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HOSPITAL OWNERSHIP AND FINANCIAL PERFORMANCE: A QUANTITATIVE RESEARCH REVIEW

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ABSTRACT

We apply meta-analytic methods to conduct a quantitative review of the empirical literature since 1990 comparing financial performance of US for-profit, not-for-profit, and government-owned general acute hospitals. We find that the diverse results in the hospital ownership literature can be explained largely by differences in authors' underlying theoretical frameworks, assumptions about the functional form of the dependent variables, and model specifications. Weaker methods and functional forms tend to predict larger differences in financial performance between not-for-profits and for-profits. The combined estimates across studies suggest little difference in cost among all three types of hospital ownership, and that for-profit hospitals generate more revenue and greater profits than not-for-profit hospitals, although the difference is only of modest economic significance. There is little difference in revenue or profits between government and not-for-profit hospitals.

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Introduction

The hospital industry in the United States is one of the few sectors where three different types of ownership have co-existed for decades (see Figure 1). Numerous studies investigate whether private not-for-profit, for-profit and government hospitals differ in patient outcomes, costs, provision of uncompensated care, or other measures of hospital performance. Conflicting empirical results, however, have left policymakers with little clear evidence and have limited our understanding of ownership and performance in the health sector.

Understanding whether profit status or public/private control affects performance is important for many policy issues, including how to structure public programs such as Medicare and the Veterans' Administration hospital system or how to guarantee access for the uninsured. Much of current policy governing for-profit conversions in the health care market assumes that government and not-for-profit hospitals differ from for-profits in policy-relevant ways, such as providing greater access through more uncompensated care. Anyone setting out to assess the impact of an ownership-related policy change, such as tax exemption policy for not-for-profit hospitals, immediately finds that the voluminous literature on not-for-profit, for-profit and government hospitals gives frustratingly unclear and contradictory evidence, inviting subjective and selective reference to studies that support the analysts' views.

There have been some qualitative reviews of the literature to date (Sloan 2000; Needleman 2001; Malani et al 2003). In this paper, we go beyond the qualitative approach and apply formal statistical methods used in the meta-analysis literature to synthesize quantitatively studies that investigate the effect of ownership on hospital financial performance (we explore the relationship between other quality measures and ownership in a companion paper). The primary goal is to understand what factors account for the wide variation in study results, and to what

extent, after taking into account of those factors, the combined empirical evidence indicates that ownership matters. Our emphasis on *explaining variation*, as well as our focus on broader outcome categories, distinguishes our study from the only precedents in the literature that perform meta-analysis related to hospital performance (Devereaux et al. 2002 and 2004).

The paper proceeds as follows. We first discuss theoretical background. Rather than a comprehensive review, this section focuses instead on a few prominent theories and summarizes theoretical predictions about how government, not-for-profit and for-profit hospitals might compare on performance measures we are examining. We then outline the methodology of our quantitative review. We present results for cost, revenue, profit margins, and efficiency, and discuss implications for policy and future research.

Theoretical Background

The comparative advantages of government and private ownership have attracted much theoretical attention and have a venerable traditional in economics (Vickers and Yarrow 1988). For example, Laffont and Tirole (1993) list several of economic theory's 'conventional wisdoms' about government ownership: government-controlled firms can take broad social welfare as their goal, and may benefit from centralized control, yet also suffer from several disadvantages. The latter include absence of capital market monitoring; soft budget constraints (Kornai 1986; Kornai, Maskin, and Roland 2003); expropriation of investments; lack of precise objectives; as well as lobbying, patronage, and politicized resource allocation (e.g. Shleifer and Vishny 1994).

Health economists have drawn upon this general ownership debate to understand mixed ownership markets for health services. For example, according to property rights theory

(Grossman and Hart 1986, Hart 1995, Hart Shleifer and Vishny 1997), since private providers (especially for-profits) have well-defined control rights, they have strong incentive to invest in innovations, but may over-emphasize cost control at the expense of noncontractible quality. By contrast, a government-owned provider lacks clear control rights to implement changes, and this constraint softens incentives for innovations. The property rights model predicts that private owners achieve lower costs, but quality may be higher or lower. Many other theories (e.g., soft budget constraints, politicized resource allocation) also predict that private for-profit providers will generally achieve lower costs for a given service than their government counterparts.

Given the prevalence of not-for-profits in the health sector, much theoretical work by health economists focuses on not-for-profit providers and how they differ from for-profit firms. Theories frequently posit that not-for-profit firms have an objective function different from that of profit maximization. Examples include maximizing quality, quantity and/or prestige (Newhouse 1970) instead of, or in addition to, maximizing net revenue (Lakdawalla and Philipson 1998); helping to fulfill demand for local public goods (Weisbrod 1988) or meet unmet need in the community (Frank and Salkever 1991); or maximizing the well-being of specific important constituencies, such as the medical staff (Pauly and Redisch 1973) or consumers (Ben-Ner and Gui 1993). Other theories place emphasis on ownership form as an organizational *choice* (Lakdawalla and Philipson 1998; David 2004). In these frameworks, objectives need not differ, although the choice does sometime reflect—indeed, signals—differences in preferences. For example, organizations choosing to be bound by a nondistribution constraint have less incentive to skimp on noncontractible quality or otherwise subvert patient and community trust (Arrow 1963; Hansmann 1980; Glaeser and Shleifer 2001). Still other theoretical frameworks emphasize regulation and tax policies, positing that firms differ in their ability to benefit from a

given ownership form (Lakdawalla and Philipson 1998; David 2004).

Since most models of not-for-profits consider objectives and/or constraints that reduce emphasis on net revenue, most such models predict—or are at least consistent with—lower costs, higher net revenue, and comparable or lower quality, of for-profits compared to not-for-profits. Yet there is no strong theoretical prediction that ownership dictates differences in performance (e.g., not-for-profits might be "for-profits in disguise"; Weisbrod 1988). Nor does theory suggest that any ownership differences will swamp other factors strongly predicted to shape behavior, such as market concentration or payment incentives. Rather, one of the strongest predictions of economic theory is that providers react to their market environment. Thus any attempt to isolate the affect of ownership on performance must address the confounding effects of market structure.

Ironically, despite a large empirical literature on hospital ownership and performance, there remains a certain disconnect between theory and evidence. Few empirical papers distinguish among economic theories of ownership form. This disconnect seems to arise for two reasons. First, many theories generate (or are consistent with) the same predictions. Second, much of the literature in health services management and clinical evaluation does not focus on testing economic theories.

Nevertheless, most empirical studies of hospital performance do "test a theory" in a broad sense: whether ownership matters for performance. Indeed, many studies that focus on other research questions, such as the volume-outcome relationship or antitrust issues, include ownership as a control variable. Apparently the majority of researchers in this field consider ownership to be a potentially important factor for explaining variation in hospital performance. Both studies focusing on ownership comparisons and those that merely include ownership as a control variable report widely varying results about the association between ownership and

financial performance. Our review seeks to explain that variation in light of theoretical predictions about how and when ownership shapes hospital performance.

Methods

Background on Meta-analysis in Observational Studies

As described in more detail below, we adopt meta-analytic methods to perform our quantitative review. Meta-analysis applies conventional statistical methods to combine the results from independent studies that use different data and methodologies to assess a similar research problem. Such formal statistical methods for integrating results are a staple of clinical science and have been applied successfully to many fields of economics. For example, this method was used to evaluate the effect of minimum wage laws (Card and Krueger 1995), to examine the gender gap in wages (Stanley and Jarrell 1998), to evaluate Ricardian Equivalence (Stanley 2001), and to study the determinants of enterprise restructuring in transition (Djankov and Murrell 2002). Meta-analysis has helped to clarify several controversial area of research, such as the effect of second hand smoking or the relationship between exposure to TV violence and aggressive behavior (Stanley 2001).

Identifying Studies and Extracting Summary Data

The first step of a quantitative review is to identify all relevant studies through a systematic procedure. We used a combination of the following keywords (and their variations) to conduct the initial search in several databases[1]: hospitals, ownership, for-profit, not-for-profit, nonprofit. We limited our search to published and unpublished articles or book chapters written

[1] The databases included Medline, EconLit, and Proquest/ABI (for dissertations). We also identified studies through work cited in the literature or previous qualitative reviews (e.g., Zeckhauser, Patel and Needleman 1995 is an unpublished report to a Foundation).

in English between January 1990 and July 2004. This initial search process identified 1357 potentially relevant studies.

We then applied the following selection criteria. First, we defined our study population to be general, acute, short-stay hospitals in the United States. Second, we applied an "intervention" criterion that only includes studies that compare hospitals of different ownership forms (including studies of ownership conversion, but excluding studies that only compare sub-categories of ownership, such as religious vs. secular not-for-profits). Third, we limited our sample to empirical studies using multivariate analysis (i.e., excluding theoretical papers and case studies). Lastly, we confined our outcome scope to the following broad categories: financial performance (such as cost, revenue, profit margin, efficiency), patient outcomes (mortality, complication rates, or other patient outcomes), uncompensated care or community benefits, and staffing. Two authors (Eggleston and Shen) independently applied the above selection criteria to identify the relevant studies for our project.[2] After we identified this initial set of relevant studies, we contacted the corresponding authors of all included papers to solicit any unpublished papers that might fit our project scope. We received responses from authors that resulted in 77 additional studies. We applied the same selection criteria again to this new set of studies. At the end of this search and selection process, we identified 141 studies for our quantitative review. Figure 2 summarizes our selection process.

In this paper, we report findings from the financial performance quantitative review. Among the 141 relevant studies, 67 focus on financial performance. Many studies analyze multiple measures of financial performance. Conversely, as Table 1 shows, many specific performance measures are analyzed only by a few studies. Since we need an adequate sample

[2] Throughout the coding process we found a discrepancy in our independent coding of only 7%; all differences were reconciled by consensus after joint review.

size to be able to apply meta-analytic methods, we only review outcomes that are analyzed by at least 10 studies. The four most commonly studied financial outcomes that we review extensively are: hospital cost, revenue (including returns on assets), profit margin, and efficiency (including both cost and technical efficiency).

Data extraction. For each included study, we extracted study information into a pre-defined abstraction form that covered the following sets of information: data sources, sampling frame (covered years, covered regions, sample size), detailed outcome definition, ownership coefficients and their associated statistics (such as standard errors, t-statistics, p-value, degrees of freedom of the model), and empirical methods. We coded empirical methods using the following set of binary variables: whether the study included patient demographic characteristics, patient severity of illness information (such as a case mix index), hospital-level characteristics (such as bed size, share of Medicare and/or Medicaid admissions), and market-level characteristics (such as per capita income, population size, hospital market characteristics), and whether ownership is only included as a control variable. In addition, we categorized each study's methodology by coding whether the study employs panel data estimation methods, whether the study explicitly models certain market interactions that can potentially bias the ownership estimates (such as explicit adjustment for selection through Heckman or instrumental variables, or explicit control for intensity of hospital competition), and the functional form of the dependent variable (e.g., log transformation, average measure, or other definition). For efficiency studies, there is an ongoing debate about the merit of data envelopment analysis and the stochastic frontier regression approach. We extracted information from the efficiency studies about how they applied these two methods.

Expert panel. To provide additional guidance on the research questions and analytic

strategies, we recruited thirteen prominent researchers in the area of hospital ownership and performance to serve on our expert panel.[3] These individuals gave input on issues ranging from the big picture questions to specific analytic methods for explaining and quantifying differences among studies.

Statistical Methodology

A typical study estimates the impact of ownership on performance as follows:

$$Y = \alpha + \beta_1 FP + \beta_2 GOV + \gamma X + \xi . \qquad (1)$$

Y is a measure of hospital financial performance, FP indicates for-profit ownership, GOV signifies government ownership (the omitted group is not-for-profit ownership—NFP), X is a vector of hospital and market characteristics, and ξ is the error term. The coefficients β_1 and β_2 capture the effect on Y of for-profit and government ownership, respectively, relative to not-for-profit ownership. In this section, we describe the methods used to answer the three questions of our quantitative review:

1. What is the **magnitude** of the relationship between ownership and financial performance—what is the "effect size" of each study?
2. How **precise** or reliable is this estimated effect size?
3. How do differences in analytic methods and other study features affect the estimates of effect size?

We first discuss how we define and compute the effect size for our review. We then describe the meta-regression procedure used to explore how differences in study features lead to different

[3] We invited researchers to serve on the expert panel based on the number of studies included in our list that they had co-authored, their areas of expertise, recent work in the field, and availability and willingness to serve on the panel. We thank their contribution. The names of our expert panel are listed in the acknowledgement section.

conclusions about ownership's effect on financial performance. We finally consider empirical issues that arise when applying meta-analytic methods to the hospital literature.

Defining effect size. To synthesize and compare studies, we must first develop a summary measure of each study's results, an "effect size," that can be compared across studies. In randomized clinical trials where meta-analytic methods are often applied, the effect size is simply the difference in average outcome between the treatment and the control group, divided by the appropriate standard deviation. However, all hospital ownership studies are observational studies that use some form of multivariate analysis. Intuitively, the coefficients β_1 and β_2 capture the effect size of for-profit and government ownership, relative to not-for-profit ownership, respectively. However, the magnitude of β's depends on the units of the dependent variable, which vary considerably because studies measure the same financial outcome differently. For example, some studies measure cost in dollars, while others transform the cost measure to logarithmic form.

Another possible metric is the t-statistic associated with the ownership coefficient estimate, which is unit-free. However, the magnitude of the t-statistic increases proportionally with the square root of the sample size. This dependence on sample size suggests that t-statistics are not the appropriate measure for the economic magnitude of ownership differences.

To define an effect size that is unit-free and does not depend on sample size, we use the partial correlation coefficient (Rosenthal 1991). A partial correlation coefficient measures the correlation between a given ownership form and performance measure Y, controlling for the effect of covariates X. Although most studies do not report partial correlation coefficients, they can be computed using statistics that are commonly reported in published studies (Greene 1997):

$$r^* = \sqrt{\frac{t_{FP}^2}{t_{FP}^2 + \text{degrees of freedom}}}\,.$$

One concern is that the distribution of r* becomes more skewed as the population value of r* gets further away from zero. We therefore standardize the effect size by applying the Fisher transformation, which is distributed nearly normally (Hedges and Olkin 1985):

$$Z_r = \frac{1}{2}\log\left[\frac{1+r}{1-r}\right].$$

We then compute the confidence interval around the effect size to answer our second research question (see the appendix for details).

Combining effect sizes. After comparing effect sizes across studies, the next common step is to synthesize the literature by combining the effect sizes across studies. It is tempting to view the combined effect size as a summary measure of whether the empirical literature as a whole predicts ownership to be a significant factor in affecting hospital financial performance. However, we must be very cautious when interpreting the combined effect size and its confidence interval. As we will discuss in more detail below, studies in the hospital ownership literature usually have overlapping samples and data sources. This implies that the statistical power of our quantitative review does not increase proportionally with the sample size of each additional study. We leave the discussion about computing the combined effect sizes and their confidence intervals in the appendix.

Explaining Variation in Study Results. To answer our third question—how do study features affect the estimated effect size? —we categorize studies' methodology and employ meta-regression analysis. These approaches allows us to examine whether study features such as analytic methods, functional forms, or region studied can explain differences in effect sizes across studies. For example, do studies that control for market-level confounding factors such as intensity of competition find larger or smaller effects of ownership *per se* on financial performance than studies that do not control for such confounding factors?

The included studies vary widely in analytic methods. Given the limited number of studies in each financial outcome category, it is necessary to categorize the diverse methods in a concise way. With input from our expert panel, we categorized studies into three types according to methodological rigor:

- Type 3: if the study meets both of the following conditions:

(a) uses panel estimation or otherwise explicitly accounts for the potential selection problem;

(b) includes two of the following three sets of controls: patient level, hospital level, or market level;

- Type 2: if the study meets either condition (a) or (b)[4];
- Type 1: if the study meets neither condition (a) nor (b).

We then can compare differences in effect sizes and their precision according to methodological classification.

To assess the importance of methodology as well as other factors in explaining variations in study results, we also conduct meta-regressions. The dependent variables in our meta-regressions are the standardized effect sizes from each study. The explanatory variables are the empirical features of each study. The model is necessarily parsimonious, since there are only a few studies for each measure of financial performance, and many study features are highly collinear.[5] Because our sample size is small for each outcome category, we examine different types of study features in separate meta-regressions.

- In the first set, we focus on analytic methods, using indicator variables for the three types

[4] In the studies we reviewed, only one study meets criteria (a) but not (b). Therefore type 2 method basically includes all cross-sectional studies that meet criteria (b), i.e., include controls at the patient, hospital, and/or market level.

[5] For example, studies that analyze national samples tend to use the same data sources. The variables that capture the covered region and data sources would be highly collinear.

of methodological rigor defined above. In addition, we include an indicator of whether ownership is only included as a control variable and not the focus of the study.

- The second set of meta-regressions focuses on the regions covered. In particular, we are interested to know whether single-state analyses differ substantially from analyses that use national samples.
- The third set of meta-regression focuses on the functional form of the dependent variables. Differences in functional forms reflect authors' underlying assumptions about cost and revenue structure. For example, among the 18 cost studies comparing not-for-profit and for-profit hospitals, 3 examine the dollar value of cost per discharge, 11 analyze the log transformation of cost measures, and the remaining 4 studies use other cost definitions. Similarly for revenue studies, some compare for-profit and not-for-profit hospitals' revenue in dollars per discharge, while others compare the differences in percentages. To examine whether these differences in specification of the dependent variable affect conclusions regarding ownership and performance, we create an indicator that takes on the value of 1 if the dependent variable is log transformed and 0 otherwise. For the efficiency studies, some authors assume that efficiency follows a deterministic model (data envelopment model) while others allow for random errors (stochastic frontier model). We create an indicator to differentiate these two approaches.

In order to avoid spurious findings from the meta-regressions (i.e., a false positive relationship between a given study feature and the effect size), we adopt a permutation test approach proposed by Higgens and Thompson (2004) to assess the true statistical significance of an observed meta-regression finding.

Issues in statistically integrating the hospital ownership literature. Most meta-

analyses of clinical trials ask how well a treatment works overall. The traditional meta-analytic methods are designed to answer the same question in the same population. In those cases, a fixed-effects model is used to combine effect sizes across studies, which assumes that there is one single underlying true effect. However, in our case the research questions are not homogeneous even within a narrowly defined financial outcome group. It is worth noting that with our selection strategy, we include not only studies whose research question focuses on the relationship between financial performance and ownership, but also studies that answer some other research questions about hospital finance that include ownership as a control variable in their multivariate analyses. Because of the heterogeneity of research questions and results, we use a random-effects model for the meta-regression and when combining the study results. The random-effects model assumes no single true effect, but rather that there is an underlying distribution of this true effect, commonly assumed to follow a normal distribution (Lau et al. 1998). The random-effects model assumes there is between-study variation in addition to within-study variation around the estimated effect size; therefore, the confidence intervals constructed under a random-effects model are larger than under a fixed-effects model.

Another issue in integrating the studies is that not all studies report the necessary statistics. In many instances, particularly for policy journals, authors report only the significance level of the coefficient. We contacted the corresponding authors to get the exact t-statistics where possible. In cases where we could not get the exact number, we estimate the t-statistic by generating a random number within the reported significance range.[6]

Unlike meta-analyses of clinical trials, where the sample in each study comes from

[6] For example, a study might report results significant at the 0.01, 0.05, and 0.10 levels. If the ownership coefficient is not statistically significant, the estimated t-statistic is a random number between 0 and 1.64. If the ownership coefficient is significant at the 0.10 level, the estimated t-statistic will be a random number between 1.64 and 1.96; and so on.

mutually exclusive patient populations, many studies we reviewed analyzed the same set of hospitals in overlapping years. There are fewer than 5000 general acute hospitals in the US. As Table 2 shows, many studies analyze national samples, and most studies use one of two common data sources: either the American Hospital Association Annual Survey or the Medicare Hospital Cost Reports (also known as Healthcare Cost Report Information System, HCRIS). Our effect size measures, defined by partial correlation coefficients, should remain valid when observations are correlated (Rosenthal 1991). However, the studies do not represent independent samples, and statistical power will not increase proportionally with each additional study's sample size even if we pool studies.

The non-independent nature of study samples sits at odds with the assumption behind the traditional meta-analysis. However, we believe applying the meta-analytic methods to our quantitative review still provides valuable insight. By comparing studies on a common metric (i.e., the standardized effect size) and characterizing methods, we are able to decipher how methodological differences influence study results.

Nevertheless, we stress that our results are most valuable for explaining variation, not for providing "one true answer" about how ownership affects financial performance. The overlapping sample problem makes the interpretation of the combined effect size very different from traditional meta-analysis. While the combined effect size provides the range of effect size estimates that the studies pooled together are likely to produce, it is important to remember that it is derived from non-independent studies. Neither the combined effect size nor the meta-regression approach can predict a specific hospital's performance. But our analysis does suggest what study designs are most likely to predict performance differences by ownership form, and suggest ways in which future research should get into the "black box" of hospital performance

variation.

Results

Table 2 summarizes the studies included in this quantitative review. Many studies analyze multiple financial outcomes. Among the 40 included studies, 25 analyze a broad sample of hospitals (either a national sample or hospitals in MSAs, which account for over 55 percent of US community hospitals). Half of the studies utilize multiple years of data, and the studied years range from 1981 to 1998. The last two columns illustrate the overlapping data sources among the studies: 30 (i.e., 75%) use the AHA survey and/or the HCRIS data.

Table 3 presents the percentage of studies with each study feature that we included in the meta-regression. The top panel shows the features of studies that compare not-for-profit with for-profit ownership; the bottom panel describes studies that compare not-for-profit with government ownership. The share of studies with a given feature varies across the four financial outcomes. The top panel shows that the percent of studies classified as type 3 (strongest) methods ranges from 17 percent for efficiency studies to 61 percent for cost studies. About 40 percent of studies do not focus on ownership but include this information in their models. The only outcome category that has a uniform functional form is profit (or loss, if negative), which is defined as the ratio of net income to revenue. Seventy percent of cost studies analyze log-transformed cost, whereas only 30 percent of revenue studies analyze the log-transformed version of revenue. Among efficiency studies, 30 percent assume a deterministic model.

The sample size of our quantitative review shrinks considerably when we look at studies that compare not-for-profit and government ownership (bottom panel of Table 3). Generally these studies are a subset of the ones that compare not-for-profit and for-profit ownership.

Cost. There are 18 studies that analyze cost differences between for-profit and not-for-

profit hospitals. Five studies examined total cost (which includes both operating cost and capital cost) while the other 13 studies used operating cost as the dependent variable.

We first summarize the effect sizes of for-profit ownership compared to not-for-profit ownership of hospitals (Figure 3A). The studies are listed by the methodological rigor. Figure 3A also reports the confidence intervals around each study's effect size, and the weight assigned to each study in the random effects model estimation of the combined effect size.[7]

Figure 3A shows that the effect size ranges from -0.23 (indicating that for-profits have lower cost than not-for-profit hospitals) to +0.27 (indicating for-profit hospitals have higher costs than not-for-profit hospitals). Except for the type-1 method studies, most studies have relatively small effect sizes with no significant difference between the two ownership forms. The overall effect size indicates little difference in cost between for-profit and not-for-profit hospitals. The three type-1 method studies are all studies using data from a single state and cover only a single year. The study with the largest negative effect also analyzed data from just one state (Florida).

Figure 3B summarizes the effect sizes for studies comparing not-for-profit and government hospitals. A negative effect size indicates that government hospitals operate at lower cost than their not-for-profit counterparts. The variation in effect sizes across studies is even smaller than that between not-for-profit and for-profit hospitals. Averaging these estimates, there appears to be little difference in cost among all three types of ownership.

One disadvantage of using the partial correlation coefficient as the effect size measure is that it is not easily interpretable in terms of real economic phenomena. One way to interpret the effect sizes is through the r^2, which represents percent variation explained by the ownership

[7] Several studies analyze different years and/or states separately, and thus have multiple effect sizes (one corresponding to each year or state estimate). For the summary plot in Figure 3 and similar plots for other performance measures, we average the multiple effect sizes so that we report one effect size per study, and adjust the standard error of the effect size to reflect the total sample size used in that particular study.

indicator. As Figure 3A shows, even the study with the largest effect size (0.27) would only account for 7 percent of the study variation. This result is not surprising, given that there are so many other factors influencing a hospital's operations. However, Rosenthal and Rubin (1982) argue that such reporting has a tendency to underestimate the importance of the effect size. They propose using the binomial effect size display to assess the magnitude of the effect size. Applying this approach, we assume that 50 percent of hospitals are below and above median cost in both the for-profit and not-for-profit categories. The effect size captures the difference in share of hospitals that have above-median cost in the two categories. For example, an effect size of 0.02 indicates that 51 percent of for-profit hospitals and 49 percent of not-for-profit hospitals are above-median cost (i.e., the difference is 2 percentage points).

The economic significance of this cost difference seems small. Consider, for example, an alternative way to illustrate how modest the ownership effect size is, by comparing the ownership effect to that of teaching status, size, and urban/rural location. In one type-3 methodology paper (Carey 1997), the comparable effect size for "heavy teaching" hospital cost (compared to non-teaching hospital cost) is more than five times that of the ownership effects, and the effect size for "large urban" is more than three times the magnitude of the ownership effects.

In Table 4, we analyze what study features might drive differences in effect sizes across studies that compare not-for-profit and for-profit hospitals. We report the meta-regression results of cost studies in the first column.[8] The analytic method regression (first panel) clearly indicates that methodological rigor matters. Type 2 and 3 methods produce much smaller effect sizes than Type 1 methods do. In other words, studies that control for a wider range of

[8] Unlike the summary plot where only one averaged effect size is associated with each study, we include all effect sizes from each study in the meta-regression; hence Tables 4 and 5 show larger sample sizes in some categories than in the corresponding figures.

confounding factors find less difference in cost between for-profit and not-for-profit hospitals. Studies that focus on a research question other than ownership are no different from ones that focus on ownership, after controlling for methodological rigor. The last row of the first panel indicates that 93 percent variation in the standardized effect size is due to heterogeneity in methodological rigor, further confirming the choice of a random-effect model over a fixed-effect model.

The second panel of Table 4 shows that functional form matters as well. Studies without log transformation of the dependent variable tend to produce larger effect sizes. Given that healthcare costs are highly skewed, it would appear that log transformation is warranted. Studies that use log of cost as the dependent variable tend to find no significant difference in cost between for-profit and not-for-profit hospitals.

Effect sizes vary widely between studies using data from different parts of the country. While California and Florida tend to produce larger and negative effect sizes that indicate for-profit hospitals have lower costs in those states, studies of Virginia's for-profit hospitals suggest they have higher costs than their not-for-profit counterparts. However, it should be noted that the two studies using Virginia data (Shukla 1997 and Wang et al. 2001) are both classified as Type 1 method and both have very wide confidence intervals around the effect sizes due to small numbers of hospitals included. (Figure 3A shows that these two studies only account for 3.2 percent of the total weight toward the overall effect size computation). The limited sample size of our meta-regression precludes us from ascertaining whether the larger effect size of these studies derives from state differences, urban/rural mix of hospitals, analytic methods, or some combination of the above factors. We also examine whether differences in effect sizes can be explained by the authors' choice of total cost or operating cost; we do not find any significant

differences (results not shown).

Table 5 reports meta-regressions exploring what study features explain differences among studies that compare government hospitals to not-for-profit hospitals. Since the variation in effect sizes is much smaller than that between not-for-profits and for-profits, we do not find much difference in effect size as we compare across analytic methods, functional form of the dependent variable, or regions. The only significant study feature is that studies that only include government ownership as a control variable tend to find government hospitals less costly than not-for-profit hospitals.

Revenue. Among the 11 studies that examine revenue differences between for-profit and not-for-profit hospitals, 4 studies analyze returns on assets, 2 examine total revenue, and the rest focus on net patient revenue. Figure 4A summarizes the effect sizes for studies on revenue and returns on assets, categorizing studies by their methods. Unlike cost studies, where there is a wide range of effect sizes from negative to positive numbers, all revenue studies report either no difference between for-profits and private not-for-profits, or a positive effect size, indicating that for-profits earn greater revenue. But similar to the cost studies, type 1 studies estimate much bigger for-profit effects than type 2 and type 3 studies. The three type 1 studies have small sample sizes, as reflected by the fact that jointly they account for only 9 percent of the overall estimated effect size. The overall effect size indicates that for-profit hospitals generate more revenue than not-for-profit hospitals. Using Rosenthal and Rubin's (1982) binomial effect size display approach, the overall effect size for revenue studies (0.06) would imply that 53 percent of for-profit hospitals earn above-median revenue, whereas only 46 percent of not-for-profit hospitals earn above-median revenue, all else held equal.

Only four studies examine revenue differences between not-for-profit and government

hospitals (Figure 4B). Three of them find no revenue difference between the two ownership forms. The only study that indicates government hospitals earn higher revenue is an ownership conversion study (Shen 2003b): that study finds that when not-for-profit hospitals convert to government ownership, they earn slightly higher revenue.

The second column of Table 4 reports the meta-regression results for revenue studies comparing not-for-profit and for-profit hospitals. The magnitude of the effect size shrinks substantially as we move from studies using Type 1 to Type 3 methods. Studies that do not control for market competition or selection bias tend to find for-profits earn substantially higher revenue than not-for-profits. The more rigorous the methods to control for these confounding factors, the less likely a study will find differences between for-profits and not-for-profits.

Functional form does not seem to explain much of the variation in study findings about revenue. Studies analyzing California and Virginia hospitals tend to produce larger effect sizes than studies using a national sample. However, all 4 studies of California and Virginia use Type 1 methods. Since these two state indicators are perfectly collinear with the Type 1 method indicator, we cannot separate out the state effect from the effect of analytic methods. We do not perform meta-regressions to explain variations in revenue between not-for-profit and government hospitals due to limited sample size.

Profit Margin. Among the financial performance measures studied, profit margin has the most consistent definition across studies. Virtually all 14 studies that examine profit margins of for-profit and not-for-profit hospitals define profit margin as the difference between revenue and cost divided by revenue. Most studies find that for-profit hospitals earn higher profit margins than not-for-profit hospitals do (Figure 5A), with the type 1 studies finding larger effects than others. The effect size ranges from -0.09 to +0.28, and the overall effect is estimated to be

0.06. Similar to the revenue review, this overall effect size would imply that the difference in share of hospitals with above-median profit margin is 6 percentage points between for-profit and not-for-profit hospitals. Given that there appears to be little cost difference between the two private ownership forms, our results would suggest that the higher profit margins of for-profit hospitals derive from their higher revenues. In contrast, Figure 5B shows that among the 6 studies that examine profit margin differences between not-for-profit and government hospitals, 4 found no differences while the remaining 2 studies found opposite effects. (Shen 2003b, which found a positive effect, studied conversion of not-for-profits to government ownership.) The effect sizes are smaller than those in Figure 5A and statistically insignificant, indicating smaller differences between not-for-profits and government-owned hospitals than between not-for-profits and for-profit hospitals.

The meta-regression results in Table 4 once again show that analytic methods can explain much of the between-study variation in estimates of how much net revenue for-profits earn relative to not-for-profit hospitals. Ninety-three percent of the variation in the standardized effect size can be attributed to the heterogeneity across studies. Type 2 and Type 3 methods produce similar effect sizes; both tend to find much smaller effect sizes than those estimated with Type 1 methods. In other words, studies that control for more confounding factors—particularly market competition and selection effects—tend to find less of a net revenue advantage of for-profits over not-for-profits. The two studies of Virginia hospitals report much larger profit differences than the other studies (as for cost and revenue), but they also have the largest confidence intervals around their effect sizes. We do not find many study features that can explain variation in study findings about net revenues earned by government and not-for-profits (Table 5), perhaps because there is less variation to explain.

Efficiency. Measuring hospital efficiency has been a controversial area of the hospital ownership literature (for example, see the discussion in the 1994 volume 14 issue of the *Journal of Health Economics*).[9] In addition to estimating hospital cost functions (as discussed above), there are two methodologies that researchers often employ: data envelopment analysis (DEA) and stochastic frontier regression (SFR). SFR analysis incorporates data on input prices, and measures efficiency as least cost production (in other words, it measures efficiency from all sources of cost), whereas DEA uses data on inputs and outputs, and measures efficiency as the least amount of input for a given amount of output (this is referred to as technical efficiency, and is considered a subset of cost efficiency). Both approaches make inferences about efficiency from a residual. The major empirical difference between the two approaches is that SFR assumes the residual term reflects both inefficiency and random factors, while DEA is a purely deterministic model that assumes all departures from the best-practice frontier reflect inefficiency. DEA offers the advantage of being relatively flexible in modeling the underlying production technology but makes no adjustment for random error. There is a concern that DEA analysis is only useful when the sample size is very large (about 1,000 observations or more), and that the deterministic nature of the model does not suit the hospital industry. SFR explicitly models random error, but it also assumes a structure for the underlying production technology. In either case, wrong assumptions about the functional form, misspecification of the models or omitted variables could easily bias the results.

In our quantitative review, we include both cost efficiency and technical efficiency since one is the subset of the other, and this allows us to compare studies using DEA and SFR approaches. In Figure 6, we group the effect sizes by whether the study analyzed a single state

[9] We especially thank our expert panel for providing input on this topic.

or a broader sample.[10] Figure 6A shows that the 4 studies that analyze single states (3 Florida studies and 1 Washington study) all find for-profit hospitals to be more efficient than not-for-profit hospitals. In contrast, 7 out of 9 national studies find for-profits to be less efficient than not-for-profit hospitals.

The last column of Table 4 shows that effect sizes do not vary that much across the three categories of analytic methods. However, studies that do not focus on ownership (about 40%) tend to report for-profits to be more efficient than not-for-profit hospitals. DEA models also produce larger effect sizes than SFR. The Florida effect shows up in the last panel of Table 4, suggesting that for-profit hospitals are more efficient than not-for-profit hospitals in Florida. Since effect sizes do not appear to differ across studies using different methodologies, we can infer that this large effect size in Florida—suggesting that for-profits are more efficient than not-for-profits—is not driven by methodological differences, although it does rely on just three studies.

Comparison between not-for-profit and government hospitals in general finds little consistent efficiency difference between these two ownership forms (Figure 6B). Estimates based on Florida data tend to find government hospitals more efficient than their not-for-profit counterparts, although again this result derives from just two studies, and cost function estimates do not find a similarly significant "Florida effect."

Publication Bias and Sensitivity Analysis

The potential for publication bias has received substantial attention in quantitative reviews in both the clinical literature as well as some in other areas of economics (e.g., estimates

[10] We chose this way to display effect sizes to reflect what the meta-regression found to be significant in explaining variation between studies.

of the effects of the minimum wage on employment as discussed in Card and Krueger 1995). The concern is that published results may be biased, because published studies are less likely to include negative results (e.g. for clinical trials) or results not supporting a strong theoretical prediction (e.g., about how the minimum wage reduces employment for low-wage workers). A priori we might suspect less concern with such bias in the hospital ownership and performance literature. As noted in the background section, some theories and previous evidence suggest little difference in behavior between ownership forms. Many, but not all, studies of hospital performance include ownership as a control variable even if it is not the key variable of interest, suggesting that researchers do not all agree on whether ownership *per se* is an important confounder of other hospital performance results.

Following the approach by Card and Krueger (1995), we test the existence of publication bias by examining the relationship between the absolute value of t-statistics and the square root of degrees of freedom. Figure 7 clearly shows that the t-statistics increase with the degrees of freedom; we do not see a pattern in which most t-statistics hover around 2 regardless of sample size. Consistent with our expectation, we conclude that there is no evidence of publication bias in this literature.

Two of the studies (Zeckhauser, Needleman, and Patel 1995; Ferrier and Valdmanis 1996) separately analyze sub-groups of for-profit hospitals, those that belong to larger systems and those that are independent. (Both types of for-profit are compared to not-for-profit hospitals). In our main review, we use the reported ownership effects from the for-profit chains; in our sensitivity analysis, we use the information from for-profit independent hospitals. The overall results are very similar, and conclusions remain the same. Our conclusions are also robust to separating cost efficiency from technical efficiency.

Disease-specific analyses are often better equipped to avoid confounding from differences in mix of services provided and to control for differences in patient case mix and severity. In sensitivity analyses for the hospital cost review, we include additional studies of cost in which the dependent variable is not the broad hospital operating cost. These additional studies include some that analyze cost associated with specific disease treatment (such as heart attacks, asthma, or hysterectomy) and studies of Medicare payments.[11] These additional studies also have relatively small effect sizes with no significant differences between for-profits and not-for-profits. We focus on the present set of 18 studies to have a relatively homogenous set of dependent variables.

Discussion

We conduct a systematic quantitative review of the empirical literature since 1990 comparing financial performance of US for-profit, not-for-profit, and government-owned general acute hospitals. The salient point from this quantitative review is that the diverse results in the hospital ownership and performance literature derive largely from differences in authors' underlying theoretical frameworks, assumptions about the functional form of the dependent variables, and model specifications. Weaker methods and functional forms tend to predict larger differences in financial performance between not-for-profits and for-profits.

More specifically, studies that control for a wider range of confounding factors—including at the patient, hospital, and market levels or using panel data estimation techniques—find smaller differences in financial performance between for-profit and not-for-profit hospitals. Studies that use a logarithmic transformation of cost and revenue for those dependent variables, as their skewed distributions suggest is appropriate, tend to find no significant difference

[11] The additional studies are Ettner et al. (2001), Huang et al. (2002), Kessler and McClellan (2002), Sloan et al. (1999), and Bazzoli (2004).

between for-profit and not-for-profit hospitals. This is true for cost, revenue, and profit margin comparisons. For efficiency studies, the meta-regression suggests that methodological rigor plays less of a role in explaining the variation in findings than differences in geographic region.

For most financial performance measures, the estimated differences between for-profit and not-for-profit hospitals vary significantly between studies using data from different regions of the country. Single-state studies, primarily from the south and west, tend to find larger differences between for-profit and not-for-profit hospitals. Unfortunately, with the exception of efficiency studies, it is difficult to disentangle what drives these differences, partly because state-specific analyses often use weaker methods and/or only a single year of data, so that regional differences are confounded by differences in analytic methods.

Even though our quantitative review provides some insight on what the magnitude of the ownership effect might be overall, such findings must be interpreted with great caution. Studies in this literature do not represent independent estimates of the "treatment" effect of ownership on performance. Most draw from two widely used sources of data, and many analyze overlapping regions and years, so that the same hospitals and patient populations underlie estimates from different studies. The statistical power of our quantitative review does not increase proportionally with the sample size of each additional study, since they are not independent samples.

Nevertheless, the pooled estimate does suggest the range of effect size estimates that the studies pooled together are likely to produce, and therefore the potential magnitude of the ownership effect on financial performance. Using this interpretation, evidence to date suggests little difference in cost among all three types of hospital ownership. Studies that compared revenues all found either that for-profits earn greater revenue or no difference between for-

profits and not-for-profits. The overall effect size suggests that for-profit hospitals generate more revenue and greater profits than not-for-profit hospitals, although the difference is only of modest economic significance. There is less clear evidence of a difference in revenue or net revenue between government and not-for-profit hospitals.

It is not surprising that for-profits tend to earn more profit: that is their mission, and is the prediction of virtually all economic models that contrast for-profit and not-for-profit behavior. However, the conventional wisdom that for-profit hospitals would operate more efficiently (i.e., at lower cost) was not supported in this review. Overall, the dispersion and inconsistency of estimates about how ownership form correlates with financial performance mirrors the larger question of what drives wide variations in performance across hospitals of the same type (e.g. McClellan and Staiger 2001). Future research can be most fruitful if it goes beyond the standard administrative datasets to explain this wide variation in performance both with more in-depth data about the "black box" of hospital decision-making and with analysis of market spillover effects. Our current exploration of the literature between non-financial performance measures and hospital ownership would provide further insight about ownership behavior differences. Evidence from other countries can also contribute significantly to furthering our understanding of ownership and behavior.

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Appendix. Technical Details on the Effect Sizes

The precision of the effect size. In order to answer the second question, how precise is the effect size, we need to compute the confidence interval around the effect size. The adjusted effect size, Z_r, is distributed normally, with variance that is proportional to the inverse of sample size. Specifically,

$$\text{variance}(Z_r) = \frac{1}{n-3}.$$

Then for each study, we can compute the 95% confidence interval around the adjusted effect size as follows:

$$Z_r \pm 1.96 * \frac{1}{\sqrt{n-3}}.$$

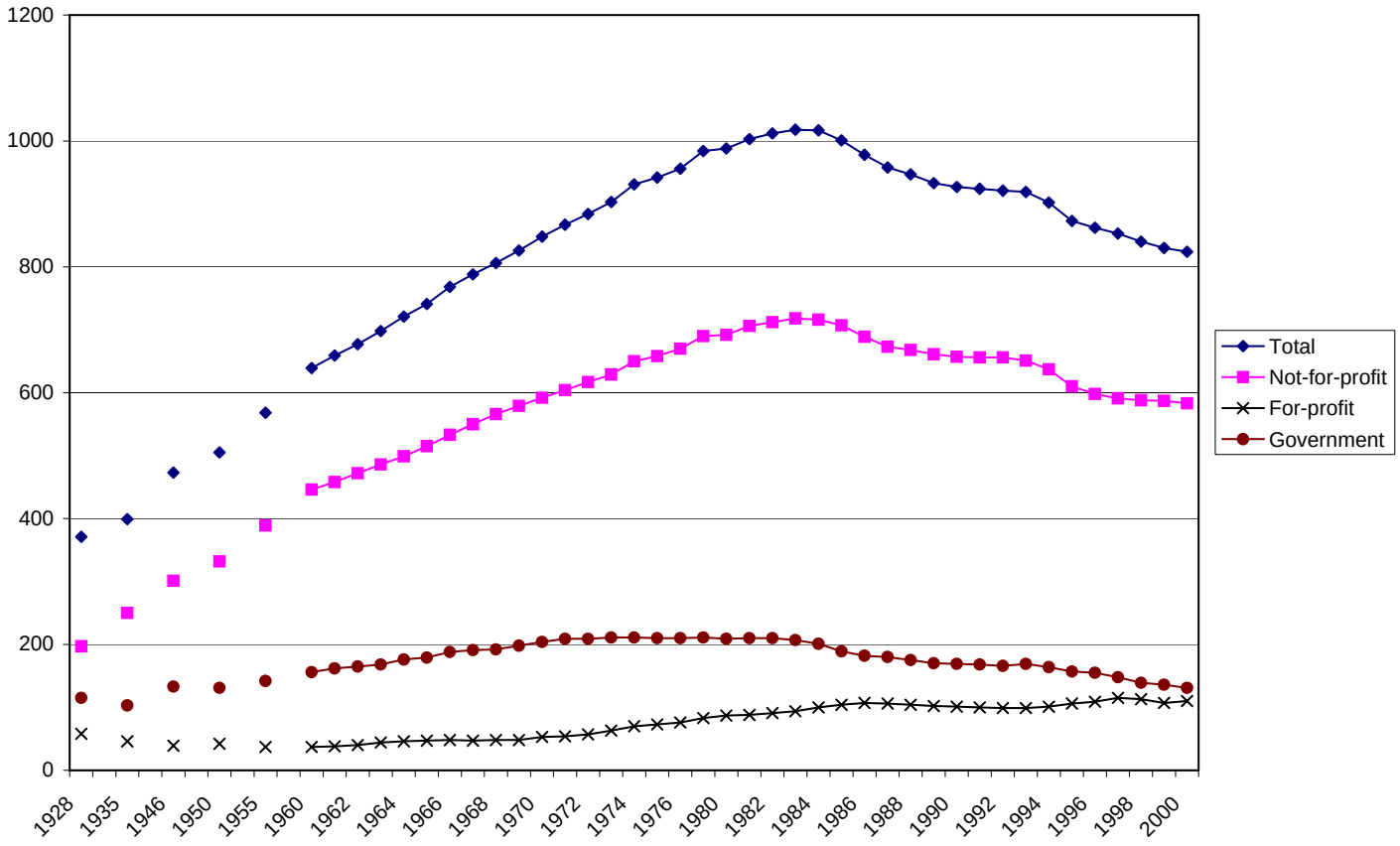
Combining effect sizes. A common way to combine study results is to compute a weighted average effect size:

$$\overline{Z}_r = \frac{\sum_{i=1}^{k} w_i Z_i}{\sum_{i=1}^{k} w_i}$$

where the weight that minimizes the variance of this measure is the inverse of the effect size variance from each study. In other words, studies with larger sample sizes (e.g., more hospitals) receive more weight because they are able to estimate the effect of ownership on performance more precisely. The variance of the combined effect size is given as follows, which allows us to construct the 95 percent confidence interval around the combined effect size:

$$Var(\overline{Z}_r) = \frac{1}{\sum_{i=1}^{k} 1/\text{var}(Z_i)}.$$

Figure 1. US Community Hospital Beds (in thousands), total and by ownership, 1928-2000



Source: Eggleston (2005), based on Rorem (1930); Hayes (1954); American Hospital Association Hospital Statistics (various years).

Figure 2. Flowchart of Literature Search Results

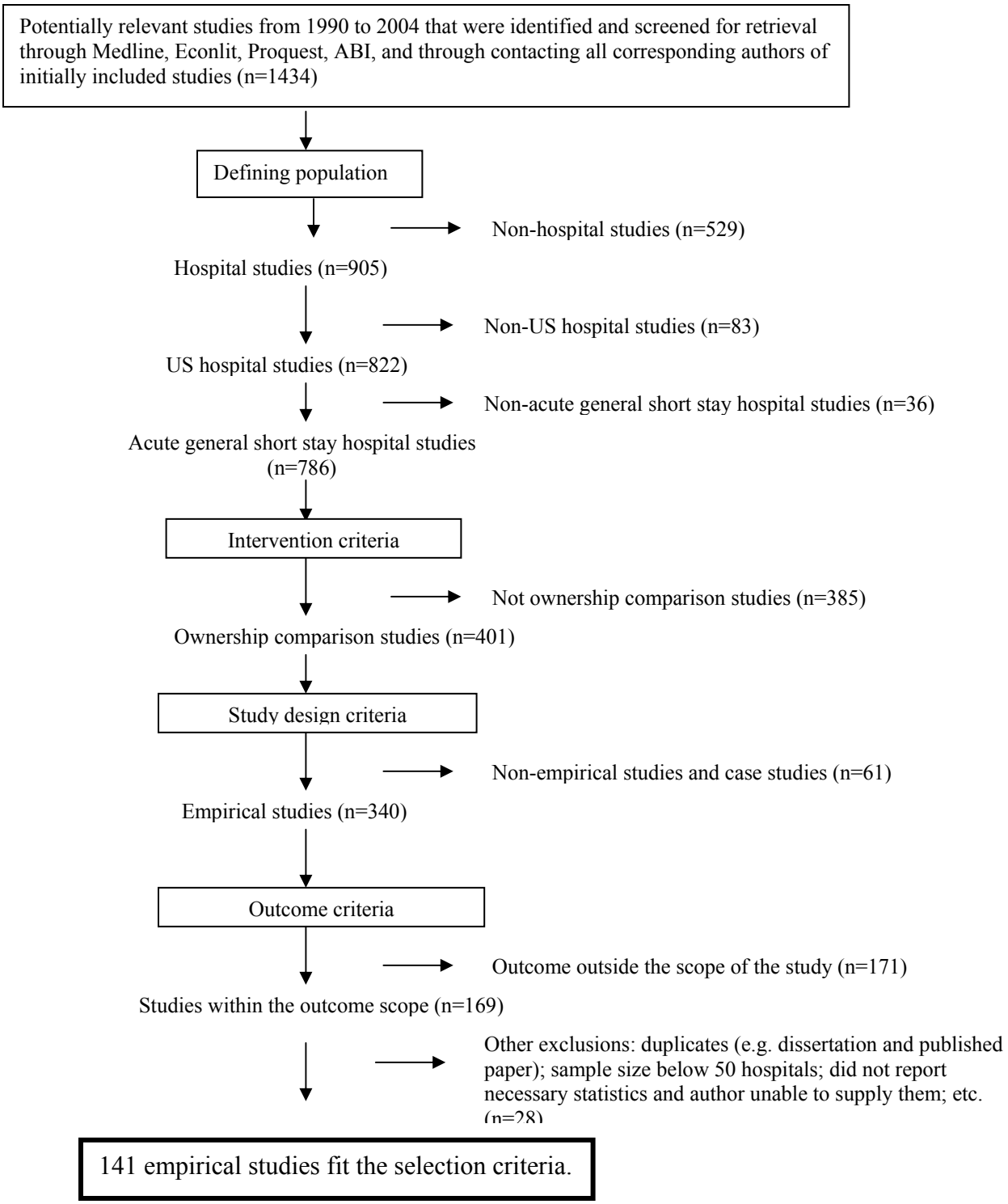
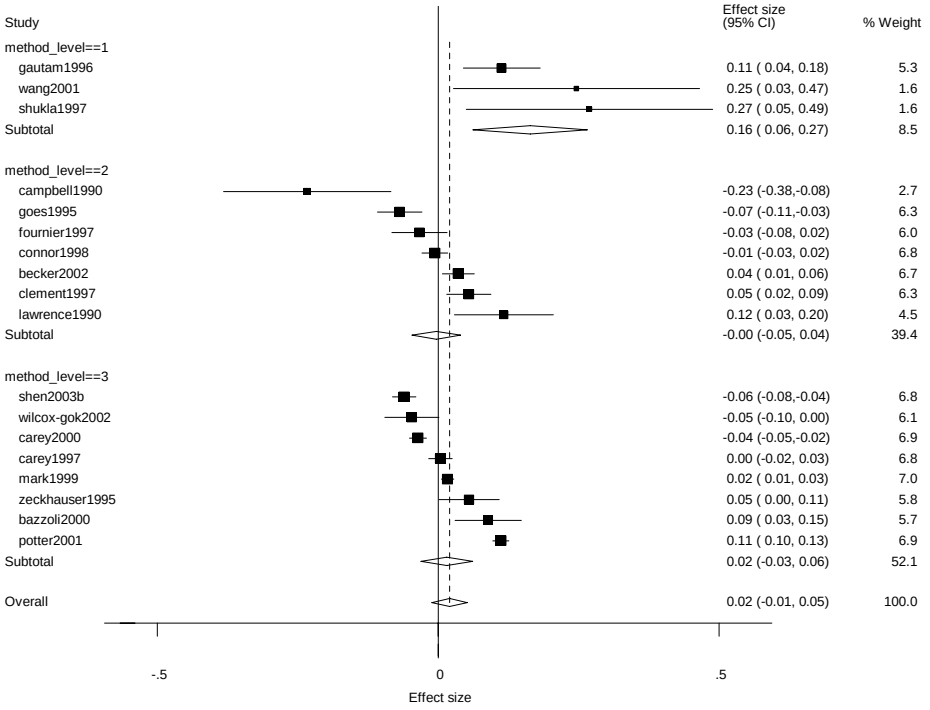
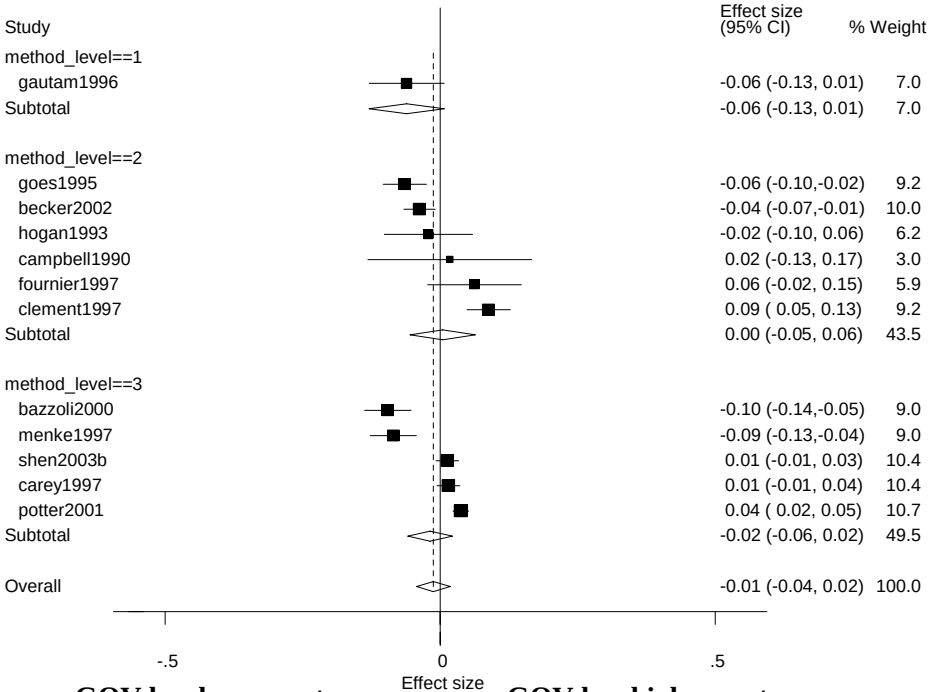


Figure 3. Summary of Effect Sizes For Hospital Cost
3A. Comparison between Not-For-Profit and For-Profit Hospitals



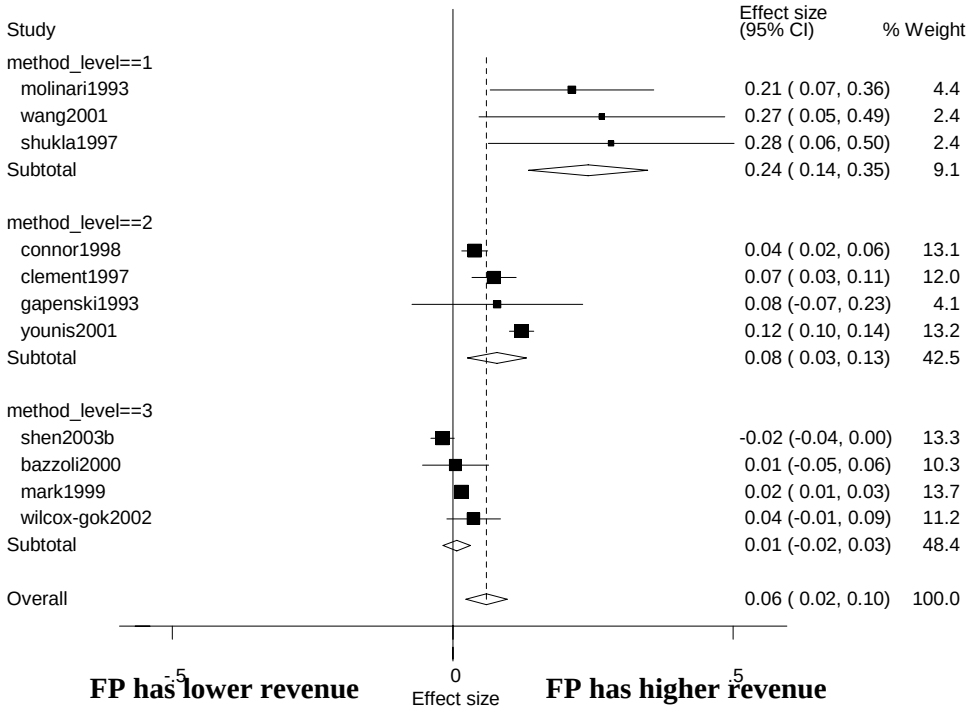
FP has lower cost **FP has higher cost**

3B. Comparison between Not-For-Profit and Government Hospitals



GOV has lower cost **GOV has higher cost**

Figure 4. Summary of Effect Sizes For Hospital Revenue
4A. Comparison between Not-For-Profit and For-Profit Hospitals



4B. Comparison between Not-For-Profit and Government Hospitals

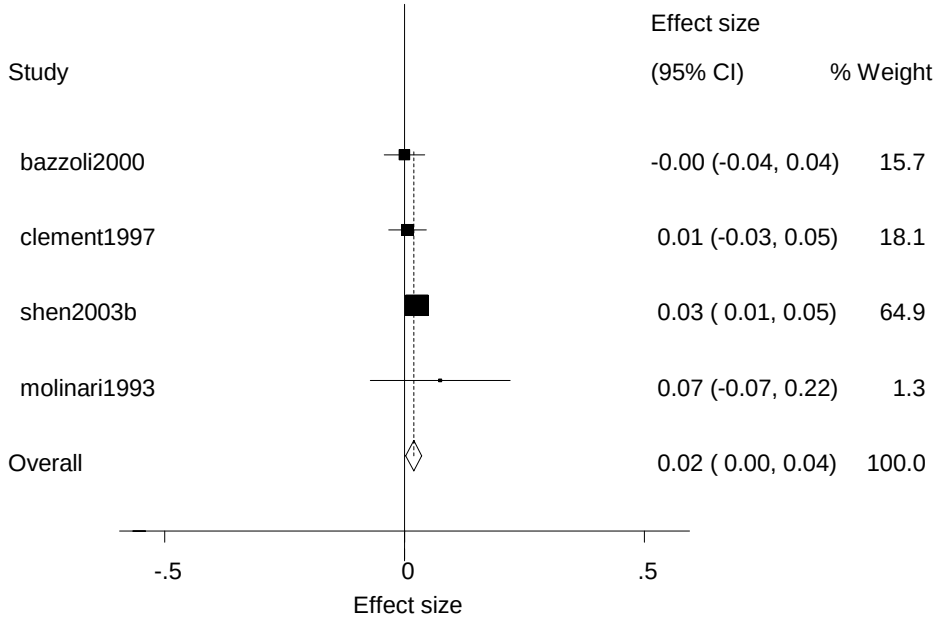
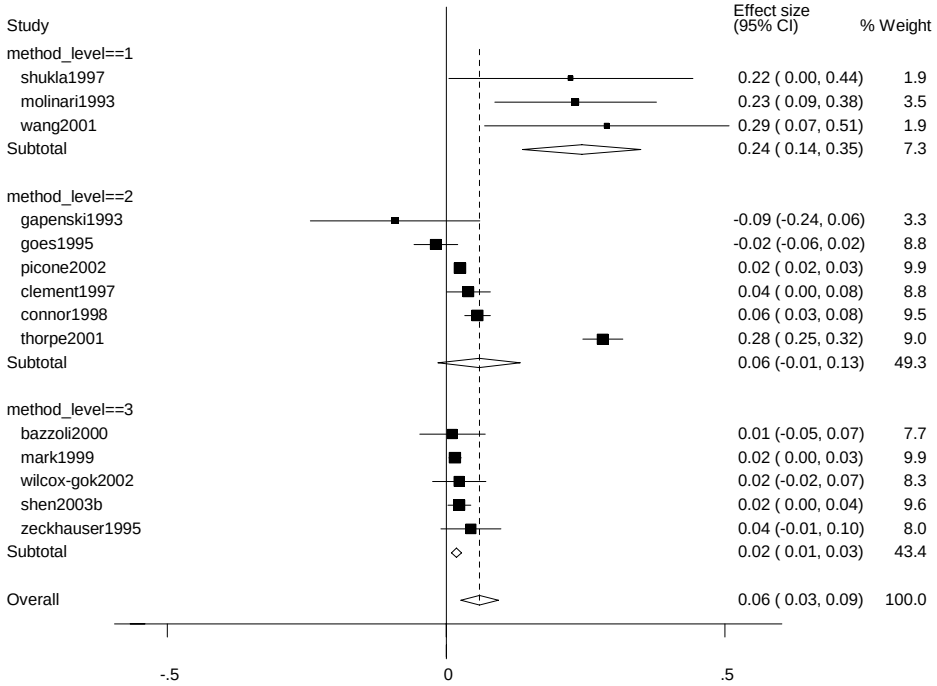
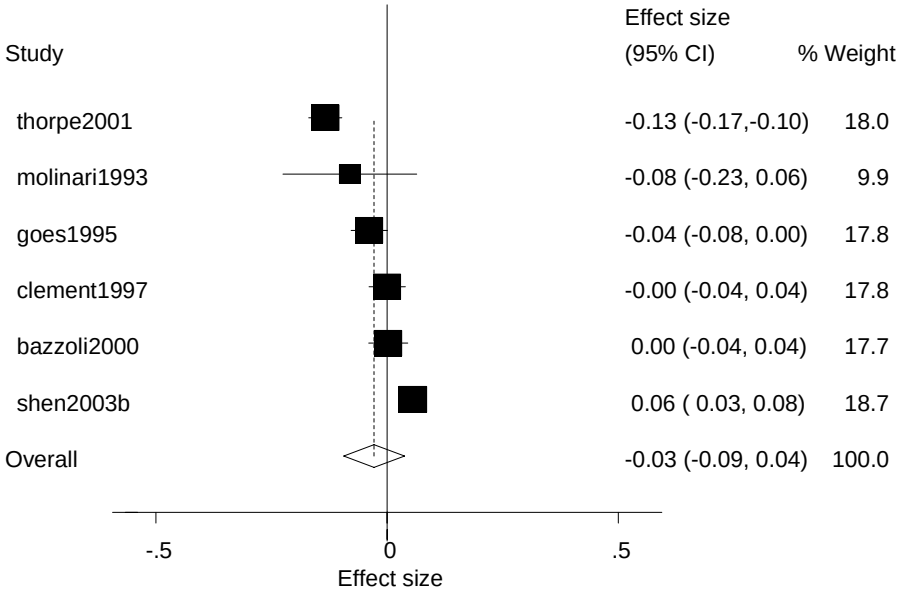


Figure 5. Summary of Effect Sizes For Profit Margins
5A. Comparison between Not-For-Profit and For-Profit Hospitals



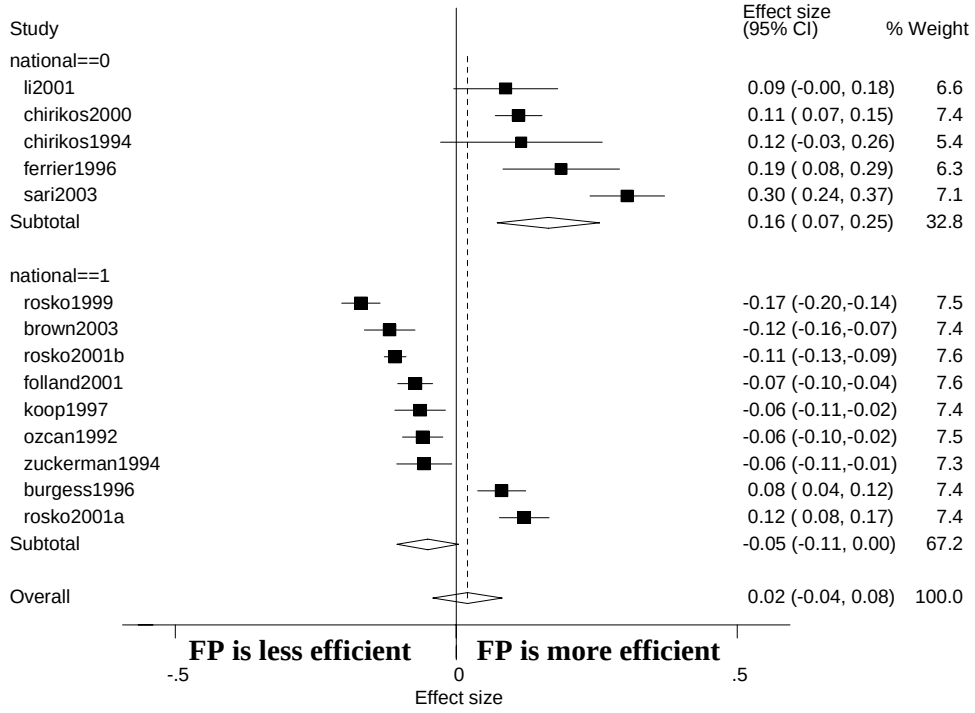
FP earns lower profit **FP earns higher profit**

5B. Comparison between Not-For-Profit and Government Hospitals



GOV earns lower profit **GOV earns higher profit**

Figure 6. Summary of Effect Sizes For Efficiency
6A. Comparison between Not-For-Profit and For-Profit Hospitals



6B. Comparison between Not-For-Profit and Government Hospitals

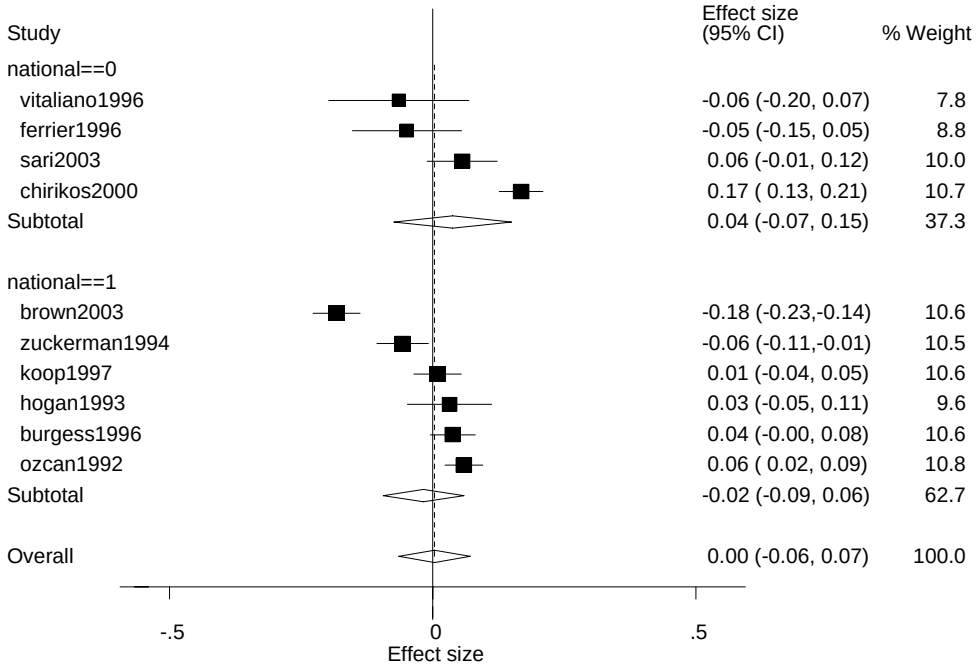


Figure 7. Relationship Between T-Stat and Degrees of Freedom

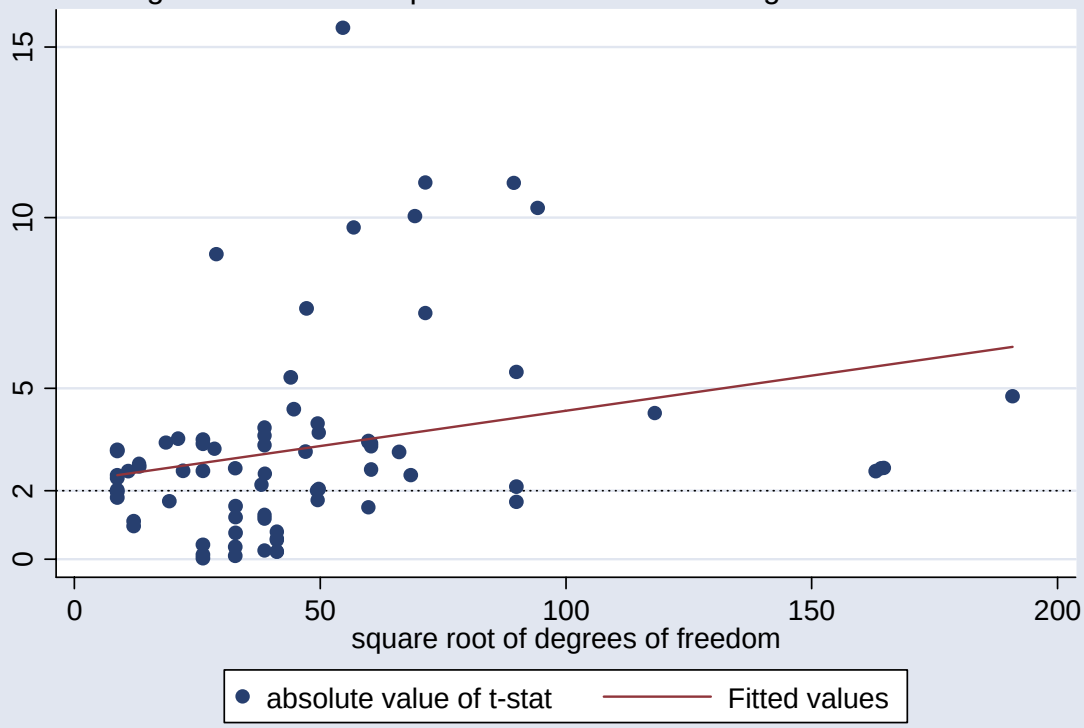


Table 1. Grouping of Financial Performance Studies

	Number of studies that analyzed each outcome	Number of studies with usable information
Outcomes Reviewed		
Operating cost	22	19
Profit margin	17	14
Patient revenue and returns on assets	14	11
Cost and technical inefficiency	19	15
Outcomes Not Reviewed		
Allocative efficiency	2	
Scale efficiency	3	
Cost of a specific disease	5	
Medicare cost	5	
Labor or personnel cost	3	
Debt/asset ratio	2	
Payroll/labor as a share of revenue or expense	2	
Changes in cost	7	
Changes in revenue	3	
Changes in other financial measures	4	
Other financial outcomes	14	
Other efficiency measures	3	

Table 2. Summary of Included Studies[¥]

article ID	Cost	Revenue	Profit Margin	Cost/Technical Efficiency	covered region	covered years		number of years	Total sample size	Type of ownership studied	Use HCRIS data**	Use AHA surveys**
bazzoli2000	X	X	X		US	1995	1995	1	1112	N,F,G	X	X
becker2002	X				US	1994	1994	1	4705	N,F,G		X
brown2003				X	MSA	1992	1996	5	1907	N,F,G		X
burgess1996				X	US	1988	1988	1	2112	N,F,G	X	X
campbell1990	X				FL	1986	1986	1	176	N,F,G		
carey1997	X				US	1987	1991	5	8665	N,F,G	X	X
carey2000	X				US	1987	1992	6	16752	N,F	X	X
chirikos1994				X	FL	1989	1989	1	189	N,F		
chirikos2000				X	FL	1982	1993	12	2232	N,F,G		
clement1997	X	X	X		MSA	1995	1995	1	2462	N,F,G	X	
connor1998	X	X	X		US	1994	1994	1	3617	N,F	X	X
ferrier1996				X	AK, LA, OK, TX	1989	1989	1	360	N,F,G		X
folland2001				X	US	1985	1985	1	2007	N,F	X	X
fournier1997	X				FL	1984	1986	2	534	N,F,G		
gapenski1993		X	X		FL	1989	1989	1	169	N,F		
gautam1996	X				MSA	1990	1992	3	825	N,F,G		X
goes1995	X		X		CA	1981	1990	10	3232	N,F,G		X
hogan1993	X			X	US	1983	1984	2	600	NF,G		X
koop1997				X	US	1987	1991	5	1910	N,F,G	X	X
lawrence1990	X				US	1986	1986	1	499	N,F		X
li2001				X	WA	1988	1993	5	450	N,F		
mark1999	X	X	X		US	1987	1995	8	30459	N,F*	X	X
menke1997	X				US	1995	1995	1	2200	N,G		X
molinari1993		X	X		CA	1985	1985	1	186	N,F		X
ozcan1992				X	MSA	1987	1987	1	3000	N,F,G		X
picone2002			X		US	1985	1995	11	40095	N,F,G*	X	X
potter2001	X				US	1980	1994	4	19453	N,F,G		X
rosko1999				X	US	1994	1994	1	3262	N,F	X	X
rosko2001a				X	MSA	1997	1997	1	1966	N,F	X	X
rosko2001b				X	MSA	1990	1996	7	10388	N,F	X	X
sari2003				X	FL	1990	1997	7	876	N,F,G		X
shen2003b	X	X	X		US	1987	1998	12	8915	N,F,G*	X	X
shukla1997	X	X	X		VA	1993	1993	1	83	N,F		
thorpe2001			X		MSA	1991	1997	7	21000	N,F,G		X
vitaliano1996				X	NY	1991	1991	1	219	N,G		
wang2001	X	X	X		VA	1993	1993	1	83	N,F		
wilcox-gok2002	X	X	X		FL	1984	1987	3	1666	N,F		
younis2001		X			US	1991	1995	2	8019	N,F	X	
zeckhauser1995	X		X		CA, FL	1982	1990	5	11075	N,F		X
zuckerman1994				X	US	1987	1987	1	1600	N,F,G	X	X
Total	**20**	**11**	**14**	**16**								

[¥] The following additional studies are included in the sensitivity analysis: Ettner et al. (2001), Huang et al. (2002), Kessler and McClellan (2002), Sloan et al. (1999), and Bazzoli et al (2004). The complete bibliography information is listed in the reference section.
MSA=Metropolitan Statistical Areas (Urban)
* Studies of ownership conversions
[**]HCRIS is the Healthcare Cost Report Information System, also known as Medicare hospital cost reports; AHA survey refers to the American Hospital Association Annual Survey of hospitals.

Table 3. Share of Studies With A Given Study Feature

Study Features	Cost	Revenue	Profit	Efficiency
Not-For-Profit and For-Profit Comparison Studies				
Methodology classification				
Type 1	9%	31%	15%	28%
Type 2	30%	38%	35%	56%
Type 3	61%	31%	50%	17%
Ownership included as a control variable	42%	46%	40%	39%
Functional form				
Dependent variable is not log transformed	30%	31%		
Dependent variable is log transformed	70%	31%		
Dependent variable is returns on assets		38%		
Assumes a deterministic model (DEA)				39%
Covered region				
National or other state sample	58%	54%	40%	78%
Virginia	6%	23%	10%	0%
California	12%	8%	25%	0%
Florida	24%	15%	25%	22%
Number of observations	18	11	14	14
Not-For-Profit and Government Comparison Studies				
Methodology classification				
Type 1	5%	20%	14%	15%
Type 2	26%	20%	43%	77%
Type 3	68%	60%	43%	8%
Ownership included as a control variable	74%	80%	86%	54%
Functional form				
Dependent variable is not log transformed	42%	60%		
Dependent variable is log transformed	58%	40%		
Dependent variable is returns on assets				
Assumes a deterministic model (DEA)				54%
Covered region				
National or other state sample	89%	80%	71%	77%
Virginia	0%	0%	0%	0%
California	5%	20%	29%	0%
Florida	5%	0%	0%	23%
Number of observations	11	4	6	10

Table 4. Random-Effects Meta Regression: Comparison Between Not-For-Profit and For-Profit Hospitals

Study Features	Dependent Variable is the Standardized Effect Size							
	Cost		Revenue		Profit Margin		Efficiency	
	Coef.	SE	Coef.	SE	Coef.	SE	Coef.	SE
Methodology classification (reference group is Type 1 methodology)								
Type 3	-0.15 **	0.06	-0.28 **	0.05	-0.15 *	0.08	-0.03	0.09
Type 2	-0.19 **	0.07	-0.19 **	0.05	-0.17 *	0.08	-0.04	0.07
Ownership included as a control variable	-0.02	0.03	-0.05 **	0.02	0.03	0.05	0.15 **	0.06
Constant term	0.18	0.06	0.29	0.05	0.21	0.08	0.00	0.06
Proportion of variation due to heterogeneity (I-square)	0.93		0.54		0.93		0.96	
Functional form								
Dependent variable is log transformed	-0.10 **	0.03	-0.05	0.06				
Dependent variable is returns on assets			0.02	0.07				
Assumes a purely deterministic model (DEA)							0.11 *	0.06
Constant term	0.09	0.02	0.11	0.05			-0.01	0.04
Proportion of variation due to heterogeneity (I-square)	0.88		0.82				0.96	
Covered region (reference group is national/MSA sample)								
Virginia	0.21 **	0.09	0.27 **	0.07	0.19 *	0.10		
California	-0.07	0.04	0.17 *	0.09	0.01	0.05		
Florida	-0.12 **	0.04	0.01	0.05	-0.01	0.06	0.17 **	0.07
Constant term	0.04	0.01	0.04	0.02	0.06	0.03	0.00	0.03
Proportion of variation due to heterogeneity (I-square)	0.93		0.91		0.93		0.96	
Number of observations	33		13		20		18	

* p<0.10 ** p<0.05

Note:

1.Each panel represents a separate regression; a positive coefficient indicates that for-profits are associated with a higher level of that dependent variable than private not-for-profit hospitals.

2. The significance test was obtained using the permutation test approach in Higgens and Thompson (2004) to avoid spurious findings

Table 5. Random-Effects Meta Regression: Comparison Between Not-For-Profit and Government Hospitals

Study Features	Dependent Variable is the Standardized Effect Size					
	Cost		Profit Margin		Efficiency	
	Coef.	SE	Coef.	SE	Coef.	SE
Methodology classification (reference group is Type 1 methodology)						
Type 3	0.04	0.05	0.08	0.14	0.10	0.16
Type 2	0.05	0.05	0.02	0.13	0.10	0.10
Ownership included as a control variable	-0.05 **	0.02	-0.05	0.11	0.04	0.07
Constant term	-0.01	0.05	-0.03	0.16	-0.09	0.11
Proportion of variation due to heterogeneity (I-square)	0.67		0.93		0.96	
Functional form						
Dependent variable is log transformed	-0.003	0.02				
Assumes a purely deterministic model (DEA)					0.04	0.06
Constant term	0.000	0.02			-0.01	0.04
Proportion of variation due to heterogeneity (I-square)	0.78				0.94	
Covered region (reference group is national/MSA sample)						
California	-0.06	0.04	-0.04	0.08		
Florida	0.05	0.05			0.15 **	0.05
Constant term	0.00	0.01	-0.01	0.04	-0.02	0.03
Proportion of variation due to heterogeneity (I-square)	0.75		0.95		0.90	
Number of observations	20		7		13	

* p<0.10 ** p<0.05

Note:

1.Each panel represents a separate regression; a positive coefficient indicates that government hospitals are associated with a higher level of that dependent variable than private not-for-profit hospitals.

2. The significance test was obtained using the permutation test approach in Higgens and Thompson (2004) to avoid spurious findings