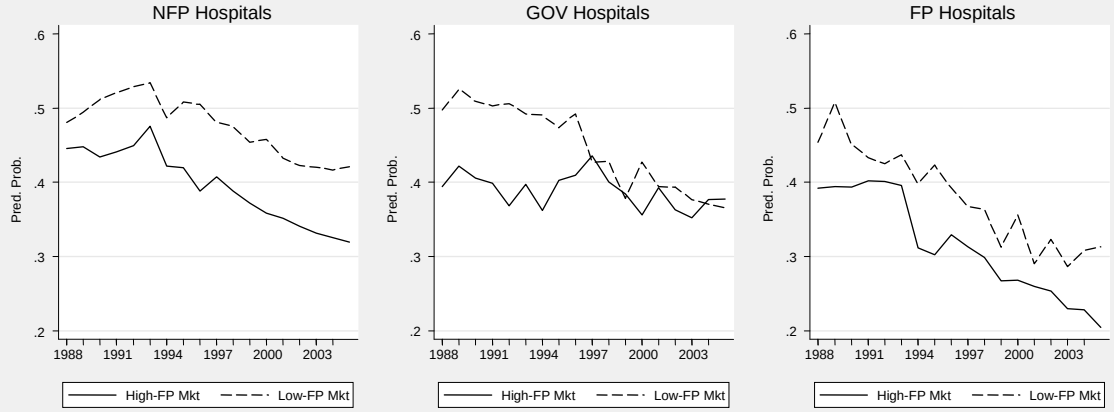
High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

PATIENT EDUCATION CENTER



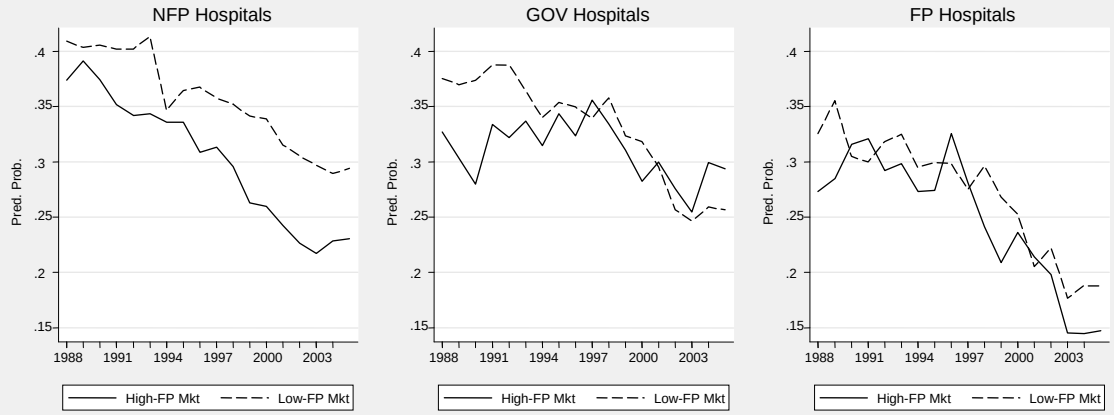
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PSYCH. CONSULT/LIAS. SERVICES



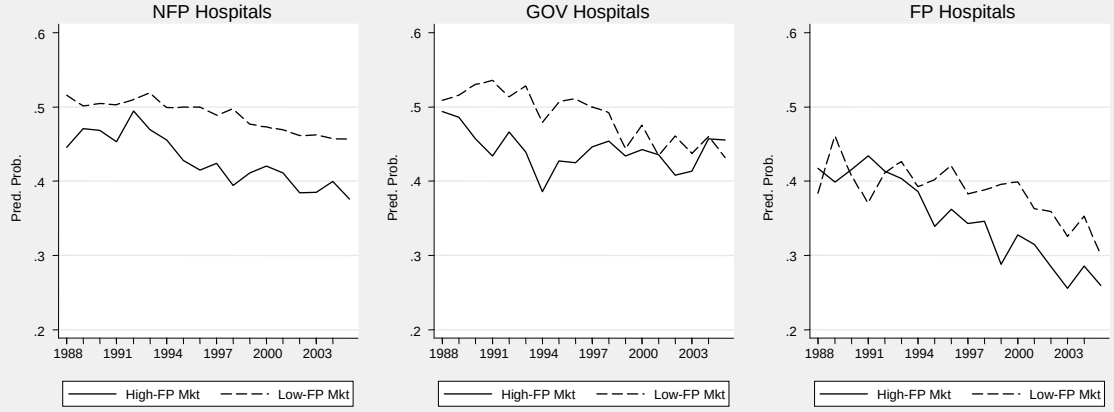
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PSYCH. EDUC. SERVICES



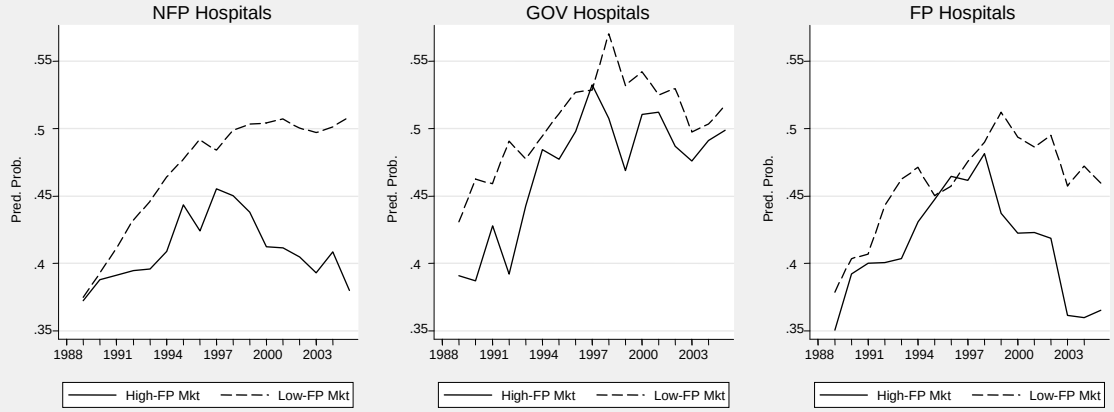
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PSYCH. EMERGENCY SERVICES



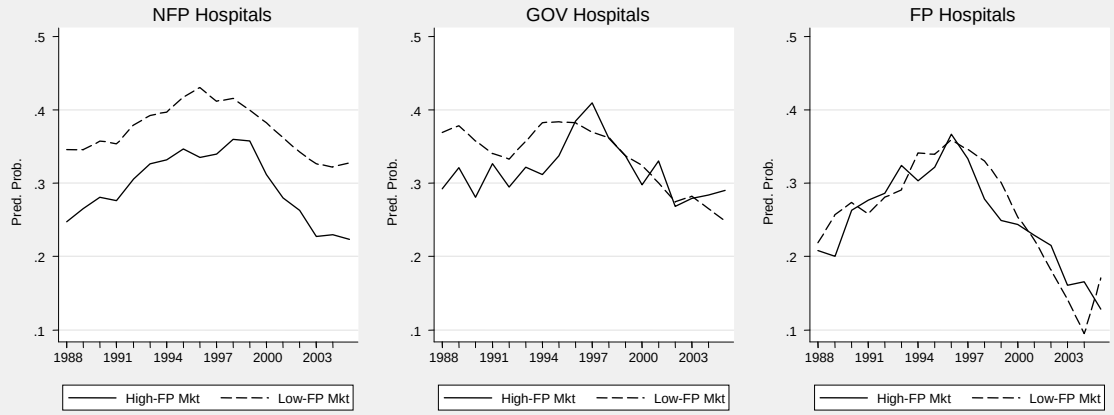
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PSYCH. BEDS



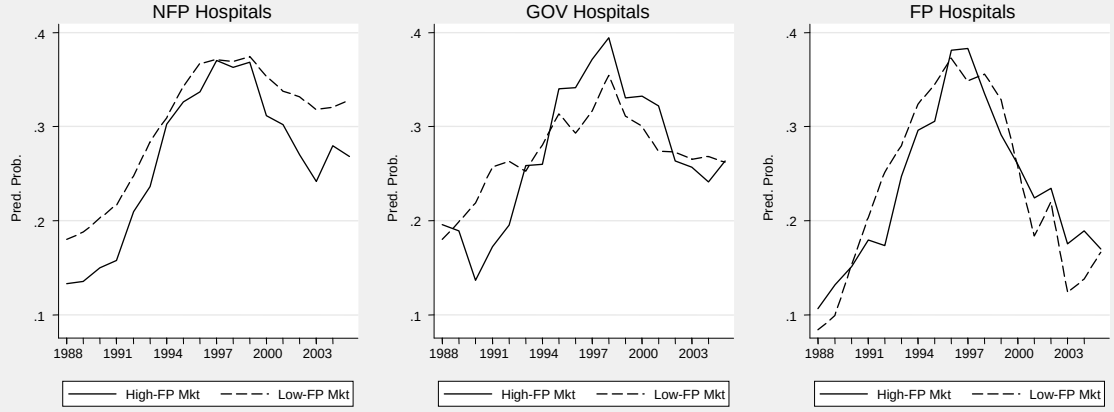
High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

PSYCH. OUTPATIENT SERVICES



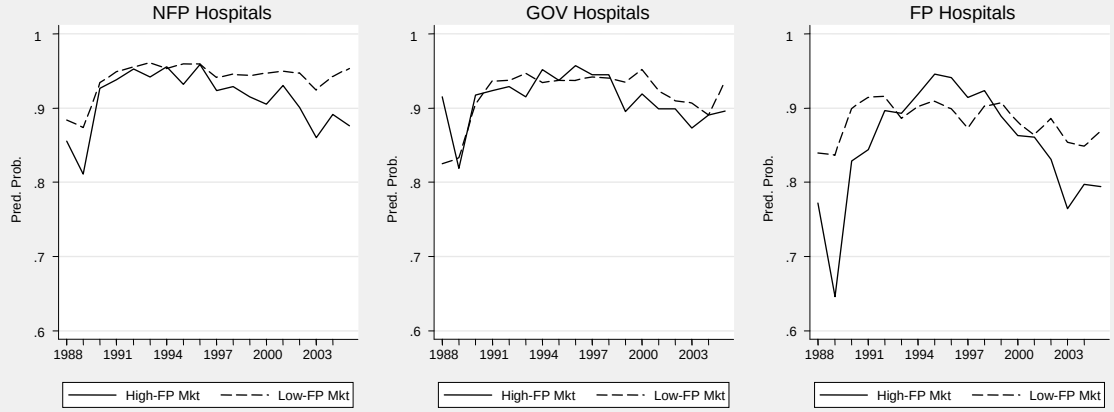
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PSYCH. PARTIAL HOSPITALIZATION

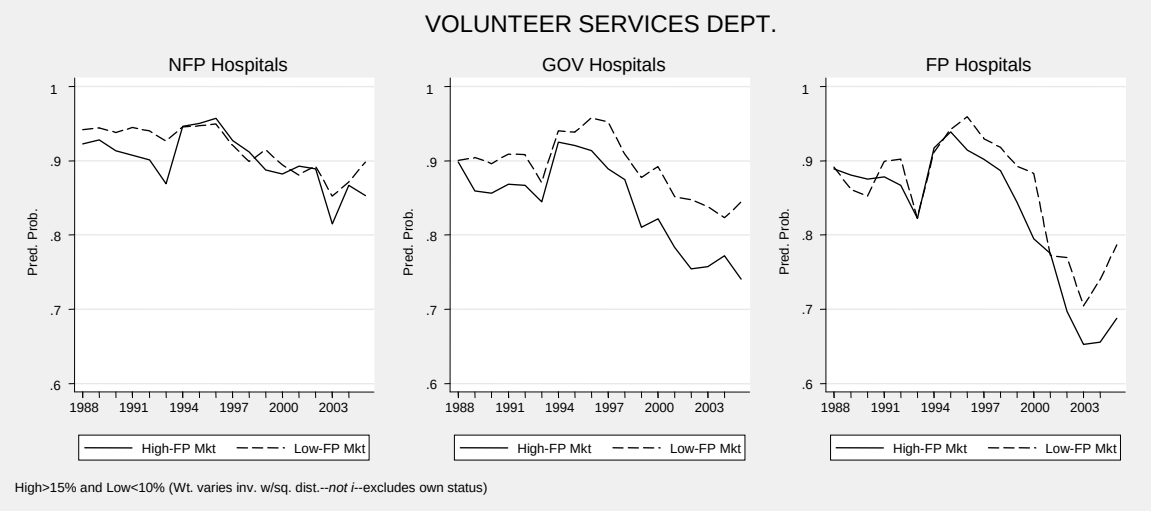


High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

SOCIAL WORK SERVICES

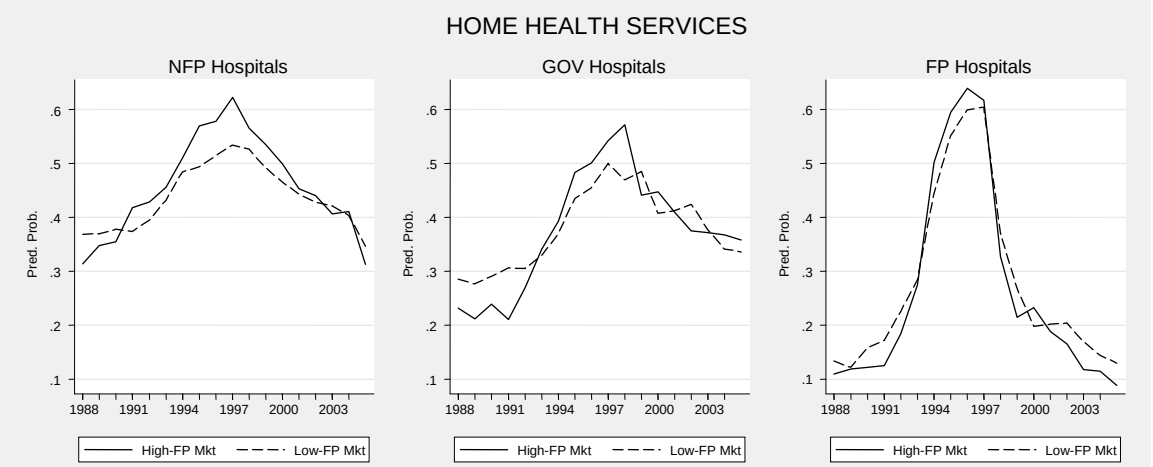


High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

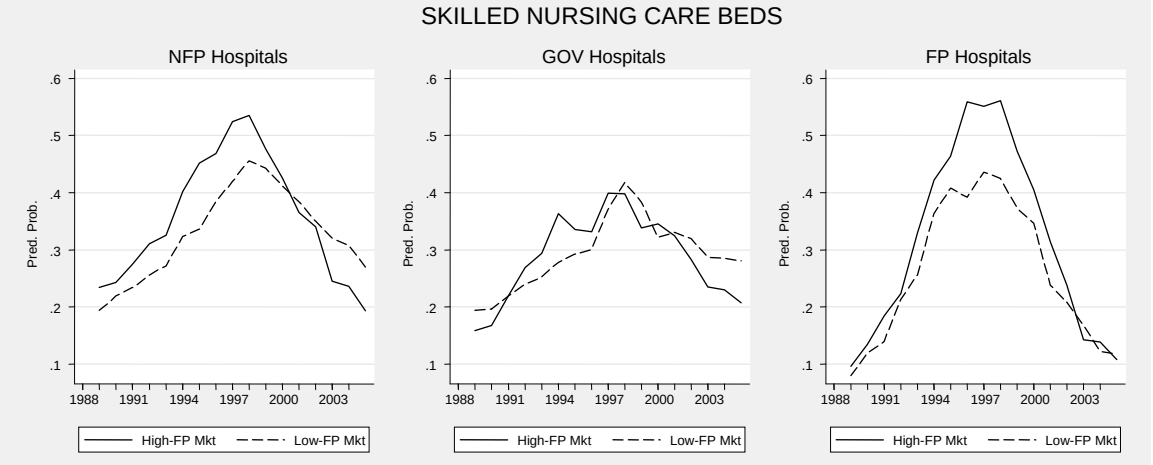


High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

3. Variably Profitable Services

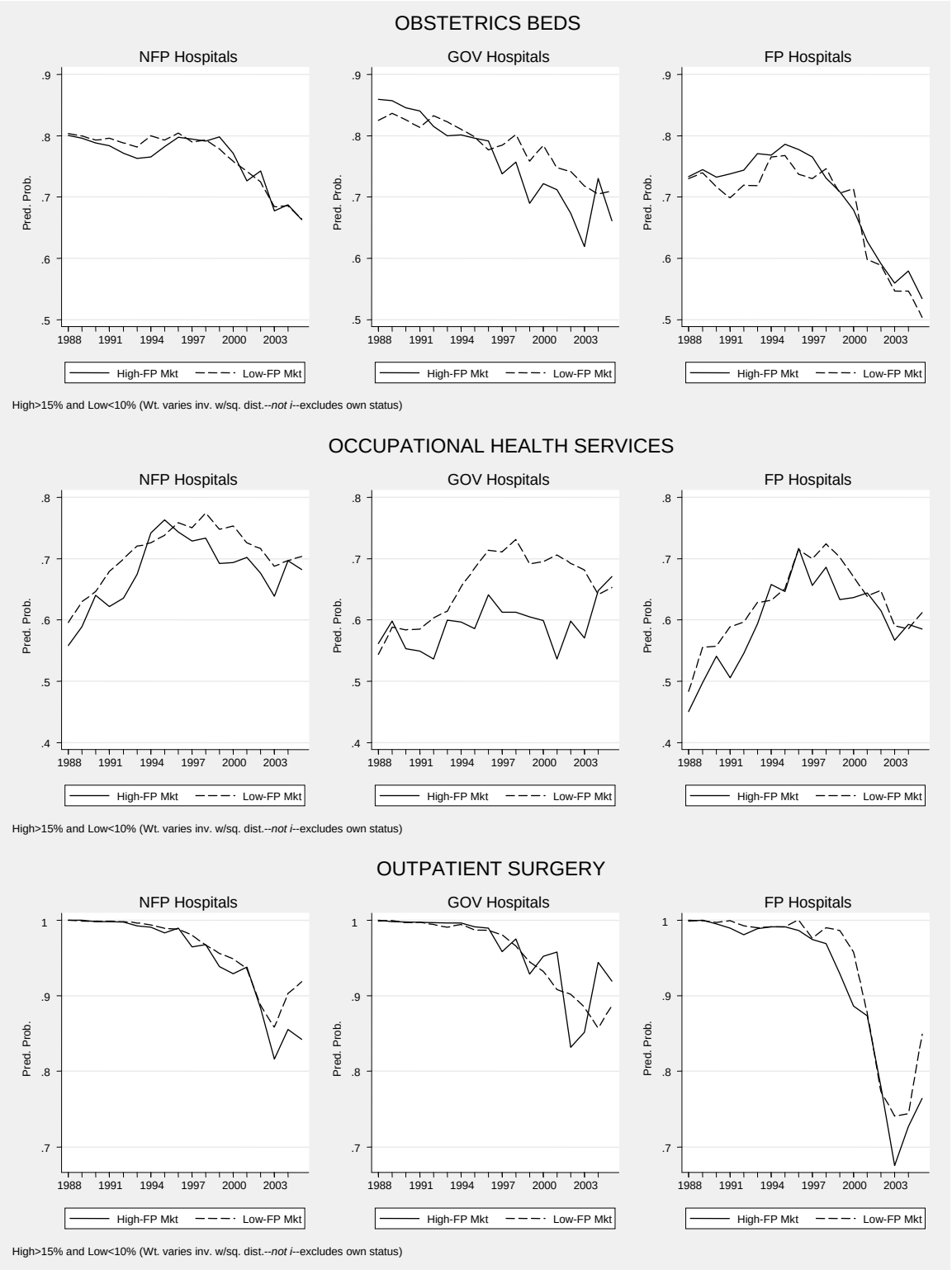


High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

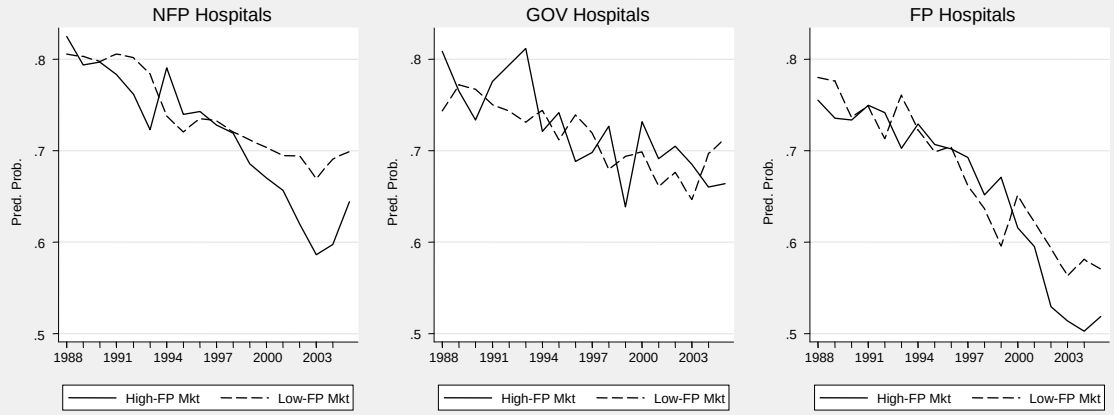


High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

4. Profitability Unknown (e.g., unclear definition, mixed patient pool)

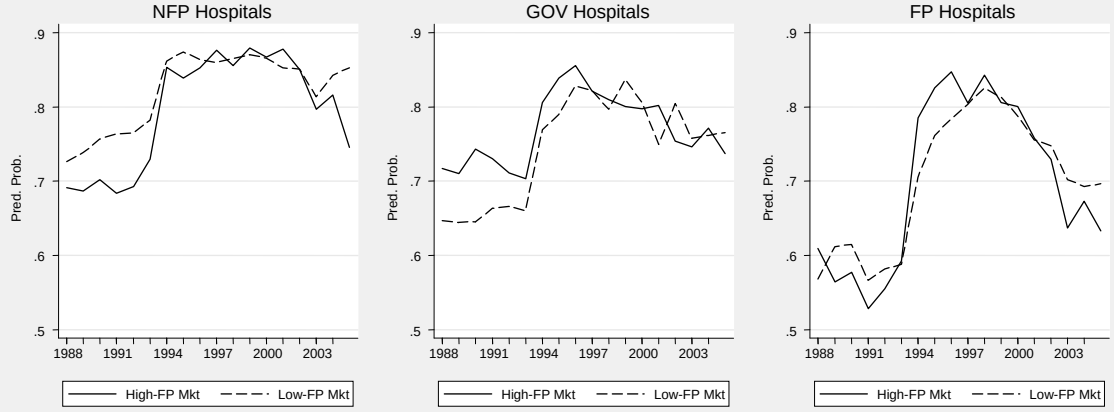


PATIENT REPRESENTATIVE SERVICES



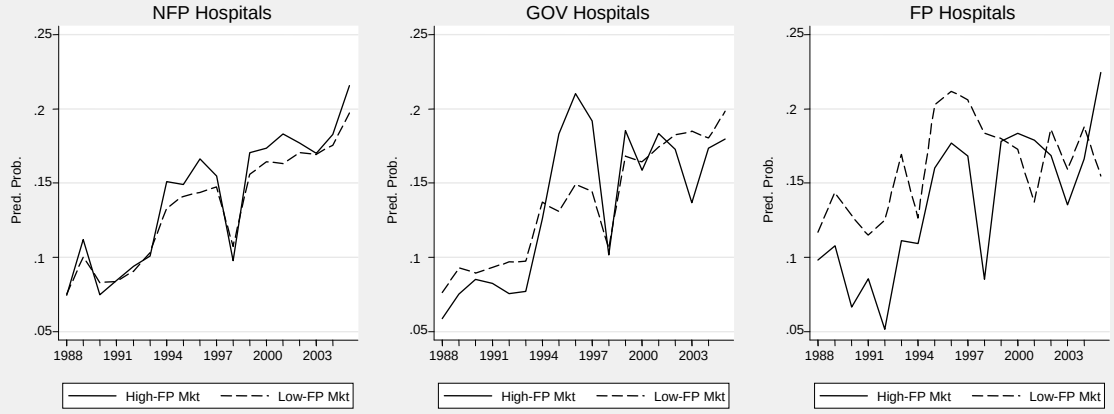
High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

PHYS. REHAB. SERVICES



High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

TRANSPLANT SERVICES



High>15% and Low<10% (Wt. varies inv. w/sq. dist.--*not i*--excludes own status)

Appendix D. Fixed-effects Estimates of Probability of Offering Medical Services by Ownership Type as For-Profit Market Share Increases and Medical Service Profitability Designation, 1988-2005

	FE estimate of the effect of increased FP share; exponentiated coefficients represent positive effect when greater than 1			Profitability Status		Percentage of Hospitals Offering Service
Service	**Gov**	**NFP**	**FP**	**Qualitative Approach**	**FP>G**	**%**
Adult Day Care Program	0.839	1.084	1.738	U*	U*	0.085
Alcohol/Chem. Depend. Beds (>0) (89-05)	1.356	0.664	0.857	U	I	0.158
Alcohol/Drug Abuse or Dependency Outpatient Services	1.274	0.657	1.026	U	U	0.288
Angioplasty (89-97)	1.221	1.278	0.574	P	P***	0.402
Birthing Room/LDR Room/LDRP Room	1.968	1.996*	2.070	P	U	0.735
Burn Care Beds	1.263	1.324	0.0888	U	U	0.047
Cardiac Catheterization Lab	2.617	1.408	0.561	P	P*	0.541
Cardiac Intensive Care Beds (>0)	2.431	0.540*	0.715	P	P**	0.414
Certified Trauma Center	1.361	0.787	0.542	U	U*	0.284
Child Psychiatric Services	1.421	1.096	2.915	U	U*	0.246
Computed-Assisted Tomography Scan (CT)	1.778	1.215	1.543	P	U	0.924
Diagnostic Radioisotope Facility	2.005*	1.321	1.342	P	P	0.813
Emergency Department	4.993	2.196	4.647*	U	U	0.958
Extracorporeal Shock-Wave Lithotripter	1.754	0.928	0.432*	P	P*	0.208
Fitness Center	1.098	1.009	0.620	P	V	0.258
HIV-AIDS Services (94-05)	1.341	0.681	0.669	U	U***	0.604
Home Health Services	1.868	1.338	1.496	V	V**	0.411
Hospice	4.147**	2.382**	3.007*	U†	U**	0.232
Magnetic Resonance Imaging (MRI)	2.117	1.304	0.791	P	P	0.533
Neonatal Intensive Care Beds (>0)	1.844	1.490	0.841	P	I	0.289
Neonatal Intermediate Care Beds (>0)	1.106	0.868	0.745	P	I	0.171
Obstetric Care Beds (>0)	1.920	1.846	2.424	?	U	0.756
Occupational Health Services	1.441	1.227	1.343	?	I	0.664
Open-Heart Surgery	3.128	0.804	0.588	P	P***	0.346
Outpatient Surgery	2.112	2.221	0.778	?	U	0.975
Patient Education Center	1.520	0.893	0.478*	U†	U	0.756
Patient Representative Services	1.892	1.111	0.772	?	U	0.716
Pediatric Intensive Care Beds (>0)	0.308	1.300	3.775	P	I	0.116
Positron Emission Tomography (PET) (90-05)	1.337	1.019	0.585	P	P	0.100
Psychiatric Consultation/Liaison Services	1.344	0.786	0.717	U	I	0.432
Psychiatric Education Services	1.693	1.076	1.137	U	U	0.327
Psychiatric Emergency Services	1.638	0.983	1.139	U	U	0.455
Psychiatric Inpatient Beds (>0) (89-05)	2.063	0.882	1.132	U	U**	0.421
Psychiatric Outpatient Services	1.614	0.671	1.870	U	U	0.336
Psychiatric Partial Hospitalization Program	1.886	0.967	1.575	U	U	0.276

Appendix D (continued). Fixed-effects Estimates of Probability of Offering Medical Services by Ownership Type as For-Profit Market Share Increases and Medical Service Profitability Designation, 1988-2005

	FE estimate of the effect of increased FP share; exponentiated coefficients represent positive effect when greater than 1			Profitability Status		Percentage of Hospitals Offering Service
Service	**Gov**	**NFP**	**FP**	**Qualitative Approach**	**FP>G**	**%**
Radiation Therapy	1.451	1.369	0.946	P	U	0.367
Rehab Services	2.359*	1.242	1.258	?	U	0.771
Single Photon Emission Comp. Tomography	1.812	1.116	0.928	P	U	0.451
Skilled Nursing Care Beds (>0)	1.557	0.737	1.158	V	V	0.315
Social Work Services	1.439	1.142	1.147	U†	U	0.911
Sports Medicine Services	1.557	1.204	1.367	P	U	0.352
Transplant Services	0.859	0.867	0.614	?	P	0.131
Ultrasound	0.854	1.578	1.487	P	U	0.951
Volunteer Services Department	1.245	1.262	0.565	U†	U	0.888
Women's Health Center/Services	1.100	1.331	1.451	P	P	0.501

Notes: All designations of profit status in Qualitative Approach column are from Horwitz (2005b) unless noted. For profit status: † = authors' determination. P=relatively profitable; U=relatively unprofitable, V=variable; ? = insufficient AHA description to categorize. Obstetric care draws from two distinct patient pools, one profitable, the other unprofitable.

FP>G results are based on probit regressions using all control variables described in the text and predicting probability of offering a service for each year in sample at the mean for-profit market share for for-profit and government hospitals. Significance tests from hypothesis $\beta_{FP*Year}+\beta_{FP*Mkt*Year}E(Mkt) = \beta_{Gov*Year}+\beta_{Gov*Mkt*Year}E(Mkt)$. P= > 10% years show significant differences of FP>G and < 10% years show significant differences of G>FP; U= < 10% years show significant differences of FP>G and >10% years show significant differences of G>FP, V= > 10% years show significant differences of FP>G and > 10% of years show significant differences of G>FP; I=indeterminate. ***p<0.01, **p<0.05, *p<0.10.