

The Convergence between For-Profit and Nonprofit Hospitals in the United States

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Abstract

This paper provides evidence of growing similarity in capacity of for-profit and nonprofit hospitals. In 1960, U.S. nonprofit hospitals maintained on average more than three times as many beds per hospital as their for-profit counterparts; following a monotonic decline in relative size, by 2000, the average nonprofit hospital was only 32% larger than the typical for-profit hospital. Hospital level data indicate that this convergence was driven primarily by entry, exit and ownership conversions, rather than expansions or downsizing of existing hospitals. These findings suggest that hospitals may in fact strategically choose their ownership type and hence, their regulatory environment. Accordingly, I develop a model in which firms have identical objectives but differ in their ability to benefit from a given ownership form. In contrast to the existing literature, this approach relies neither on different ownership-specific objectives nor market failure to generate an equilibrium in which both ownership types are chosen. Changes in the economic environment alter firms' incentives to maintain a given ownership type. This in turn induces firms to modify their capacity and encourages some firms to switch ownership type. Declining roles of government hospitals, population growth, and increasing government intervention in the healthcare market help explain the convergence in size. Analysis of data at the state and Metropolitan Statistical Area (MSA) levels is consistent with the principal theoretical predictions.

JEL classifications: L11, L13, L25, L31, L44, I11 and I18.

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“The adoption of the nonprofit form does not change human nature”[†] Richard Posner

1. Introduction

The role, objectives and performance of nonprofit firms in the U.S. hospital sector have been hotly debated. The nonprofit share of total hospital capacity has remained relatively stable (about 70%) for decades, while the average size of for-profit hospitals has steadily approached that of nonprofit hospitals. I theoretically and empirically analyze this convergence in size under the assumption that nonprofits and for-profits have the same objectives. The results suggest that the convergence in size is consistent with changes in regulatory, tax and demographic factors that affect choice of hospital ownership and capacity, rather than differences in organizational objectives. The findings have important implications for the policy debate concerning nonprofit and for-profit firms.

Private hospitals in the US can organize as either nonprofit or for-profit institutions, but nonprofit hospitals have been dominating the hospital industry with a persistently large share of beds over the period from 1960 to 2000. Nonprofit and for-profit hospitals are also subject to different regulatory rules. In particular, nonprofit hospitals are eligible for exemptions from property, sales, and income taxes. Despite these differences, there has been growing similarity in capacity between nonprofit and for-profit hospitals during the last four decades.¹

According to aggregate U.S. data from the American Hospital Association (AHA), in 1960 nonprofit hospitals maintained on average more than three times as many beds per hospital as their for-profit counterparts. Following a monotonic decline in relative size, by 2000, the average nonprofit hospital was only about thirty percent larger than the typical for-profit hospital. I present evidence that eighty percent of the convergence in size is attributable to convergence in the number of admissions (i.e. volume) and that the remaining twenty percent reflects convergence in lengths of stay (i.e. duration). The model developed in this paper provides a theoretical framework for understanding such

[†] Opinion, *Hospital Corp. of America v. FTC*, 870 F.2d 1381 (7th Cir. 1986)

¹ The trend of *growing similarity in capacity* or *convergence in size*, is documented and described in section 2 of this paper.

convergence. The theoretical and empirical analysis has implications for several policy issues, including factors that affect the provision of services to indigent patients, access to care, and welfare, and whether convergence of for-profit and nonprofit hospitals provides grounds for changes in tax policy. Consistent with the model's predictions, I provide evidence that the convergence in size was driven primarily by industry-wide effects such as entry, exit, and ownership conversions, rather than expansions or downsizing of existing hospitals.

Authors who find similarities between the two ownership types often question whether and to what extent modern nonprofit hospitals really differ from their for-profit counterparts.² These empirical studies and others, however, pay little attention to the process by which for-profit and nonprofit hospitals grew similar. Theoretical models of the behavior of nonprofit firms in general and nonprofit hospitals in particular imply that applying conventional neoclassical models to nonprofit firms is inappropriate. Yet, like the empirical literature, theoretical efforts to explain the difference in behavior, efficiency, objectives, and quality of care between nonprofit and for-profit hospitals generally omit dynamic considerations.

My evidence on convergence along with the large body of research on ownership conversions (see e.g. Gaynor and Haas-Wilson, 1999), highlights the importance of the economic and regulatory environments in which hospitals with different ownership types operate. I focus on the possibility that hospitals *choose* their ownership type (nonprofit vs. for-profit status) and attendant regulatory environment strategically. My model and empirical evidence suggests that the differential ability to benefit from a given ownership status, and not some underlying difference in objectives, accounts for discrepancies in behavior across hospitals. Specifically, I present a model in which firms have identical objectives yet heterogeneous distributive constraints that yield different ownership forms. In contrast to the existing literature, this approach relies neither on different ownership type-specific objectives nor on market failure to generate an equilibrium in which both ownership types are chosen by a strictly positive fraction of hospitals.

² For example: Duggan (2000), Malani et. al. (2003), Sloan (2000a) and Sloan et al. (2000b).

Changes in the economic environment alter firms' incentives to maintain a given ownership type. This in turn induces firms to modify their capacity and encourages some firms to switch their ownership type. This approach suggests that positive demand shocks, negative supply shocks, and the changing nature of government involvement in the healthcare market may explain the growing convergence in size. I test these predictions by constructing measures of the model's parameters and analyzing the historical convergence using state and Metropolitan Statistical Area (MSA) level data.

The paper is organized as follows: Section 2 describes the convergence between nonprofit and for-profit hospitals observed over the past forty years in the U.S. The third section presents the theoretical model, which provides a rationale for the coexistence of for-profit and nonprofit firms in the same market. That is consistent with original differences in capacity and predicts subsequent convergence between the two ownership types. Using the American Hospital Association's Annual Survey database from 1970 to 1998 and regional demographic data from the U.S. census and other sources, the fourth section provides a closer look at the convergence process across different locations to test the theoretical predictions. The fifth section considers the policy implication of the analysis and section 6 concludes.

2. The Dynamics of the US Hospital Market

Major medical developments have altered the original role of hospitals; from the last resort for the sick and poor to the superior organizational form of acute medical care, in both diagnosis and treatment, for all members of society.³ White (1982) suggested that for-profit hospitals played an important role in the early growth of the industry.⁴ These hospitals were small proprietary institutions, owned by doctors who wanted to provide facilities for themselves and for the community (Gray, 1991). This type of hospital gradually disappeared throughout the century; by 1960 its share has declined to 15%. For-profit hospitals in small communities and rural areas were often replaced by nonprofit hospitals, or even changed their ownership status to the nonprofit form directly.

³ The number of hospitals in the U.S. grew 20 fold between 1873 and 1925 (White, 1982).

⁴ In 1928, the share of for-profit hospitals was 43.6%, which was similar to the share of nonprofit hospitals (43.9%) and with government hospitals accounting for the remaining 12.5%.

Over the period from 1960 to 2000 the dominance of nonprofit hospitals, and their persistently large share of beds (about 70%), led most researchers to promote the idea that permanent discrepancies in objectives distinguished nonprofit and for-profit providers. Moreover, the fact that many nonprofit hospitals originated as charitable institutions led to a notion that nonprofit providers are altruistic in nature, while for-profit providers engage in self-interested profit-seeking behavior.

Despite the fact that nonprofit share is persistence in the US hospital market, Gray (1991) notes four significant ways in which nonprofit hospitals grew similar to for-profit hospitals: (1) a growing reliance of nonprofit hospitals on revenues from the sale of services versus donations; (2) a dependence on economic performance for gaining access to capital; (3) a decline in local control resulting from the rise of the multi-institutional systems; and (4) growing involvement of nonprofit hospitals in types of hybrid arrangements, such as management and departmental contracts, restructuring, joint ventures and alliances.⁵ However, another important trend was overlooked - a growing similarity in capacity of for-profit and nonprofit hospitals. Little empirical work has focused on the impact of ownership form on hospitals' capacity choice (Hansmann et al., 2003).

Figure 1 presents the ratio of nonprofit to for-profit hospitals based on the average number of beds per hospital, from 1928 to 2000. Between 1928 and the early 1960s nonprofit hospitals maintained on average more than three times as many beds per hospital as their for-profit counterparts. By 2000 the average nonprofit hospital was only 32% larger than the typical for-profit hospital.⁶

⁵ "Business terminology and business thinking have pervaded the nonprofit hospital world reliance on the sale of services for economic survival has important consequences nonprofit status can become more of a convenience than a necessity or an expression of philosophy." Gray (1991). Since nonprofit hospitals generate most of their revenue from sales of services, they fit Hansmann's (1980) definition of "commercial nonprofits."

⁶ This convergence in capacity from the 1960's on is mirrored by a convergence in utilization, though at a slower rate: In 1960, a nonprofit hospital admitted on average 2.8 times more patients per hospital than a for-profit hospital; by 2000 that figure had fallen to 1.47 (See subsection 2.2 for detailed discussion).

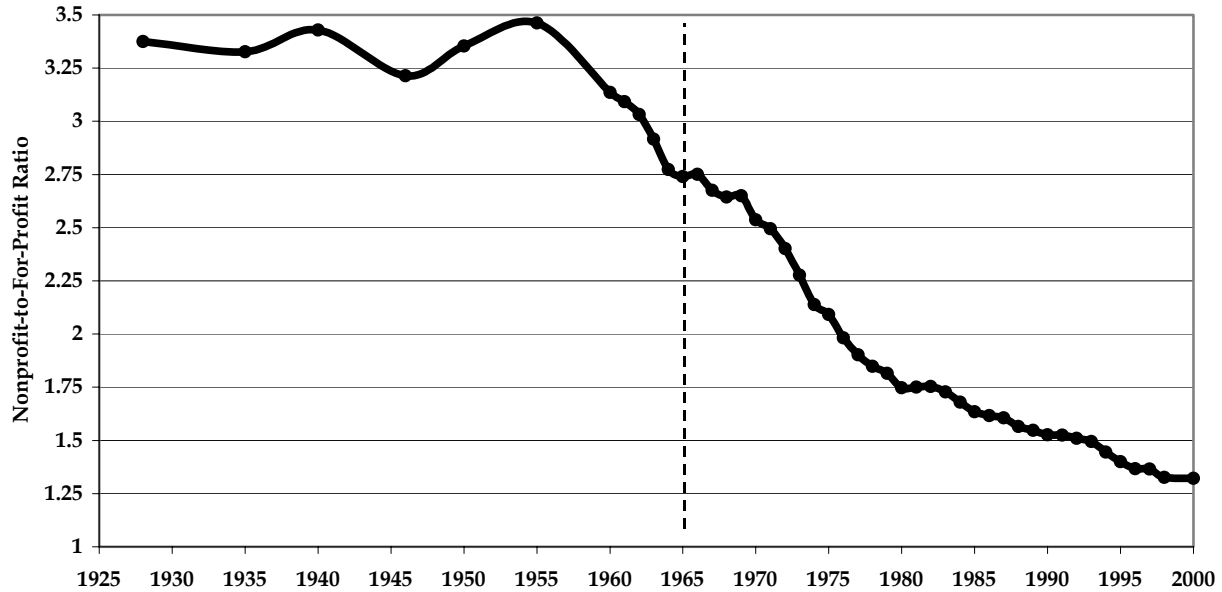


FIG. 1 - Convergence in Average Number of Beds per Hospital, between Nonprofits and For-Profits.
 Sources: 1928, 1935 and 1940: White, D. William "The American Hospital Industry Since 1900: A Short History" *Advances in Health Economics and Health Services Research*, Vol. 3, (1982) p 143-170. 1946-2000: American Hospital Association, *Hospital Statistics* (Various Years).

While the downward sloping part of the nonprofit-to-for-profit ratio curve begins in the mid-1950s, it is not clear that any dramatic change took place at that time that might have triggered subsequent convergence. Instead, it is possible that introduction of the Medicare and Medicaid programs in 1965 prompted the trend, with the downward sloping segment between the mid-1950s and the mid-1960s attributable to cyclical fluctuations that appears to characterize the earlier data.

The need for public and nonprofit hospitals to provide free or subsidized services substantially declined as the government began subsidizing purchases of medical care directly through programs like Medicare and Medicaid (White, 1979). Medicare paid hospitals on a cost-plus basis, a method that did not encourage hospitals to operate efficiently. Most private insurance plans paid whatever charges hospitals billed. As the cost of Medicare rose rapidly, the government began requiring hospitals to have government approval for the purchase of major equipment, the expansion of existing

medical facilities, and the construction of new facilities through certificate of need (CON) rules.⁷

In 1983, a fundamental change to the hospitals' environment took place - the introduction of the Medicare Prospective Payment System (PPS). Prior to the PPS, government programs reimbursed hospitals on a cost basis, whereby hospitals were paid retrospectively based on their reported costs. Under the new system, hospitals were reimbursed on the basis of a fixed payment per patient independent of the actual cost incurred and depended on the diagnosis of the patient at the time of admission.⁸ Gray (1991) calls this period *the end of the golden era* as the "reimbursement environment from the late 1960s until the early 1980s made it difficult not to make money operating hospitals, so long as they were located away from concentrations of low-income populations and in states that did not regulate hospital income." In the late 1960s, while the decline in the number of proprietary hospitals continued, a new type of for-profit hospital has emerged - the investor-owned hospital company. In 1984, close to 60 percent of all investor-owned hospitals were owned by six hospital chains.⁹

Hospitals reacted to the PPS by limiting services: curtailing lengths of stay, reducing inpatient testing, and laying off staff. The new system helped contain hospital costs, and the number of Medicare admissions declined (Raffel and Raffel, 1989). Despite these changes, the convergence trend illustrated in Figure 1 was not disrupted by the introduction of the PPS. However, the sources of convergence changed.

Table 1 illustrates changes in the underlying sources of convergence. Prior to the introduction of the PPS in the early 1980s, both for-profit and nonprofit hospitals grew in scale. For-profit hospitals grew at a rate of more than 5 percent per year, whereas nonprofit hospitals grew at about 2.3 percent per year, leading to convergence in size.

⁷ Phelps (1997) argues that, based on the empirical studies of CON laws, such regulations were generally inefficient in controlling hospital cost and possibly had perverse effects on overall cost, as hospitals substituted away from beds to other costly inputs such as equipment and personnel.

⁸ Payments under PPS were made at a predetermined, specific rate for each discharge according to its classification in one of 467 diagnostic related groups (DRGs).

⁹ Gray (1991) provides the following information regarding those six hospitals: Hospital Corporation of America (200 hospitals), American Medical International (115 hospitals), Humana (87 hospitals), national Medical Enterprises (47 hospitals), Charter Medical Corporation (41 hospitals), and Republic Health Corporation (24 hospitals).

TABLE 1
Growth Rate of the Average Number of Beds per Hospital, by
Ownership Type: 1955 - 2000. (Percent)

Year	Nonprofit	For-Profit	Government
1955-1960	7.9	19.2	-2.3
1960-1965	10.9	26.9	-0.5
1965-1970	16.3	25.7	-2.8
1970-1975	12.7	36.7	-0.3
1975-1980	5.7	26.5	-0.9
1980-1985	1.3	8.4	1.4
1985-1990	-2.5	4.4	-2.3
1990-1995	-4.2	4.5	-0.1
1995-2000	-1.6	4.2	-3.2

Source: American Hospital Association, *Hospital Statistics* (Various Years), author's calculations.

After the introduction of PPS, for-profit hospitals continued to grow, albeit at a markedly lower rate. Nonprofit hospitals, on the other hand, contracted. Government hospitals experienced a modest decline in average size throughout most of the period. The decline was mainly attributable to the changing role of government, as subsidizing medical care gradually supplanted the production of hospital services.¹⁰

Figure 2.2 presents a percentile-percentile graph that illustrates the dissimilarity between the size-distribution of for-profit and nonprofit hospitals in a given year, as well as demonstrating the convergence of the size-distributions over time. Percentiles for the for-profit hospitals appear on the x-axis while percentiles for the nonprofit hospitals appear on the y-axis. The 45° line represents a situation in which the size distribution of nonprofit and for-profit hospital is identical.

I illustrate the change over time in the relative size of nonprofit and for-profit providers by using three curves: for 1970, 1982 and 1998. A point on any of these contours corresponds to a pair of percentile points for an identical hospital's capacity. For example, the pair (0.5, 0.2) on the 1970 curve means that a hospital in the 50th percentile of the for-profit size-distribution had the same number of beds as a hospital in the 20th percentile of the nonprofit size-distribution. By 1998, the median for-profit hospital

¹⁰ Duggan (2000) finds evidence to support the claim that public hospitals differ substantially from all private hospitals (for-profit or nonprofit) because of their soft budget constraint. That is, government hospitals exhibit little responsiveness to changes in federal or state programs.

utilized the same number of beds as a hospital in the 43rd percentile of the nonprofit size-distribution.

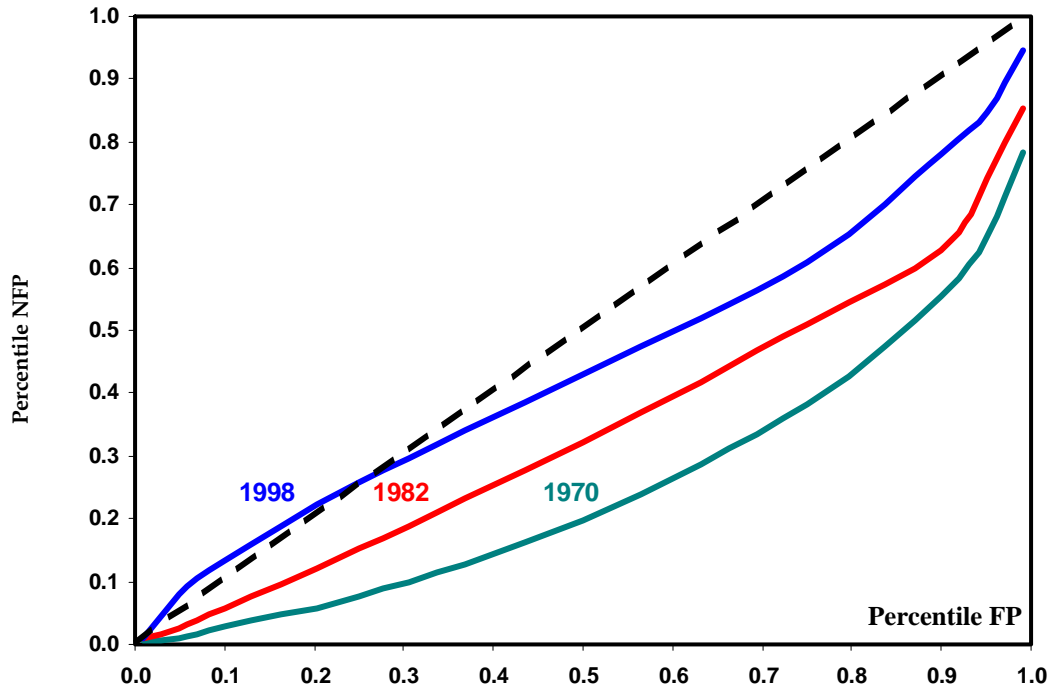


FIG. 2. - Percentile Nonprofit vs. Percentile For-Profit Graph for Capacity in 1970, 1982 and 1998.

It is clear from Figure 2 that for-profit hospitals moved through the size-distribution of the nonprofit hospitals. In 1998, for-profit hospitals in the 25th percentile and below were even larger than their nonprofit counterparts.

Using aggregate hospital data for the U.S. between 1960 and 2000, David (2004) discusses the determinants of hospitals' capacity choice, namely, number of admissions, lengths of stay and occupancy rates and shows that although most of the convergence in capacity is replicated by the convergence in the number of admissions. Medical practice, represented by average length of stay, contributed to the growing similarity between nonprofit and for-profit hospitals as well.

The convergence in size between for-profit and nonprofit hospitals may arise from many different sources, including entry of new facilities, closures, mergers, expansion or

downsizing of existing facilities, and changes in ownership.¹¹ These channels, through which the convergence took place, are in turn affected by laws and frequently regulated by government agencies.¹²

To identify the extent to which the change in ownership-specific average hospital size can be accounted for by changes in the size of the staying hospitals (intensive margin), as oppose to entry, exit, acquisitions, and divestitures (extensive margin), I divide hospital-level panel data for 1970-1998 into seven time intervals; 1970-1974, 1974-1978, 1978-1982, 1982-1986, 1986-1990, 1990-1994 and 1994-1998.¹³ I partition each sample into the following five mutually exclusive categories: (1) *constant-status hospitals (stayers)*: general hospitals (including small/rural and teaching hospitals) that maintained their ownership type throughout a given time interval; (2) *exitors*: hospitals that exited the market prior to the end of a given time interval; (3) *entrants*: hospitals that entered the market after the beginning of a given time interval; (4) *switched into*: hospitals that switched from government or nonprofit status to for-profit status after the beginning of a given time interval; and (5) *switched from*: hospitals that no longer maintained for-profit status by the end of a given time interval.

A given time interval is indexed by a pair of years (i,j) , where i represent the first year and j the last year of a given time interval. For any given pair (i,j) , each hospital will belong to one of the five, mutually exclusive, categories, k , listed above. Denote the share of hospitals with ownership type $h \in [NFP, FP]$, group k in year i as s_{ik}^h , and the average size of hospitals of ownership type $h \in [NFP, FP]$, group k and year i as x_{ik}^h . The staying hospital category is indexed $k=1$. Define the nonprofit to for-profit size ratio, in year i ,

¹¹ Mitchell et al. (2001) find that AHA hospital data are often incomplete and inaccurate with regard to mergers and affiliations. Affiliations are not introduced as a separate channel in my analysis. In addition, in most cases, the individual hospital facilities involved in mergers continue to report separately to the AHA.

¹² For instance, the Department of Justice and the Federal Trade Commission monitor and sanction mergers and other forms of strategic behavior among hospitals; the states' attorneys general oversee conversions and acquisitions of nonprofit hospitals; certificate-of-need laws limit entry of new hospitals and expansions of existing ones; state legislators frequently evaluate the cost of tax exempting nonprofit hospitals; and states and the federal government introduce programs to improve accessibility, insure certain groups and finance research activities.

¹³ The four-year interval data rather than year-to-year data are used, since hospitals' capacity adjustment (measured by changes to the number of beds) is a slow process.

as $R_i = \sum_k s_{ik}^{NFP} x_{ik}^{NFP} / \sum_k s_{ik}^{FP} x_{ik}^{FP}$. Furthermore, denote the growth rate, within a given time interval, for ownership type h , as G_{ij}^h .

The change in the nonprofit to for-profit size ratio moving from year i to year j (arranged around the staying hospitals category) is given by:¹⁴

$$\Delta_{ij} = \frac{R_j - R_i}{R_i} = \frac{G_{ij}^{NFP} x_{i1}^{FP} - x_{j1}^{FP}}{\sum_k s_{jk}^{FP} x_{jk}^{FP}} + \left[\frac{G_{ij}^{NFP} \sum_k s_{ik}^{FP} (x_{ik}^{FP} - x_{i1}^{FP}) - \sum_k s_{jk}^{FP} (x_{jk}^{FP} - x_{j1}^{FP})}{\sum_k s_{jk}^{FP} x_{jk}^{FP}} \right]$$

The first term is a “*within*” component and the second term is a “*between*” component. The staying for-profit hospitals category serves as a cross-sectional reference group whereas all nonprofit hospitals serve as a reference group for the time dimension. It is important to realize that such decomposition considers for-profit and nonprofit hospitals simultaneously; yet, the resulting decomposition of effects is not unique.¹⁵ The “*within*” component, represents intensive margin changes, and focuses on the staying hospitals group ($k=1$). The sign of the “*within*” component is determined by the sign of $G_{ij}^{NFP} x_{i1}^{FP} - x_{j1}^{FP}$.¹⁶ If the staying for-profit hospitals were to grow at the same rate as all nonprofit hospitals, the within component would equal zero. Intuitively, similar growth rates in size for both for-profits and nonprofits hospital, even of large magnitude, will have little or no effect on the ratio of sizes.¹⁷

Table 2 presents the decompositions given by the equation above for the seven time periods. The bottom row – *Total* – lists the percentage decline in the nonprofit-to-for-

¹⁴ See appendix A for the derivation.

¹⁵ For example, by using the staying nonprofit hospital as cross sectional reference group and for-profit hospitals as reference group for the time dimension a different decomposition would emerge. When decomposing differences, it is common to take an average of such two polar decompositions (viewed as lower and upper bounds). This is not the case when decomposing ratios, as it treats both for-profit and nonprofit hospitals simultaneously. Therefore it can be viewed as the choice of an angle through which one studies a phenomenon, rather than the choice of upper or lower bounds.

¹⁶ The average size of a staying for-profit hospital in year j is subtracted from average size of a staying for-profit hospital in year i , multiplied by the growth rate of all nonprofit hospitals.

¹⁷ Note that the nonprofit hospitals growth rate is used as multiplier in the case of *exitors*, and hospitals *switching from* for-profit status, as these hospitals appear only in the starting period, i , but are absent in the end period, j .

profit size ratio for each time segment and is the sum of the effects of each of the five categories. Components with negative sign contribute to the convergence trend, whereas components with positive sign increase the differential between for-profit and nonprofit hospitals.

TABLE 2
Decomposition of the Change in Nonprofit-to-For-Profit Average Size Ratio.

Category	70 - 74	74 - 78	78 - 82	82 - 86	86 - 90	90 - 94	94 - 98
Stayers	-0.8	-1.0	-3.3	-4.5	0.6	-0.3	-0.7
Exitors	-7.2	-6.7	-4.0	-4.7	-5.7	-1.3	-1.4
Entrants	-5.9	-2.3	0.5	0.8	-0.9	-1.2	-1.0
Switch into	-1.0	-0.3	2.9	2.5	1.8	-1.6	-3.6
Switch from	0.1	-1.3	-0.8	-1.2	-3.1	-2.3	-1.0
Total	-14.9	-11.6	-4.7	-7.1	-7.3	-6.7	-7.7

In the 1970-1978 period most of the dynamics reflects for-profit *exitors* and *entrants*, which account for 88% of the convergence trend in the 1970-1974 period and 78% of the convergence trend in the 1974-1978 period. This finding corresponds to the gradual disappearance of small proprietary hospitals coupled with the emerging of large investor-owned hospitals described by Gray (1991). Conversion of ownership status played a minor role. The capacity increase of nonprofit hospitals did not lag behind those of staying for-profit hospitals, leading to a small positive effect of the *staying* category on the convergence trend.

In the 1978-1986 period, the *staying* category explains about half of the convergence trend. While staying for-profit hospitals maintained their size throughout the period, it was the nonprofit hospitals that experienced a major slowdown in capacity growth followed by a switch to negative growth. The continued exit of small proprietary hospitals accounts for the other half. This period also highlights another important feature, the conversion of government hospitals to both for-profit and nonprofit status. Those government hospitals that chose for-profit status were smaller on average than the typical for-profit hospital, creating an offsetting effect on convergence. Wu (1992) claims that government hospitals account for nearly 50 percent of all hospitals that changed

ownership status during that period. At the same time, government hospitals that were privatized were more likely to switch to nonprofit status.¹⁸

In the 1986-1998 period, the capacity of both *staying* for-profit hospitals and nonprofit hospitals decreased. As both moved in the same direction with similar proportions the effect of the *staying* category on the convergence trend was small. In fact, the *staying* for-profit category for the 1986-1990 period was slightly offsetting the convergence trend, as existing for-profit hospital lowered their capacity faster than nonprofit hospitals. This finding corresponds to empirical research by Hansmann et al. (2003) who suggest that “nonprofit firms have a tendency to act as capital traps, in which capital remains inefficiently embedded over long periods”. By studying the 1985-1994 period, the authors find that for-profit hospitals are the most responsive to reductions in demand. In the 1990s, all categories positively contributed to the convergence trend, yet, switches in ownership types through mergers, acquisitions and divestitures accounted for 58% of the trend in the 1990-1994 period, and 60% in the 1994-1998 period. The remainder is explained by entry, exit, and intensive margins changes, all operating in the same direction.

3. A Model of Ownership Choice

Ownership status, whether for-profit or nonprofit, represents a choice. Two choice mechanisms have been proposed in the nonprofit literature to explain a mixed-ownership equilibrium. The first traces ownership-type choice back to intrinsic differences in objectives across individuals and often identifies a “residual claimant” in nonprofit hospitals.¹⁹ The second stream of literature argues that the choice of ownership status need not depend on a-priori differences in objectives. It can result from balancing the benefits and drawbacks of each status under uncertainty and incomplete markets for risk.²⁰

¹⁸ Government hospitals that choose a nonprofit status were also smaller on average than the typical nonprofit hospital, which stimulated the convergence process. The overall effect is likely to support the convergence process as government-to-nonprofit switches were more pronounced than government-to-for-profit switches.

¹⁹ Examples include: Lakdawalla and Philipson (1999), Pauly and Redisch (1973) and Newhouse (1970).

²⁰ Examples include: Arrow (1963), Hansmann (1980), Easley and O’Hara (1983), Hirth (1999), Glaeser and Shleifer (1998) and Glaeser (2003).

The theoretical model presented in this section relies neither on ownership specific objectives nor on incomplete information to generate an equilibrium in which both ownership types are chosen by a strictly positive fraction of hospitals. Moreover, the model highlights potential reasons for the original large difference in size between nonprofit and for-profit hospitals, by emphasizing the role that a choice of regulatory status has on the choice of capacity. In addition, the model allows for subsequent convergence in hospitals' size in relation to demographic trends, subsidies, local pressure, and government behavior.

All hospitals are assumed to produce a homogeneous service. Patients and physicians do not favor one ownership type over the other; hence, service prices and wages are equal across ownership types.²¹ I use a reduced form analysis, in which all decisions for both for-profit and nonprofit firms are made in accord with the objectives of the person or group in control of the organization, which I shall refer to as the *owner*.²² The owner has access to a common production technology and maximizes utility from monetary and non-monetary gains by choosing an ownership type (nonprofit status or for-profit status). Switching from one ownership type to another is assumed to be costless. In addition, if the owner chooses a nonprofit status, she will benefit from cost advantages and will be subject to a non-distribution constraint.

Cost advantages: nonprofit hospitals benefit from tax-exemptions, government grants, and access to tax-exempt capital financing.²³ Hansmann (1987) finds that “tax exemption offers nonprofit firms a significant advantage in establishing market share vis-à-vis for-profit firms offering similar services.” Debt has traditionally been the most important source of external capital for private hospitals (Institute of Medicine, 1986). Federal and state laws permit private nonprofit hospitals to issue tax-exempt bonds through local and

²¹ Sloan and Steinwald (1980) find no difference in wage rates paid by hospitals of different ownership type, holding other factors constant.

²² The use of a single “owner” is similar to the representative member of the physician staff in Pauly and Redisch (1973), the “manager” in Eckel and Steinberg (1993), the unified concept of investor/donor in Lakdawalla and Philipson (1999), the entrepreneur in Glaeser and Shleifer (1998), or the owner/patron in Malani, Philipson and David (2003).

²³ Arrow (1963) argues that “Departure from the profit motive is strikingly manifested by the overwhelming predominance of nonprofit over proprietary hospitals The simplest explanation is that public and private subsidies decrease the cost to the patient in nonprofit hospitals.”

state governments. This allows these hospitals to borrow money at substantially lower rates than for-profit borrowers, because bondholders need not pay taxes on the bond interest income.²⁴ Formally, I model all the economic advantages of nonprofit firms through access to lower capital prices.

Non-distribution constraint: cash income for nonprofit owners is constrained to be zero. The *owner* can, however, draw non-cash income in the form of perquisites such as a luxurious office and a company car. In other words, nonprofit firms can modify the form in which they pay out profits, by converting monetary income into perks, or “dividends-in-kind” (Pauly, 1987).²⁵ Eckel and Steinberg (1993) point out that although the alleged purpose of the non-distribution constraint is to prevent excessive perks, it is difficult to enforce proscriptions against excessive non-cash benefits paid to managers. Ortmann and Schlesinger (2002) claim that there is little in the nonprofit regulatory status to reduce the threat of fraud.²⁶ A key assumption made in this analysis is that the utility from cash is at least as high as the utility from perks.²⁷ Define π as profit and δ as a parameter, bounded between zero and one. $\delta\pi$ represents the income that would provide the same level of utility as π dollars spent on perks. The owner of a for-profit firm derives utility from the firm’s profits, $U_{FP} = \pi_{FP}$. On the other hand, the utility for the nonprofit firm can be written as $U_{NFP} = \delta\pi_{NFP}$.

Firms can take on one of three ownership types; private for-profit, private nonprofit, or public/government. There are G government firms and N private firms, out of which n are for-profit firms and the remaining $N-n$, are nonprofit firms. All $N+G$ firms in the

²⁴ Wu (1992) discusses the cost advantages that nonprofit firms have over for-profit firms due to their ability to raise capital through the sale of tax-exempt bonds.

²⁵ Inefficiencies do not qualify as perks in this model since perks are not embedded in the production process but rather funded through surplus.

²⁶ The authors suggests that resources meant for a particular purpose might be misappropriate towards other purposes, typically self-serving ones.

²⁷ Here I assume that all perks can be purchased with cash. Note that once the firm has access to lower prices for certain goods or services than the individual employee has (e.g. the firm can often bargain for better insurance premium rates) we might have higher utility from perks relative to cash. Nevertheless, for-profit firms can modify the form in which they pay out all or some of their profits. This allows for-profits to mimic the behavior of nonprofit firms whenever perks are superior to cash.

economy are assumed to compete in quantities (Cournot competition). However, I treat the number of government firms and their quantity choices as given.

Localized competition with relatively high barriers to entry, due to regulation, licensing and high setup costs is usually studied using models of imperfect competition, such as the Cournot model.²⁸ Moreover, health insurance, third-party payment (Wu, 1992), and physicians' induced demand (Roemer, 1961; Fuchs, 1978) may lower patients' sensitivity to price. For example, Dranove and White (1999) argue that patients' decisions about which hospital to use were based on convenience of access rather than price.²⁹ Likewise, there is no conclusive empirical evidence indicating that nonprofit providers enjoy a price premium despite the attention that has been devoted to competition in quality in the literature (Philipson, 2000).³⁰

The symmetric properties of the Cournot model will entail that all firms with common ownership type choose the same output level. Define total industry output, Y , as;

$$Y \equiv \sum_{i=1}^n y_{i,FP} + \sum_{j=n+1}^N y_{j,NFP} + G y_G = n y_{FP} + (N - n) y_{NFP} + G y_G \quad (1)$$

Where, y_h is the individual firm's production level, $h \in [FP, NFP, G]$. The inverse demand function is assumed to be linear and take the form $p(Y) = \alpha - \beta Y$, where α and β are demand shifters and p is output price. A private firm $i \in N$ of ownership type h will maximize its profits by choosing $y_{i,h}$.³¹

$$\text{Max}_{y_{i,h}} \quad p(Y) y_{i,h} - c(w, r_h, y_{i,h})$$

Denote the marginal cost for ownership type h as, $\frac{\partial c(w, r_h, y_h)}{\partial y_h} \equiv C'_h$

²⁸ Gaynor and Haas-Wilson (1999) argue that nonprofit hospitals will exercise market power if they can. Simpson and Shin (1998) argue that nonprofit hospitals may still exercise market power even if their primary objective is not to maximize managers' profit.

²⁹ "Insured patients had little incentive to shop around for the best prices, enabling providers to set prices in excess of marginal costs." (Dranove and White, 1999)

³⁰ Young and Desai (1999) examined 43 hospitals in Texas, Florida and California that switched from nonprofit to for-profit type between 1981 and 1995. They find virtually no effect on prices, uncompensated care, or unprofitable services.

³¹ Note again that both for-profit and nonprofit share a common objective function, as long as the utility function monotonically increases with profits.

In the optimum two sets of first-order conditions are satisfied. As marginal cost varies by ownership type, we have n first-order conditions of the type: $\alpha - \beta Y - \beta y_{i,FP} - C'_{FP} = 0$ and, $(N-n)$ first-order conditions of the type: $\alpha - \beta Y - \beta y_{i,NFP} - C'_{NFP} = 0$. Summing the first-order conditions over all N private firms, imposing symmetry within ownership type and using the industry output definition in (4.1) we can rewrite the industry output as;³²

$$Y = \frac{N(\alpha - C'_{NFP}) - n(C'_{FP} - C'_{NFP}) + \beta G y_G}{\beta(N+1)} \quad (2)$$

Plugging (2) back into the first order conditions we get the output choice of for-profit and nonprofit firms.

$$y_{FP} = \frac{(\alpha - C'_{FP}) - (N-n)(C'_{FP} - C'_{NFP}) - \beta G y_G}{\beta(N+1)} \quad (3)$$

$$y_{NFP} = \frac{(\alpha - C'_{NFP}) + n(C'_{FP} - C'_{NFP}) - \beta G y_G}{\beta(N+1)} \quad (4)$$

In what follows I will assume, for simplicity, that the production function for the individual firm exhibits constant returns to scale.³³ Nonprofit firms are assumed to have access to lower capital prices, $r_{FP} > r_{NFP}$.³⁴ With constant returns to scale the difference in marginal costs across ownership-types, $(C'_{FP} - C'_{NFP})$ will be positive for any level of output and its magnitude will depend on both the difference in capital prices and the form of the production function (e.g. the capital intensity).

Since the output choice of for-profit firms is negatively related to the number of nonprofit firms while the output choice of nonprofit firms is positively related to the number of for-profit firms, conversion from nonprofit status to for-profit status will lead to higher

³² This is assuming an interior solution, that is, the difference in marginal costs across ownership types supports participation in production of all N firms.

³³ The model's predictions hold for increasing marginal costs under additional conditions regarding the share of for-profit firms and the ownership type-related supply elasticity (See appendix B).

³⁴ This is also true for property tax exemptions. The lower capital price will affect efficiency by encouraging a shift in the input mix of nonprofit firms towards capital.

output levels for both types. However, from (2) we see that the total industry output is negatively related to the share of for-profit firms.³⁵

Lemma 1: Regardless of the number of private firms in the economy, N , the production level in the government sector, Gy_G , or the presence of a non-distribution constraint, a nonprofit firm will produce more than a for-profit firm when tax exemptions/subsidies are non-zero.³⁶

The rationale is fairly simple; the nonprofit firm enjoys a competitive advantage in that it has lower production costs. It exploits this cost advantage by increasing production. As quantities are strategic substitutes, the choice of output by nonprofit firms in turn induces a reduction in output by for-profit firms.³⁷ Subsidies and tax-exemptions for nonprofit firms increase their minimum efficient scale, and affect their choice of inputs mix. Since utility maximization corresponds to profit maximization, the non-distribution constraint does not play a role in the choice of capacity.³⁸

Figure 1 in section 2 documents the convergence in size between nonprofit and for-profit hospitals by featuring the behavior over time of the nonprofit-to-for-profit size ratio. In this model, all firms with identical ownership-type choose the same level of output/capacity, so this ratio is simply; $R_y \equiv y_{NFP} / y_{FP}$

3.1 Market Equilibrium

In order to study the determinants of the convergence process, a definition of market equilibrium is needed. Changes to relative size affect the relative profitability and hence alter the incentives for choosing ownership type.

³⁵ Although all firms increase their scale (individual-firm effect) the mix of nonprofit and for-profit firms is changed (composition effect). Industry output falls with switching from nonprofit to for-profit status as the composition effects dominate the individual-firm effect.

³⁶ For proof see Appendix B.

³⁷ Another way to obtain the same result is by rearranging the first order condition, such that $p(Y)(1 + s_h / \varepsilon) = C_h$ where s_h is the share of industry output produced by firm of ownership type h and ε is the demand elasticity. The nonprofit firms having lower marginal costs are expected to have higher share of industry output.

³⁸ In some models the non-distribution constraint is assumed to induce nonprofit firms to channel their surplus into additional output.

Nonprofit firms are bigger and generate more surplus, as profits equal one-half times output squared, $\pi_h = 1/2 \cdot y_h^2$, where $h \in [FP, NFP]$.³⁹ This has to hold in equilibrium, since nonprofit firms turn the higher surplus into perks, and perks generates lower utility relative to cash. Utility from perks (as a nonprofit firm) has to be higher than the utility from cash (as a for-profit firm) for owners to choose a nonprofit status.

The owner will choose a nonprofit status if and only if, $U_{NFP} = \delta\pi_{NFP} > \pi_{FP} = U_{FP}$. If all owners face identical δ , the condition above will either hold or fail for all potential owners. Mixed equilibrium is ruled out as all firms choose the same ownership status. Moreover, this implies a constant profit ratio, as the profit ratio equals the output ratio squared; the output ratio is also constant and equal $R_y = (\sqrt{\delta})^{-1}$.

In what follows, δ is allowed to vary across firms. Possible reasons for such heterogeneity in δ might arise from different degrees of involvement of local communities or different levels of regulatory intensity, or they may simply mean that some firms are better than others at transforming cash into perks. In fact, it is rather unlikely that δ would represent altruism, quantity preferences, or “empire-building motives” because higher δ does not imply a stronger tendency to substitute profits for quantity.⁴⁰ Moreover, owners with different δ s who chose the nonprofit status would produce identical levels of output.

Assuming δ is distributed uniformly between 0 and 1, the share of for-profit firms will be given by:

$$\frac{n}{N} = \Pr(\delta \leq \frac{\pi_{FP}(n)}{\pi_{NFP}(n)}) = \frac{\pi_{FP}(n)}{\pi_{NFP}(n)} = R_p(n) \quad (5)$$

The for-profit-to-nonprofit profit ratio, $R_p(n)$, has to equal to the for-profit share, n/N , (out of all private hospitals). n/N is compact and convex, and $R_p: n/N \rightarrow n/N$ a continuous function. Therefore R_p has a *fixed point*.

³⁹ U.S. Medicare Payment Advisory Commission, 1998, reports that nonprofit hospitals were more profitable than for-profit hospitals between 1988 and 1990.

⁴⁰ δ need not be a characteristic of firms’ objectives but rather of firms’ technology.

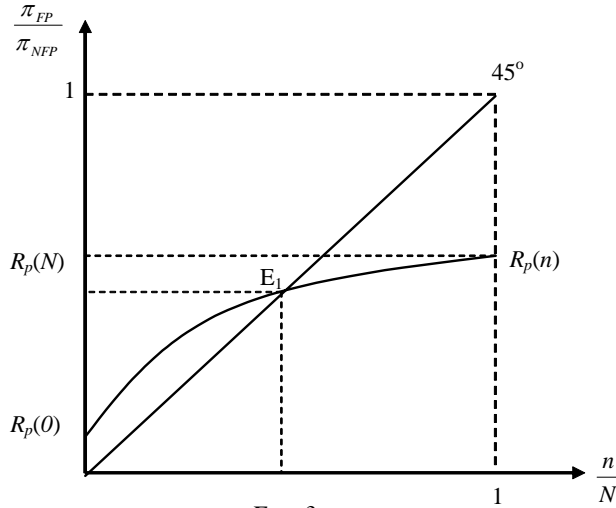


FIG. 3.

The fixed point, E_1 in Figure 3 represents the mixed ownership equilibrium, as it lies both on the 45° degree line (the cumulative distribution function of a uniform $(0, 1)$) and on the for-profit-to-nonprofit profit ratio function.

Also note that since $\frac{\partial R_p(n)}{\partial n} > 0$, $\frac{\partial R_p(n)}{\partial n^2} < 0$, $\frac{\partial R_p(n)}{\partial n^3} = 0$ and $0 < R_p(0) < R_p(N) < 1$.

E_1 is a unique equilibrium.

3.2 Comparative-Static Analysis

The purpose of this section is to compare different equilibrium states that are associated with different values of exogenous variables. More specifically, in this section I study how conversion from nonprofit to for-profit status, demographic changes, changes in government subsidies and crowding out of government beds affect the convergence process. In order to study the convergence process, denote demand and supply shifters by s . The ratio of average sizes corresponds to the share of for-profit hospital in the following way:

$$R_y(n) = \frac{y_{NFP}}{y_{FP}}(s, n) = \sqrt{\frac{n}{N}}^{-1} \quad (6)$$

A shock that increases the profit-ratio, $R_p(n)$ decreases the size-ratio, $R_y(n)$ and would lead to a disequilibrium, as the incentive to become a for-profit firm increases. As a result, the share of for-profit firms, which is determined endogenously, increases until a new equilibrium level is attained.

Note that no additional insight with regard to the process of adjustment is offered, as this is merely a comparison of two equilibrium states. Net conversion from nonprofit to for-profit type plays an important role in clearing the ownership-market. The direction of the effect of switches from nonprofit to for-profit status on the growing similarity between the two types of firms is fully captured by the sign of the partial derivative of R_y with respect to the number of for-profit firms, n .⁴¹

Lemma 2: Regardless of the number of private firms in the economy, N , the production level in the government sector, G_{yG} , and the presence of a non-distribution constraint, conversion from nonprofit to for-profit status leads to convergence in size, when tax exemptions / subsidies are non-zero.⁴²

Following lemma 1, where I asserted that $R_y > 1$, lemma 2 claims that ownership switches is one possible driving force behind the convergence in size. Furthermore, the second derivative of R_y with respect to n is positive, indicating that the convergence process slows as the share of for-profit firms increases.

In this formulation there are two potential demand shifters, α and β , the intercept and slope of the linear inverse demand function respectively.⁴³ When α increases, demand shifts out and in turn induces higher levels of production in both for-profit and nonprofit firms. All firms have equal absolute change in capacity, yet for-profit firms will experience a higher percentage change, due to their relatively smaller scale.

In addition, when β decreases demand pivots upwards. If government hospitals are absent from the market (i.e. $G_{yG}=0$) the effect of a change in β induces a proportional change in scale across ownership types and the size-ratio, R_y is unaffected. However, when government hospitals are present in the market, and are less sensitive to shocks relative to their private counterparts, a decrease in β does lead to convergence in capacity.⁴⁴

⁴¹ The partial derivative of R_y with respect to the number of for-profit firms, n , holds, by definition, the number of private firms, N , constant. Therefore it represents switching of ownership type from nonprofit to for-profit on the margin.

⁴² For proof see Appendix B.

⁴³ If we think of a representative consumer, i with a demand function $y_i = \alpha - p$, and a resulting aggregate inverse demand function, $p = \alpha - \beta Y$, α can represent the maximum willingness to pay of a typical individual and β would be one over total population.

⁴⁴ For empirical discussion of this feature see Appendix C.

Moreover, a negative supply shock represented by a decrease in the total number of public beds, Gy_G , will have similar effects on convergence as an increase in α . It will lead to equal absolute increase in the number of beds for both types and will result in convergence.⁴⁵ A negative supply shock to the government providers would have similar properties as a positive demand shock.

$$\frac{\partial R_y}{\partial \alpha} < 0, \quad \frac{\partial R_y}{\partial \beta} > 0, \quad \frac{\partial R_y}{\partial Gy_G} > 0, \quad \frac{\partial R_y}{\partial N} > 0, \quad \frac{\partial R_y}{\partial (C'_{FP} - C'_{NFP})} > 0$$

Likewise, when the number of private firms, N , increases the profit-ratio, R_p shifts downwards, subsequently, the share of for-profit firms falls and the size-ratio expands. In other words, exit stimulates the growing similarity in size. Markets with fewer hospitals would tend to have a lower share of nonprofit hospitals. In such markets, differences in capacity across ownership types are minimal. This result coincides with Lakdawalla and Philipson's (1999) model, in which "the share of nonprofit firms rises with the number of firms in the industry." In both formulations, entry reduces the relative attractiveness of the for-profit status.

Finally, when cost advantages of nonprofit firms decrease, due to lower availability of government funds and subsidies, for-profit firms and non-profit converge in size. However, this particular shifter does not trigger differential growth rates but rather has a positive effect on the scale of for-profit firms and a negative effect on the scale of nonprofit firms. This is the only shifter in this model, consistent with the convergence pattern that followed the introduction of the Prospective Payment System.

The model presented in this section stresses the cost advantages of nonprofit firms, and the constraints these firms face in term of paying out profits, as the key trade-off determining the mixed-ownership equilibrium. This simple model appears to be flexible enough to account for the static differences between for-profits and nonprofits, as well as the dynamics of the convergence in capacity. The model allows different potential shifters to shape the convergence trend, in ways that correspond to both the period prior to the introduction of the PPS and successive periods.

⁴⁵ It is worth noting that the effect on R_y comes from public beds per capita, βGy_G , pointing out that it is the relevant component for the econometric evaluation of this model.

4. Empirical Analysis

In this section I test to what extent measures of the model's parameters explain the convergence in capacity by exploiting variation across different geographical areas. I employ both hospital-level and demographic data; hospital-level data are collected by the American Hospital Association (AHA). For the purpose of this analysis, the sample is limited to community hospitals that provide short-term general care.⁴⁶ Community hospitals are facilities whose services are available to the general public. Short-term general hospitals are facilities whose primary function is to provide patient services for a variety of medical conditions. Hospitals are divided into three categories: nonprofit hospitals, for-profit hospitals, and government hospitals.⁴⁷

I consider two geographical partitions: states and metropolitan statistical areas (MSA). The Office of Management and Budget defines metropolitan areas for purposes of collecting, tabulating, and publishing federal data. The general concept of a metropolitan area is that of a large population nucleus, together with adjacent communities having a high degree of social and economic integration with that core.⁴⁸ The concept of Metropolitan Statistical Area (MSA) has remained essentially the same throughout the sample years.⁴⁹

The panel data sets at the state (including Washington, D.C.) and MSA levels cover the years 1970, 1974, 1978, 1982, 1986, 1990, 1994 and 1998. Descriptive statistics for the

⁴⁶ Included in this category are all university medical centers, and both teaching and non-teaching hospitals. Excluded are all "specialty" hospitals (e.g. psychiatric hospitals, children's hospitals, respiratory disease hospital, long-term facilities etc.)

⁴⁷ Hospitals in the nonprofit category are non-governmental entities that are controlled by nonprofit organizations. These facilities include mostly hospitals operated by or affiliated with religious organizations, community hospitals, cooperative hospitals and hospitals operated by fraternal societies. Hospitals in the for-profit category are non-governmental entities that are administered on a for-profit basis, most of which are organized legally as corporations. Federal agencies, states, counties, cities and other local governments operate hospitals in the government category.

⁴⁸ Metropolitan areas comprise one or more entire counties, except in New England, where cities and towns are the basic geographic units. Each metropolitan area must contain either a place with a minimum population of 50,000 or a Census Bureau-defined urbanized area and a total metropolitan area population of at least 100,000. A metropolitan area comprises one or more counties.

⁴⁹ There are two basic comparability issues: first, most metropolitan areas encompassed less territory during earlier years than they did in later ones, as the census reconsidered and adjusted the boundaries of each metropolitan area to account for growth during each ten-year period. Second, as population grows and people migrate to urban areas, new metropolitan areas regularly emerge, so the number of them has steadily increased since the concept was first invented.

main variables are displayed in Appendix C. For the state-level analysis, all 408 state-year observations include public (government) hospitals and private nonprofit hospitals. Private for-profit hospitals appear in 82% of state-years (335/408).⁵⁰ For the remaining (18%) state-years that have no for-profit hospitals, the ratio of average sizes is not defined. For the MSA-level analysis, I examine 2,344 MSA-years, which include single, double, and triple ownership-type markets. 960 MSA-year pairs (approximately 41%) include both for-profit and nonprofit hospitals.

4.1 Empirical Framework

The model developed in the previous section suggests that nonprofit-to-for-profit size-ratio is a function of demand shifters; the number of government beds in the market; the cost advantage of nonprofit firms; and the share of for-profit firms in the market, which is endogenously determined in the model. I calculate the size ratio as the average number of beds in nonprofit hospitals divided by the average number of beds in for-profit hospitals for each year and geographical area. The for-profit share corresponds to the share of for-profit facilities out of all private (for-profit and nonprofit) facilities in a given geographical area. I use income per capita and population size as the two demand shifters in the model. Note that an increase in income per capita and population size are expected to decrease the size ratio and lead to convergence.⁵¹ A decrease in the number of government beds is expected to decrease the size ratio as well. Finally, In addition to the endogenous for-profit share, another challenging task is developing a measure for the cost advantage for nonprofit hospitals.

The theoretical literature provides several justifications for higher average costs in nonprofit hospitals.⁵² However, empirical cost studies present mixed evidence regarding

⁵⁰ The states Connecticut, Delaware, Rhode Island, and Vermont have no for-profit hospitals throughout the sample period. In the states Alaska, Maine, Minnesota, Montana, New Hampshire, New Jersey, New Mexico and Wyoming for-profit hospitals appear in several periods but not in all. In 33 states all three-ownership types appear in all years.

⁵¹ Note that the slope of the demand function, β equals $1/pop$, hence when population increases β falls and we get convergence.

⁵² In the quantity-quality model (Newhouse, 1970) average costs will be higher for nonprofits since they supply higher quantity and/or quality of care. This argument carries through for the non-contractible quality models (e.g. Glaeser and Shleifer, 1998), as nonprofit firms will exert less cost-cutting effort. The physician cooperative model (Pauly and Redisch, 1973) yields similar predictions, however in this case, it is the choice of input-mix that leads to higher average costs for nonprofit hospitals.

cost disparity across hospitals with different ownership types (Malani et. al. 2003). Moreover, when properly controlling for scale, input prices, taxes, case-mix severity and teaching status, these studies fail to detect systematic difference in efficiency between for-profit and nonprofit hospitals (Sloan, 2000a).

In the model presented in the previous section, I assume that nonprofit hospitals enjoy cost advantages over their for-profit counterparts, such that the average cost of producing healthcare in nonprofits is lower. Nevertheless, the observed costs for nonprofit firms include both the cost of producing medical services and the cost of *producing* perks.⁵³

To construct a measure of nonprofit cost advantage I have imposed the equilibrium condition in equation (5): $\pi_{FP} = \delta\pi_{NFP}$ where, δ is uniformly distributed, and hence equals the for-profit share (n/N). Using the mean actual surplus of for-profit hospitals and their share in each geographical area, I calculated an estimate for the latent nonprofit surplus in that area. Assuming that all hospitals in a given area face similar output prices, and using the discrepancy between reported surplus of for-profits and approximated surplus of nonprofits, a measure of nonprofit cost advantage was constructed. Equation (7) specifies the reduced form relationship between the size ratio and its determinants:

$$\ln\left(\frac{y_{NFP}}{y_{FP}}\right)_{it} = \mu + \gamma \ln S_{it} + \delta X_t + \varepsilon_{it} \quad (7)$$

The log of the size ratio for state or MSA i in year t is regressed on the vector $\ln S_{it}$, which includes: log income per capita, log population size, log number of beds per capita in government hospitals and log cost difference. X_t is a set of year dummies, and ε_{it} is an independently and identically distributed error term.

⁵³ Williamson (1964) argues that managers use their authority to divert funds away from profit to serve their own self-interests, that is, enhance their own utility. The excess profits are absorbed as discretionary expenditure or income. Williamson suggests that managers consciously drive up the cost of production in an attempt to further their own self-interests. Note that since in the model, presented here, firms operate efficiently, their surplus will appear on the cost side, much like a fixed cost.

4.2 Results

Table 3 presents reduced-form estimates of equation (7). In columns (1) and (3), the dependent variable is the log size ratio between nonprofit and for-profit hospitals. In columns (2) and (4), the dependant variable is the log share of for-profit hospitals.

All regressions are estimated using ordinary least squares with robust (Huber/White) estimates of standard errors; regressions (1) and (2) include state-fixed effects, regressions (3) and (4) include MSA-fixed effects, which allow for levels of the key variables to systematically differ across states/MSAs.

Note that the cost variable is divided in two; $\ln\text{CostDif (+)}$, the log difference in average cost for areas, in which nonprofit hospitals have cost advantages over for-profit hospitals, zero otherwise. $\ln\text{CostDif (-)}$ is the log difference in average cost for areas, in which for-profit hospitals enjoy cost advantages over nonprofit hospitals, zero otherwise.

TABLE 3
State and MSA Level Analysis –Reduced-Form Convergence Regressions

Dependent Variable	State-Level Analysis		MSA-Level Analysis	
	ln Size-Ratio	ln FP Share	ln Size-Ratio	ln FP Share
	(1)	(2)	(3)	(4)
<u>Variable</u>				
ln Income per capita	-0.361 (0.72)	1.158 (2.60) ^{***}	-0.235 (1.04)	0.284 (1.44)
ln Population	0.365 (1.54)	0.161 (0.77)	0.266 (2.42) ^{**}	0.273 (2.85) ^{***}
ln Gov. beds per capita	0.211 (2.12) ^{**}	-0.041 (0.47)	0.024 (2.66) ^{**}	-0.002 (0.16)
ln Cost dif (+)	0.066 (3.18) ^{***}	-0.047 (2.58) ^{***}	0.009 (2.33) ^{**}	-0.005 (1.28)
ln Cost dif (-)	-0.017 (0.89)	0.014 (0.78)	-0.011 (3.02) ^{***}	0.014 (4.39) ^{***}
Constant	-7.248 (1.27)	8.876 (1.76) [*]	-0.335 (0.12)	-7.512 (3.08) ^{***}
R²	0.675	0.899	0.815	0.841
Obs.	333	333	960	960

The parameter estimates for the state, MSA and time dummies are not reported. Absolute value of t -statistics in parentheses (* significant at 10%; ** significant at 5%; *** significant at 1%)

The model predicts that an increase in income per capita, crowding out of government hospitals and a decline in the cost advantage of nonprofit hospitals will all have a

negative effect on the size ratio and a positive effect on the for-profit share. These predictions are confirmed by all coefficients in table 3. Moreover, half of these coefficients are statistically significant. The regressor that yields contradictory coefficient estimates is population size, which is expected to have a negative effect on the size ratio.⁵⁴ Nevertheless, the model's prediction that population size will have a positive effect on the for-profit share is confirmed.

In the model, the share of for-profit hospitals and the size ratio are determined simultaneously. This simultaneity makes it difficult to isolate the causal effect of changes in ownership mix on the size ratio. To deal with this difficulty I rely on the concept that areas might differ in their favoritism towards either non-profit or for-profit healthcare providers. For example, the share of for-profit institutions in different parts of the US may be linked to area specific historical factors. Subsequently, the for-profit market share in other healthcare industries may serve as a plausible instrument for the market share of for-profit hospitals. (e.g. areas with a higher market share of for-profit hospitals are expected to also have a larger for-profit nursing home share). The share of for-profit nursing homes in a given area would be correlated with the share of for-profit hospitals in that area but presumably uncorrelated with other factors influencing the hospital size-ratio. If the share of for-profit nursing homes provides an exogenous source of variation in the share of for-profit hospitals, changes in the size-ratio of hospitals should not be driven by changes in the share of for-profit nursing homes.

Table 4 presents estimates of the size ratio using the same data sets and covariates used in Table 3. In columns (1) and (4), OLS coefficients, which do not control for the endogeneity of for-profit share, are presented. In the other columns the share of for-profit nursing homes is used as an instrument for the share of for-profit hospitals.⁵⁵ Columns (3) and (6) also include random effects.⁵⁶

⁵⁴ In the model, population growth leads to convergence only in markets where government providers are present. This prediction is confirmed in Appendix C.

⁵⁵ The share of for-profit nursing homes is computed using the 2002-03 Nursing Home Compare survey, which includes 16,385 nursing homes nationwide. The Center of Medicare & Medicaid Services (CMS) collects and publishes the data.

⁵⁶ Fixed effects cannot be obtained, as the share of for-profit nursing homes is measured at a point in time and therefore does not vary over time.

When the share of for-profit hospitals is treated as exogenous in columns (1) and (4), the estimated elasticity of the size ratio with respect to the for-profit share is -0.206 for the state-level analysis and -0.257 for the MSA-level analysis. In other words, if the share of for-profit hospitals in the MSA doubles, the size-ratio declines by 25.7%.

Instrumenting for the for-profit share has a pronounced effect on the estimated elasticity. At the MSA level, the estimated elasticity for size ratio is -0.521 , which is twice as big as the elasticity without instrumenting. At the state level, the estimated elasticity for size ratio is -0.254 , 23% bigger than the elasticity without instrumenting (-0.206).⁵⁷

TABLE 4
State and MSA Level Analysis –Structural-Form Convergence Regressions

Dependent Variable: ln Size-Ratio	State-Level Analysis			MSA-Level Analysis		
	OLS	IV	IV	OLS	IV	IV
	(1)	(2)	(3)	(4)	(5)	(6)
<u>Variable</u>						
ln For-Profit Share	-0.206 (6.67)***	-0.254 (4.03)***	-0.253 (2.99)**	-0.257 (5.10)***	-0.521 (4.29)***	-0.581 (2.08)**
ln Income per capita	-0.835 (3.98)***	-0.936 (3.90)***	-0.698 (2.27)**	-0.429 (1.56)	-0.155 (0.50)	-0.506 (1.21)
ln Population	0.141 (4.32)***	0.144 (4.37)***	0.135 (3.11)***	0.134 (2.75)***	0.045 (0.72)	0.006 (0.06)
ln Gov. beds per capita	0.059 (1.28)	0.083 (1.54)	0.113 (1.77)*	0.076 (4.62)***	0.071 (4.05)***	0.033 (1.40)
ln Cost dif (+)	0.092 (4.38)***	0.093 (4.39)***	0.074 (3.60)***	0.028 (4.03)***	0.031 (4.16)***	0.006 (0.81)
ln Cost dif (-)	-0.025 (1.24)	-0.026 (1.30)	-0.020 (0.99)	-0.011 (1.84)*	-0.016 (2.42)**	-0.025 (2.68)***
Constant	7.159 (3.52)***	7.982 (3.56)***	5.449 (1.88)*	3.202 (1.30)	1.307 (0.49)	5.281 (1.37)
Year controls	Yes	Yes	Yes	Yes	Yes	Yes
Random Effects	No	No	Yes	No	No	Yes
Instrument	No	Yes	Yes	No	Yes	Yes
R²	0.4010	0.3962	0.3906	0.3210	0.2626	0.1999

Absolute value of t-statistics in parentheses (* significant at 10%; ** significant at 5%; *** significant at 1%).

⁵⁷ When performing a Durbin-Wu-Hausman endogeneity test at the MSA level the critical value of chi-squared with 1 degree of freedom at the 5 percent level is 3.84. Hence, I reject the null hypothesis and conclude that OLS estimators are inconsistent. The reason for these inconsistent estimates is due to the endogeneity of the for-profit share. However, when the same test is performed at the state level I cannot reject the null hypothesis.

In the theory presented in the previous section I implicitly assume that private hospitals are more responsive than government hospitals to market changes and policy interventions.⁵⁸ More specifically, in markets where government hospitals are absent, changes in population proportionally affect the capacity choice of nonprofit and for-profit hospitals, such that the size-ratio is unaffected. On the other hand, in markets where government hospitals operate alongside for-profit and nonprofit hospitals, larger population is associated with smaller size-ratio. Fortunately, the MSA-level data allows for testing this feature; as it includes both MSA-year pairs that include hospitals of all three ownership-types and MSA-year pairs that include only for-profit and nonprofit hospitals.⁵⁹ To test this effect I add an interaction term between population size and government beds to the OLS and IV structural regressions for the MSA-level. The coefficient for the resulting interaction term is negative and significant whereas the coefficient for population losses its statistical significance.⁶⁰

All coefficient estimates in table 4 have the expected sign except for population size, which has a positive and sometime significant coefficient; however, that might result from omitting the interaction between population and the number of government beds. The share of for-profit hospitals and the measure of cost advantages for nonprofit hospitals are generally significant for both the state and the MSA-level regressions. Income per-capita is significant only at the state level, while government beds per-capita is significant only at the MSA-level. These results highlight the importance of industry wide effects in explaining the convergence trend.

5. Discussion

While private hospitals in the US can organize as either nonprofit or for-profit institutions, nonprofit hospitals dominate the hospital industry with a persistently large share of beds (about 70%) over the period from 1960 to 2000. Moreover, nonprofit and for-profit hospitals are subject to different regulatory rules, in particular the tax code. More specifically, nonprofit hospitals are eligible for exemptions from property, sales,

⁵⁸ Duggan (2000) finds evidence for low responsiveness of government hospitals relative to private ones.

⁵⁹ Out of the 960 MSA-year pairs that include both for-profit and nonprofit hospitals, 816 (85%) also include government providers, whereas 144 (15%) include only for-profit and nonprofit hospitals.

⁶⁰ See Appendix C for the explicit test and results.

and income taxes, while for-profit hospitals are required to pay these taxes. Despite these legal and regulatory distinctions, there has been growing similarity in capacity between nonprofit and for-profit hospitals during these four decades. One of the driving forces behind this growing similarity (i.e. convergence) is the number of ownership switches from nonprofit to for-profit status and vice-versa.

Failing to appreciate the dynamics of this convergence contributes to the perception that the hospital industry is somewhat stagnant with respect to ownership composition. Due to this perception, scholars often fuse hospitals' ownership status and hospitals' objectives. Therefore, it is not surprising that for some observers, for-profit hospitals symbolize profit-seeking, compassionless, and opportunistic motives, whereas nonprofit hospitals are often viewed as community-oriented, charitable institutions. Moreover, this belief is often used to justify preferential treatment for nonprofit hospitals. However, such belief fails to account for the convergence in capacity. More specifically, when firms essentially choose between two distinct regulatory systems, an observed discrepancy in behavior does not necessarily arise from variation in objectives. In that sense, a simple revealed-preferences argument need not work in the case of nonprofit organizations. Clearly, the quest for identifying the objectives of nonprofit hospitals is important for shaping courts' decisions, government policies, and antitrust interventions. Yet, if policymakers and legislators rely on nonfactual arguments, they might promote inefficient policy interventions. The analysis presented in this paper raises the possibility that systematic differences in behavior between for-profit and nonprofit hospitals might be a consequence of the hospitals' regulatory environment and not the result of unusual objectives.⁶¹

There is evidence to support the notion that the regulatory environment enables and induces community-oriented behavior on the part of nonprofit hospitals. For-example, Wu (1992) points out that nonprofit hospitals that received Hill-Burton funding were required to provide community services and uncompensated or charity care annually for

⁶¹ Note that it is not evident that there are systematic differences between nonprofit and for-profit hospitals. For example, Sloan and Vraciu (1983) found that for-profit and nonprofit hospitals in Florida were virtually identical in terms of profit margins, dollar value of charity care, percentage of Medicare and Medicaid patient days, and net operating funds per admission and patient days.

twenty years after the date of the hospital's expansion. Likewise, in several legal cases, courts required nonprofit hospitals to provide uncompensated care and threatened to revoke their tax-exempt status if they failed to do so. Finally, Fournier and Campbell (1997) find that nonprofit hospitals are indirectly compensated for the provision of indigent care with legal protections against competition under certificate-of-need regulation. What is clear from these examples is that nonprofits' community-oriented behavior need not be altruistic or unselfish. The regulatory environment provides enough sticks and carrots to produce variation in behavior between for-profit and nonprofit hospitals.

Moreover, if nonprofit hospitals indeed shared strong intrinsic attributes, which separate them from for-profit hospitals, then evidence for that would more likely originate at the organization level rather than at the industry level. For example, if nonprofit hospitals selflessly sought to provide benefits to the communities in which they operate one would find evidence for hospital-level mechanisms that encourage and enforce such altruistic behavior. Still, Milstead (1999) finds that despite the growing focus on community benefits, most compensation plans for executives of nonprofit health care organizations do not include goals or provisions for providing such benefits. Likewise, Brickley and Van Horn (2003) find no evidence that nonprofit hospitals provide explicit incentives for their CEOs to focus on altruistic activities. Both articles essentially claim that the behavior of nonprofit hospitals does not seem to be induced by hospital-level built-in incentive mechanisms.

The same can be said of for-profit hospitals. They do not have organizationally defined incentives to avoid providing benefits to the community, and yet, they pick a regulatory environment that compels them to provide a community benefit by paying taxes. Thus, both types of hospitals are forced to pay a tax of some sort for the benefit of the community. Put differently, hospitals that choose the for-profit form do so *despite* the fact that they will have to pay taxes. It seems doubtful that such behavior can be traced back to their objectives in the sense that these hospitals take pleasure in paying out taxes. Tax liability is a feature of the for-profit hospitals' regulatory environment. Applying this logic to the nonprofit sector, I argue that those hospitals that organize as nonprofit

entities might do so *despite* the fact that they will be more likely to face outside pressure to provide free or unprofitable services. The cost of free care is a “tax” paid by nonprofit hospitals to the communities in which they operate. CEOs of nonprofit hospitals are not induced to focus on altruistic activities in the same way that CEOs of for-profit hospitals do not receive a bonus for paying out corporate taxes.

Hospitals’ behavior not only reflects their objectives but also corresponds to their economic, legal and political environment. The growing similarity in capacity between nonprofit and for-profit hospitals raises a conceptual obstacle for the assertion that nonprofit and for-profit hospitals have intrinsically different objectives. This is especially true when, currently, for-profit and nonprofit hospitals treat a rather similar mix of patients in addition to offering and delivering comparable services. I claim that the growing similarity between for-profits and nonprofit hospitals is the result of changing market conditions, such as crowding-out of government owned hospitals, growing population size, and changes in policy dynamics (e.g. tax code, antitrust involvement, federal and state programs). If different behavior is the result of different objectives, then growing similarity in behavior must correspond to growing similarity in objectives. Some scholars subscribe to such a statement and claim that nonprofit hospitals “lost their way”.⁶² Yet, according to Stigler and Becker (1977) the treatment of individual preferences as constant is more valuable and credible for finding an economic reason for observed market changes.⁶³

In this growing similarity between nonprofit and for-profit hospitals, a significant role is attributed to ownership-type switches. This is especially true for the period after the introduction of the prospective payment system, when relatively large nonprofit hospitals converted to for-profit status and hence made the typical for-profit and nonprofit hospital

⁶² “If voluntary [nonprofit] hospital trustees and managers are indeed at risk of losing sight of the historical mission and social *raison d’être* of their institutions, it is incumbent upon them to stop and take stock of what it means to be a voluntary institution,....” (Seay and Vladeck, 1988) or “...in pursuing the business mission, they [nonprofit hospitals] will lose their identity, their soul, and perhaps their tax-exempt status.” (Jones and Du Val, 1988)

⁶³ “...we are proposing the hypothesis that widespread and/or persistent human behavior can be explained by a generalized calculus of utility-maximizing behavior, without introducing the qualification “tastes remaining the same.” It is a thesis that does not permit of direct proof because it is an assertion about the world, not a proposition in logic.” (Stigler and Becker, 1977)

more comparable. But why switch? Did the entrepreneur become benevolent or did the altruist become self-centered? Or were those that switched to nonprofit “for-profits in disguise”? It is hard to explain switching behavior when relying on the assertion that nonprofit and for-profit hospitals exhibit strong systematic differences in objectives. I claim that a set of initial market conditions dictates the initial mix of for-profit and nonprofit hospitals. A change in those conditions can subsequently alter the initial mix through switching.

When one syntactically splits the objectives of nonprofit and for-profit hospitals into altruistic and opportunistic ones respectively, the notion of mixed-ownership equilibrium becomes rather trivial. In this view, the demand for nonprofit hospitals’ services would be fairly detached from the demand for for-profit hospitals’ services, as these services are differentiated. This notion of mixed-ownership equilibrium is straightforward in a static perspective; the dynamics of convergence and conversions, however, raise doubts regarding the validity such arguments. To avoid such a limitation, the model presented in this paper considers the uniform goal of surplus maximization for both for-profit and nonprofit hospitals. The healthcare industry is viewed as offering private firms a choice between two alternative ownership statuses; a firm’s selection of ownership type is viewed as a vehicle to reach its objectives rather than a reflection of those objectives.

If switching from nonprofit to for-profit status makes the nonprofit status less attractive, a stable-equilibrium notion must hinge on the assumption of heterogeneity among hospitals or among consumers. In my formulation, this heterogeneity is represented by variation in the ability to benefit from a given ownership type rather than a variation in the propensity to trade off hospital-level profits for the promotion of community interests.

Guarding such community interests, policymakers and legislators need a clear view of what for-profit and nonprofit hospitals represent in order to effectively promote goals such as access to care, quality of services and fair competition (David and Helmchen, 2004). In my view, relying on the idea that nonprofit and for-profit hospitals differ in their objectives, produces a rather weak justification for favoring nonprofit providers, by granting them special tax treatment. In fact, preferential treatment for nonprofit hospitals would be more valuable for society if nonprofit hospitals’ community-oriented behavior

was induced by their unique regulatory status rather than by their unique objectives. For example, if different tax treatment induced different behavior and such taxation dissimilarities were eliminated, one would expect to see a dramatic change in the behavior of nonprofit hospitals. On the other hand, one would expect a much smaller change in behavior if originally this behavior reflected nonprofit hospitals' mission to benefit society.

In conclusion, the regulatory environment appears to play a key role in explaining differences in behavior between for-profit and nonprofit hospitals. The fact that nonprofit and for-profit providers compete in the same markets, yet are subject to different regulatory rules, casts doubt on the idea that observed differences in behavior between the two types of hospitals could be used to reveal their objectives.⁶⁴

There is little doubt that hospitals, whether for-profit or nonprofit, possess unique features that require them to balance economic, ethical, professional and social considerations. Yet, whether or not nonprofit and for-profit hospitals have intrinsically different objectives is not merely a matter of competing viewpoints. Uniformity in objectives across ownership type is not a belief but rather a working assumption. This assumption encourages one to seek explanations for phenomena such as the growing similarity in capacity, mixed ownership equilibrium or switching of ownership form by applying standard economic logic.

6. Conclusion

In this paper, I provide evidence of the growing similarity in capacity between for-profit and nonprofit hospitals. Convergence in both the average size and the size distribution persists over time and was driven by both convergence in the number of patients treated and convergence in length of stay. Moreover, the convergence in capacity was driven primarily by industry-wide effects such as entry, exit and ownership switches, rather than

⁶⁴ For example, Jones and Du Val (1988) pose the question "What would be lost to our society if voluntary [nonprofit] hospitals were to de-emphasize or abandon their community services missions and pursue primarily or solely their business mission?" this faulty assertion views the organization's ownership status and objectives as one. Another example is found in Schramm (1988) who poses the following questions with respect to nonprofit and for-profit hospitals "Are we dominated by the profit motive? Is there no place in our society for pure altruism? Will economics prevail over compassion? Is nothing sacred?"

expansions or downsizing of existing hospitals. The convergence trend persisted over the period of 1960 to 2000 and survived certificate-of-need regulation, the prospective payment reimbursement system and the expansion of managed care. I highlight a novel conceptualization, in which firms have identical objectives yet differ in their ability to benefit from a given ownership status. In this model the role of localized competition, demographic changes, crowding out of government hospitals, the cost advantage of nonprofit hospitals and the share of for-profit hospitals in explaining the growing similarity among private hospitals. The empirical analysis in section 4 examines the growing similarity in size over the 1970 – 1998 period. Tables 3 and 4 report results from estimating the theoretical model at the state and metropolitan statistical area levels. Results in this section indicate that variations in demand, government provision of hospital services, share of for-profit hospitals and cost advantages for nonprofit hospitals explain much of the convergence in size between for-profit and nonprofit hospitals. For the most part, the directions of these effects are consistent with the theory I lay out in section 3. Overall, the evidence presented this part is more suggestive than definitive. More specifically, the empirical analysis does not refute alternative conceptualizations, such as the altruism model. Nevertheless, it generally does supports the implications of the model. There is little doubt that hospitals, whether for-profit or nonprofit, possess unique features that require them to balance economic, ethical, professional and public considerations. Yet, whether or not nonprofit and for-profit hospitals have intrinsically different objectives remains an open question. In fact, there is no conceptual need to rely on differences in objectives in order to explain the growing similarity in capacity, which I have documented in this paper, or the coexistence of for-profit and nonprofit hospitals. In particular, this paper produces similar predictions using standard economic logic by relying on uniformity in objectives across ownership type.

Appendix A

Derivation of the Decomposition Equation

The change in the nonprofit to for-profit size ratio moving from year i to year j is given by:

$$\Delta_{ij} = \frac{R_j - R_i}{R_i} = \frac{G_{ij}^{NFP} \sum_k S_{ik}^{FP} x_{ik}^{FP} - \sum_k S_{jk}^{FP} x_{jk}^{FP}}{\sum_k S_{jk}^{FP} x_{jk}^{FP}}$$

$$\Delta_{ij} = \frac{\frac{\sum_k S_{jk}^{NFP} x_{jk}^{NFP}}{\sum_k S_{jk}^{FP} x_{jk}^{FP}} \cdot \frac{\sum_k S_{ik}^{NFP} x_{ik}^{NFP}}{\sum_k S_{ik}^{FP} x_{ik}^{FP}}}{\frac{\sum_k S_{ik}^{NFP} x_{ik}^{NFP}}{\sum_k S_{ik}^{FP} x_{ik}^{FP}}} = \frac{\sum_k S_{jk}^{NFP} x_{jk}^{NFP}}{\sum_k S_{ik}^{NFP} x_{ik}^{NFP}} \cdot \frac{\sum_k S_{ik}^{FP} x_{ik}^{FP}}{\sum_k S_{jk}^{FP} x_{jk}^{FP}} \cdot \frac{\sum_k S_{jk}^{FP} x_{jk}^{FP}}{\sum_k S_{jk}^{FP} x_{jk}^{FP}} = \frac{G_{ij}^{NFP} \sum_k S_{ik}^{FP} x_{ik}^{FP} - \sum_k S_{jk}^{FP} x_{jk}^{FP}}{\sum_k S_{jk}^{FP} x_{jk}^{FP}}$$

By adding and subtracting common term we get:

$$\Delta_{ij} = \frac{G_{ij}^{NFP} \sum_k S_{ik}^{FP} x_{ik}^{FP} - \sum_k S_{jk}^{FP} x_{jk}^{FP} + G_{ij}^{NFP} (\sum_k S_{ik}^{FP} x_{i1}^{FP} - \sum_k S_{ik}^{FP} x_{i1}^{FP}) - (\sum_k S_{jk}^{FP} x_{j1}^{FP} - \sum_k S_{jk}^{FP} x_{j1}^{FP})}{\sum_k S_{jk}^{FP} x_{jk}^{FP}}$$

By rearranging the expression above we get:

$$\Delta_{ij} = \frac{G_{ij}^{NFP} x_{i1}^{FP} - x_{j1}^{FP}}{\sum_k S_{jk}^{FP} x_{jk}^{FP}} + \left[\frac{G_{ij}^{NFP} \sum_k S_{ik}^{FP} (x_{ik}^{FP} - x_{i1}^{FP}) - \sum_k S_{jk}^{FP} (x_{jk}^{FP} - x_{j1}^{FP})}{\sum_k S_{jk}^{FP} x_{jk}^{FP}} \right]$$

Appendix B

Model's Predictions under Increasing Marginal Costs

When we don't have constant marginal costs, output will appear on both sides of equations (3) and (4). The first order conditions for nonprofit and for-profit firms can be represented by the following two implicit functions:

$$\psi_{FP} = \alpha - \beta Y - \beta y_{FP} - C'_{FP} \quad \text{and} \quad \psi_{NFP} = \alpha - \beta Y - \beta y_{NFP} - C'_{NFP}.$$

For a given parameter or variable s , we can use the implicit function theorem to sign both

$$\frac{dy_{FP}}{ds} = - \frac{\partial \psi_{FP} / \partial s}{\partial \psi_{FP} / \partial y_{FP}} \quad \text{and} \quad \frac{dy_{NFP}}{ds} = - \frac{\partial \psi_{NFP} / \partial s}{\partial \psi_{NFP} / \partial y_{NFP}}$$

The effect of a change in s on the size ratio is given by:

$$\frac{d \left[\frac{y_{NFP}}{y_{FP}} \right]}{ds} = \frac{1}{y_{FP}} \left[\frac{dy_{NFP}}{ds} - \frac{y_{NFP}}{y_{FP}} \frac{dy_{FP}}{ds} \right]. \quad \text{Define } \varepsilon_k \equiv \frac{\partial^2 c}{\partial y_k^2} \frac{y_k}{C'_k} \text{ as the elasticity of supply for}$$

firm with ownership type k . The sign of this derivative depends on the sign of the expression in the square brackets.

$$\frac{d\left[\frac{y_{NFP}}{y_{FP}}\right]}{ds} < 0 \text{ iff } (N+1)(C'_{FP} - C'_{NFP}) + C'_{NFP}(n+1)\varepsilon_{NFP} > C'_{FP}(N-n+1)\varepsilon_{FP}$$

For a sufficiently high share of for-profit firms, a sufficient condition for the model's predictions to hold when firms have increasing marginal costs is an equally or more elastic supply function for nonprofit firms. Nevertheless, the model's prediction could be preserved even if supply is more elastic for the for-profit firm, as long as, it is sufficiently close to the nonprofit firm's supply elasticity.

Proof of Lemma 1

Assuming nonprofits have cost advantage over for-profit firms,

$$C'_{FP} - C'_{NFP} > 0$$

$$(N+1)(C'_{FP} - C'_{NFP}) > 0$$

$$-C'_{NFP} > -C'_{FP} - N(C'_{FP} - C'_{NFP})$$

Add $\alpha + n(C'_{FP} - C'_{NFP}) - \beta G y_G$ to both sides

$$(\alpha - C'_{NFP}) + n(C'_{FP} - C'_{NFP}) - \beta G y_G > (\alpha - C'_{FP}) - (N-n)(C'_{FP} - C'_{NFP}) - \beta G y_G$$

Divide both sides by $\beta(N+1)$

$$\frac{(\alpha - C'_{NFP}) + n(C'_{FP} - C'_{NFP}) - \beta G y_G}{\beta(N+1)} > \frac{(\alpha - C'_{FP}) - (N-n)(C'_{FP} - C'_{NFP}) - \beta G y_G}{\beta(N+1)}$$

Using (4.3) and (4.4) we get,

$$y_{NFP} > y_{FP}$$

Proof of Lemma 2

Here we are interested in the partial derivative of the nonprofit-to-for-profit size ratio with respect to the number of for-profit firms in the industry.

$$\frac{\partial\left(\frac{y_{NFP}}{y_{FP}}\right)}{\partial n} = -\frac{(y_{NFP} - y_{FP})(C'_{FP} - C'_{NFP})}{\beta(N+1)y_{FP}^2} < 0.$$

It is fairly easy to show that the second derivative is positive; hence the convergence process has a concave shape, which corresponds to the observed trends, Figure 1 and Figure 2.

Appendix C

List of Model Variables, Means, Standard Deviations and Sources

Variable	State		MSA		Description of Variable and Source
	Mean	S.D	Mean	S.D	
Ratio	2.14	1.62	2.63	2.23	The state-level ratio of the average number of beds in nonprofit hospitals divided by the average number of beds in for-profit hospitals. ^a
Income per capita	13,965	7,721	14,317	7,740	State/MSA personal income per capita divided by CPI. ^{b,c}
Population	5,304	5,289	941	1,381	Total population (in thousands). ^b
Cost differences	121.8	235	90.4	144	The difference in hospital costs per adjusted patient day in for-profit and nonprofit hospitals. ^{a,b}
Cost per day	649	564	612	483	Hospital costs per adjusted patient day, for all hospitals, divided by CPI (1982=100.) ^{a,b}
Government beds	6,344	5,877	1,008	1,552	The total number of public owned hospital beds in the state or MSA. ^a
For-profit hospitals share	0.156	0.176	0.348	0.188	The share of for-profit hospitals out of all private hospitals (for-profit and nonprofit) in a state/MSA. ^a
For-profit nursing homes share	0.672	0.161	0.605	0.163	The share of for-profit nursing homes out of all private nursing homes (for-profit and nonprofit) in a state/MSA. ^d

^a American Hospital Association, *Hospital Statistics*, Various issues.

^b *U.S Statistical Abstract*, Various Issues.

^c Bureau of Economic Analysis, U.S. Department of Commerce (at www.bea.gov)

^d Nursing Home Compare, Center for Medicare and Medicaid Services (CMS) (at www.medicare.gov/NHCompare/home.asp)

Testing the Effect of Government Hospitals on the Convergence in Size

Consider the following variant of the specification in equation (7):

$$\ln\left(\frac{y_{NFP}}{y_{FP}}\right)_{it} = \ln R_{y,it} = \mu + \beta_1 \ln Pop_{it} + \beta_2 \ln Gov_{it} \cdot \ln Pop_{it} + \gamma \ln S_{it} + \delta X_t + \varepsilon_{it}$$

I took the log population in the MSA, $\ln Pop_{it}$ out of the vector $\ln S_{it}$ and added the interaction term ($\ln Gov_{it} \times \ln Pop_{it}$) between the log number of public owned beds in the MSA and the log population in the MSA. $\ln S_{it}$, X_t and ε_{it} are defined in equation (7). Columns (1) and (2) treat the share of for-profit hospitals as exogenous, whereas, column (3) treats it as endogenous.

In markets where government hospitals are absent, changes in population affect nonprofit and for-profit hospitals proportionately, whereas, in market where government hospitals operate along side nonprofit and for-profit hospitals, larger population is associated with smaller size ratio.

$$\frac{\partial \ln R_y}{\partial \ln Pop}(Gov = 0) = \beta_1 = 0 \quad \text{and,} \quad \frac{\partial \ln R_y}{\partial \ln Pop}(Gov > 0) = \beta_1 + \beta_2 \ln Gov \leq 0$$

The null hypothesis is therefore⁶⁵:

$H_0: \beta_1=0$ and $\beta_2<0$

H_1 : other

TABLE 5

Dependent variable:	OLS	OLS	IV
<i>ln</i> Size-Ratio	(1)	(2)	(3)
<u>Coefficient</u>			
<i>ln</i> Population (β_1)	0.065 (1.51)	0.198 (0.94)	0.112 (1.55)
<i>ln</i> Government beds x <i>ln</i> Population (β_2)	-0.561 (4.86)***	-0.691 (3.40)***	-0.498 (2.58)**
Year controls	Yes	Yes	Yes
MSA controls	No	Yes	No
Instrument	No	No	Yes
R ²	0.2874	0.8268	0.3541

All regressions include the same data and covariates as in Table 4

The results from this test highlight the effect that government hospitals' presence has on the way in which demand shocks affect the convergence trend. The test provides additional evidence for the lower responsiveness of public hospitals relative to private ones. Nevertheless, note that this is a test of the model's assumptions rather than the model's predictions.

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⁶⁵ Note that the null and alternative hypotheses are not nested. I could not reject the null hypothesis that $\beta_1=0$; I can reject both the null hypothesis that $\beta_2=0$ and the joint null hypothesis that $\beta_1+\beta_2=0$. In addition, note that the sign of β_2 is negative as expected.

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