A Note on the Efficiency of "Switching" Hospitals*

Charles A. Register
University of Baltimore

Donald R. Williams
Kent State University

Edward R. Bruning
Kent State University

Abstract

Previous empirical evidence fails to support the property rights prediction of superior for-profit hospital performance. It has been suggested that one reason for this outcome is that at any point in time, a large proportion of existing for-profit hospitals only recently have switched to for-profit status and that such switches are most likely to involve relatively inefficient nonprofits. To test this proposition, a cross section of 674 nonprofit hospitals from the 1985 annual survey of the American Hospital Association was analyzed. Of these nonprofits, 13 switched to corporate for-profit status between 1985 and 1986. Using a deterministic frontier procedure, this research assesses the relative efficiency of each of the hospitals and then employs a probit regression to determine whether an inefficiency/switch relationship exists. The results indicate that the nonprofits that switched were no less efficient than those that did not, thus casting doubt on the proposition that existing hospital performance studies are biased due to overlooking nonprofit to for-profit switches.

Introduction

Based on the estimation of cost and revenue functions for a nationwide sample of 2,231 hospitals in 1979, Becker and Sloan (1985) conclude that the for-profit hospitals of the sample were no more efficient than their nonprofit counterparts.[1] Although the empirical analysis appears robust and is consistent with much previous research, Becker and Sloan question the outcome because it

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[1]Other studies reporting similar results include Register, Sharp, and Bivin (1985), Fruend, Shachton, Ruffin, and Quade (1985), Register and Bruning (1987), and Register, Sharp, and Stevans (1988).

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runs counter to the theory of property rights.[2] Property rights theory predicts that for-profit firms, or at least firms that operate under profit incentives, should be expected to produce more efficiently than nonprofit firms—in nonprofit firms, no individual can augment his or her income significantly by enforcing efficient behavior. Lacking a profit incentive, the nonprofit firm is expected to diverge from strict cost-minimizing behavior. In contrast, owners of the for-profit firm hold an exclusive residual claim to the firm's net revenues.

Why have empirical studies of hospitals failed to support consistently the property rights prediction of superior for-profit performance? Becker and Sloan suggest that a large number of the existing for-profit hospitals only recently have switched from nonprofit status. In addition, they argue that nonprofit-to-for-profit switches may involve relatively weak, inefficient nonprofit hospitals. Thus, the property rights prediction of superior for-profit performance may prove valid, but only after the managements of the new for-profits have had time to improve the performance of these switching hospitals. To the extent that Becker and Sloan are correct, existing for-profit/nonprofit hospital studies are biased against the for-profits because these studies typically fail to distinguish between the older, more mature for-profits and those for-profits that only recently have switched from nonprofit status.[3]

This paper analyzes whether hospitals switching from nonprofit to corporate for-profit status are relatively inefficient. If switching hospitals are inefficient, care should be taken before concluding that the property rights paradigm does not fit the hospital sector. To make this determination, data on a cross-section of 674 hospitals in 1984 are analyzed. It is reported that the hospitals that switched from nonprofit to corporate for-profit status between 1985 and 1986 were no less efficient than the nonprofits that did not switch. The evidence reported here supports those who question the applicability of the property rights theory in the hospital industry.

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[2]On the theory of property rights, consider DeAllessi (1980). For a discussion of property rights as applied to hospitals, see Clarkson (1972).

[3]Becker and Sloan (1985) offer indirect evidence of the inefficiency/switch hypothesis by noting that the length of time that a hospital has been affiliated with a multihospital system is associated negatively with the average cost of providing hospital care. No direct test of their hypothesis is offered.

Efficiency and Hospital Switching: Methodology

Hospital Switching as Rent-Seeking Behavior

The process of hospital switching may be analyzed within the context of rent-seeking behavior. According to Tollison (1982), rents are contrived artificially by firms through actions that limit the supply of a good or service in a market.[4] The ability to enter the hospital market is limited by Certificate of Need (CON) controls. In essence, an actual need must be established by the entering party and a CON acquired prior to entry. The market protection provided to the established hospitals through CON regulation thus creates a significant barrier to entry and a strong potential for excess rents to be transferred to the favored hospitals. With entry limited, hospital corporations may seek inefficient hospitals as takeover targets in order to obtain rents. The expenditures necessary to achieve such takeovers (such as legal fees, paperwork, and financing expenses) are costs expended to appropriate the artificially contrived rents. Thus, the switching behavior may be considered broadly as a rent-seeking behavior.

Measurement of Efficiency

Given the foregoing discussion, two questions are analyzed. Do switching hospitals systematically operate at lower levels of technical efficiency than nonswitching hospitals? Does technical efficiency affect the likelihood of a switch from nonprofit status?

Technical efficiency relates to maximizing output(s) for a given set of factor inputs. Firms are said to be technically efficient if the inputs they employ produce maximum potential output.[5] Register and Bruning (1987) present a data envelopment technique based on linear programing for calculating indexes of

[4]Unlike traditional profit-seeking, rent-seeking behavior is wasteful, because expenditures are incurred as firms compete for artificially contrived profits.

[5]Although technical efficiency is the focus of this paper, it is important to recognize other concepts. Allocative efficiency occurs when factor inputs are employed in the correct proportions with respect to input prices. Scale efficiency occurs when production takes place in plants of optimal size and, thus, connotes a long-run notion of efficiency. Economic efficiency exists whenever technical, allocative, and scale efficiencies prevail, and the firm produces the output that maximizes consumer satisfaction. This paper focuses on the narrower notion of technical efficiency because explicit price information is lacking on several of the factor inputs required for analysis of allocative, scale, and economic efficiency. Given the general lack of price information, limiting the analysis to technical efficiency is common in the literature, e.g., see Grosskopf and Valdmanis (1987).

technical efficiency that permits relative performance comparisons. The first step in the process is to identify all hospitals that produce a given quantity of output. The hospital or hospitals that produce this quantity of output with the fewest inputs form the reference set or *best practice hospitals*. The degree of technical efficiency for the remaining hospitals then is calculated as the ratio of inputs used by the best practice hospital(s) to the inputs used by the hospital in question. Thus, each technically efficient hospital will have an efficiency score, known as the *index of technical efficiency* (ITE) of unity, while those that are inefficient will have scores below unity. Further, the degree by which the inefficient hospitals diverge from unity gives a direct indication of the extent of the technical inefficiency. For example, a score of 0.75 would indicate that if the resources used by this hospital were conceptually reallocated to best practice hospitals, output would be increased 25 percent.[6]

Efficiency and Switching: Specification

Two methods are used to determine whether hospitals switching from nonprofit to for-profit status are less efficient that those that do not switch.[7] The first method is a simple comparison of the mean ITE values for the two groups. The second method is to estimate the parameters of a probability-of-switching function, wherein the ITE is an explanatory variable. The second approach is especially useful because it controls for other factors that may influence switching behavior. No attempt is made to develop a model of switching behavior; the purpose of the empirical modeling is simply to determine whether inefficiency is related to switching while controlling for other factors. Let Pr(Switch) denote the probability of switching from nonprofit to corporate for-profit status during the 1985-1986 time period. Letting X represent a vector of independent explanatory variables affecting Pr(Switch), an equation for Pr(Switch) can be represented by:

(1) $Pr(Switch) = F(a + bX)$.

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[6]For a more thorough discussion of the procedures involved in the eficiency estimation process, see Register and Bruning (1987) or Bruning and Register (1989). The procedures discussed in these sources initially were proposed by Farrell (1957) and expressed mathematically by Boles (1967). Further, the procedures have been used extensively in other areas. For an example of a recent application of the procedures outside the hospital sector, consider Byrnes, Grosskopy, and Hayes (1986).

[7]The issue of efficiency and switching also could be addressed by examining switches from for-profit to nonprofit status. Unfortunately, complete data existed only for one such switch in the current data set.

Among the explanatory variables affecting Pr(Switch) are:

ITE	= the level of efficiency of the hospital in 1984;
FSI	= the level of sophistication of the hospital as measured by a facilities and services index;
MSHARE	= the degree of local market competition facing the hospital as measured by the hospital's market share;
DENSE	= the local market population density;
GROW	= the population growth rate in the county of domicile;
DEATH	= the population death rate in the county of domicile;
INC	= the median household income in the county of domicile; and,
NURSEPOP	= the local availability of trained nurses.

It is assumed that the function F is the normal CDF; thus, the parameters of the function are estimated utilizing the probit procedure.[8]

The explanatory variables employed are drawn primarily from the literature relating to the differences between for-profit and nonprofit hospitals. For-profit hospitals typically have offered fewer facilities and services and used existing facilities and services less intensively than nonprofits (Bayes, 1977; Lee, 1971; and Rafferty and Schweitzer, 1974). It would be expected, therefore, that hospitals will be more likely to switch from nonprofit to for-profit status the lower is their facilities and service index (FSI). The market share variable (MSHARE) is expected to be related directly to switching behavior. As discussed by Bayes (1983), for-profits should be more likely to take over a hospital that operates in a highly concentrated market than one that operates in a less concentrated (more competitive) market. This relationship is discussed in Bayes (1983). The local market demographic variables (DENSE, GROW, DEATH, and INC) each have been used in previous work (Becker and Sloan, 1985; Wilson and Jadlow, 1982; and Bayes, 1983) and are used here to proxy for factors that affect the potential demand for hospital services. Each is expected to be related positively to switching behavior. The last variable used, NURSEPOP, is a measure of the availability of trained medical personnel. It is expected that NURSEPOP should be positively related to the probability of switching because profit-maximizing firms should prefer to locate where there is a relative abundance of necessary labor inputs.[9]

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[8]For a discussion of this procedure, see Judge *et al.* (1980, p. 591).

[9]Given that the variable NURSEPOP is not drawn from the literature on differences between for-profit and nonprofit hospitals, the empirical analysis was conducted with and without this variable. The qualitative results were unchanged when NURSEPOP was omitted.

The Data

The empirical analysis begins by incorporating both hospital level and local market data to determine the indexes of technical efficiency. Then the efficiency indexes are used to estimate the parameters of equation (1). Variable definitions and data sources are summarized in Table 1. The hospital level data are taken from the *American Hospital Association's Annual Survey of Hospitals for 1985* (AHA, 1985). This survey profiles approximately 7,000 hospitals in the U.S. and includes information on the hospital's inputs, outputs, facilities and services, and ownership. Because the efficiency index is based on the interaction of inputs and outputs, care is taken in specifying these variables. Following previous studies, the number of staffed beds is used as a proxy for the individual hospital's capital stock (Hellinger, 1975; van Montfort, 1981; and Register, Sharp, and Bivin, 1985). The labor input for the study is a vector composed of the full-time equivalent personnel in each of four skill-related categories: physicians; registered nurses; licensed practical nurses; and other personnel.

The health economics literature is replete with observations on the difficulty in defining a comprehensive measure or set of measures of hospital output. The numbers of admissions, discharges, and inpatient days, to name several of the more prominent measures, all have significant flaws.[10] Nonetheless, each measure indicates one or more dimensions of hospital performance and often is used as a proxy for output. A multiple output methodology is used in this study in order to minimize the measurement problem associated with heterogeneous output. The output measure is a vector composed of the number of outpatient visits and the number of inpatient days in each of three service categories: general medical and surgical; intensive care; and sub-acute care. To increase the likelihood of comparing similar hospitals in similar operating environments, the sample is restricted to short-term, general medical and surgical, and nonteaching hospitals. Case mix differences are minimized further by requiring all hospitals to be comprehensive, i.e., to produce output in each of the four output categories listed above. These constraints reduce the sample to 674 nonprofit hospitals, with 13 switching from nonprofit to corporate for-profit status between 1985 and 1986.

[10]For example, the number of admissions fails to take into account the length of stay of the typical patient, the severity of the individual cases, and the hotel services (housekeeping...) provided by the hospital. From the opposite perspective, the number of inpatient days does not distinguish between types of inpatient days, the severity of the cases and completely overlooks outpatient care. For a thorough discussion of the output classification problem, see Klastorin and Watts (1980).

The facilities and services index (FSI) also is constructed from the hospital level data. It is defined as the proportion of 38 potential facilities and services the individual hospital offers.[11]

The local market data are taken from published Bureau of the Census sources (U.S. Department of Commerce, 1983). The first variable (MSHARE) is defined as the ratio of the number of staffed beds within the hospital to the number of staffed beds in the county of domicile. DENSE is the county population density; GROW is the percentage change in the population of the county between 1970 and 1980; DEATH is the 1980 death rate; INC is the median household income in the county; and NURSEPOP is the ratio of trained nurses to the population within the county.

Empirical Results

The first empirical result indicates that the average switching hospital was 76.7 percent as efficient as the best practice hospitals, while the average nonswitching hospital was only 75.3 percent as efficient as the same frontier group. Although the switching hospitals were slightly more efficient than the nonswitching hospitals, the difference is not statistically significant (t = 0.22). This outcome seems to suggest that previous profit/nonprofit studies are not biased due to failure to consider the age of the for-profits. Before drawing such a conclusion, however, it is necessary to consider the influence of inefficiency within the framework of the probability of switching.

The results of the estimated probability of switching equation are reported in Table 1. Two results are noteworthy. First, technical efficiency is not significantly related to the probability of switching.[12] Second, the only included factor that seems to exhibit a strong effect on switching is the degree of sophistication of the nonprofit hospitals' facilities and services (FSI). With a highly significant negative coefficient, nonprofit to for-profit switches are most

[11]Using an index of facilities and services instead of a vector of individual offerings is common in the hospital research literature. e.g., see Becker and Sloan (1985), Ruchlin, Pointer, and Cannedy (1973), and Rafferty and Schweitzer (1974).

[12]Two points should be made with reference to the estimation results. First, the ITE index is calculated from a linear programming algorithm and is a nonstochastic variable in this work. Second, one might be concerned that the results are driven by collinearity problems between, for example, ITE and FSI. Pearson's correlation coefficient for ITE and FSI is only 0.0814 in this sample, however, suggesting that this is not a problem. The correlation coefficient between ITE and any other variable is never above 0.10.

likely to involve those nonprofits offering a less complete set of facilities and services. The variables in the model are not jointly significant (at the 0.05 level), suggesting that the ad hoc specification of the probability of switching sheds little additional light on the determinants of such switches.[13]

Conclusions and Implications

Numerous researchers have suggested that the property rights paradigm does not fit the hospital sector. It has been argued by Becker and Sloan (1985) that studies typically have failed to distinguish between mature for-profit hospitals and those that only recently have switched to for-profit status. If relatively inefficient nonprofits are the most likely candidates for switches, prior profit/nonprofit comparative studies incorporate a bias against the for-profits. The existence of such a bias would vindicate, somewhat, the applicability of the property rights paradigm.

This paper used data on 674 hospitals in 1984 to analyze whether a significant inefficiency/switch relationship existed. Utilizing a linear programming procedure to construct an index of technical efficiency, it was determined that hospitals that switched from nonprofit to for-profit status between 1985 and 1986 were no less efficient, on average, than those nonprofits that did not switch. The findings thus fail to lend support to the property rights paradigm.

Further research should be conducted with other data sets to test the robustness of these results. Potentially fruitful future research also may attempt to determine factors that are related to for-profit switches by developing and estimating a theoretical model of switching behavior. Identifying such factors not only would provide valuable information concerning the motivations of for-profit hospitals, but also would allow the property rights paradigm to be evaluated further.

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[13]One might feel that the statistical insignificance of most of the variables in the model is due to the small number of switching hospitals. The analysis was replicated using four random subsamples drawn from the 661 hospital main sample such that the switching hospitals made up about 10 percent of each of the four new groups. The probit model was estimated for each of these groups. In every case, the essential conclusion of the paper was found. These results are available from the authors upon request. Further research attemping to replicate the current results with a larger set of switching hospitals would be fruitful, if such a set could be found.

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Table 1
Estimate of the Determinants of the Probability of Switching
Dependent Variable: Probability of Switching

INDEPENDENT VARIABLE		COEFFICIENT (t-ratio)
INTERCEPT		4.546 (4.031)
ITE:	Measure of Relative Technical Efficiency	0.866 (1.012)
FSI:	Proportion of 38 Potential Facilities and Services	-6.017 (-3.812)
MSHARE:	Ratio of Staffed Beds in Hospital to Number in County	-0.517 (-1.130)
DENSE:	Population Per Square Mile in the County	-0.001 (-0.137)
GROW:	Percentage Change in the County's Population, 1970-1980	-0.008 (-0.959)
DEATH:	Death Rate in the County, 1980	0.071 (1.129)
INC:	Median Household Income in the County, 1980	0.011 (1.231)
NURSEPOP:	Ratio of Trained Nurses to Population in County, 1980	1.808 (0.023)

Chi-Squared: 518.97

Degrees of Freedom: 666

Notes: FSI and MSHARE are taken from the *Annual Survey of Hospitals for 1985*, while the remaining data are from the *County and City Data Book, 1983*