Outsourcing and Ownership: Theory and Evidence from California General Care Hospitals

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Abstract

For-profit hospitals in California contract out to a much greater extent than either public hospitals or private non-profit hospitals. To explain why, we build a model in which the outsourcing decision is a trade-off between net revenues and quality. Since non-profit firms must consume profits indirectly through perquisites, they will trade-off differently from for-profit firms. This difference will be emphasized when quality is important or the firm is hit with a positive net-revenue shock. We test these predictions in a panel of California hospitals, finding evidence for each. These results suggest that a model of public or non-profit make-or-buy decisions should be more than a simple relabeling of a model derived in the for-profit context.

JEL Classification: XX

Keywords: Hospitals, Make-or-Buy, Public versus Private, Non-Profit Firm Behavior

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If you want a thing done well, do it yourself. - Napoleon Bonaparte

1 Introduction

For-profit, non-profit, and public hospitals in California vary significantly in the extent to which they outsource the provision of services. During the years 1998-2006, for-profit short-term general-care hospitals outsourced 25.7 percent of the cost of an average with outside providers, with 5.5 percent of services completely outsourced. Nonprofits outsourced a significantly smaller amount, 18.9 percent of the cost of an average service, with 2.9 percent of services completely outsourced. The rates for public hospitals were similar to private non-profits.[1] In this paper, we use a rich dataset of California hospitals with service-specific measures of output and contracting to investigate the reasons for these differences.

We begin by reviewing the institutional environment in which California hospitals find themselves, and what is currently known about the drivers of the make-or-buy decisions in the public and private sector. Motivated by a number of features of the market and the literature, we build a simple model of the outsourcing decision by extending the well-known model of non-profit entrepreneurship by Glaeser and Shleifer (2001) to include a make-or-buy decision. The key result is that whenever the outside producer has a comparative advantage in providing relatively low-quality service, outsourcing is more attractive to for-profit firms than it is for non-profit firms. Furthermore, this difference is amplified when quality is particularly important or net incomes (profits) are high, but a fixed cost shock that lowers net incomes leads the nonprofit firm to conform its behavior more closely to the for-profit firm's.

Before investigating our proposed mechanism, it's important to verify that the differences we observe are not merely due to differences in average circumstances among the three ownership classes. Our first empirical result, in section 3.2 is that the difference in mean outsourcing rates across ownership classes is robust to a variety of controls, including hospital size and scope, service-specific output, presence of a residency program, market characteristics, and service, year, and county fixed effects. We take these results to mean that for-profits firms are making these decisions in very different ways than non-profit firms, and different outsourcing decisions are not merely driven by other differences in circumstance.

Given this important underlying difference in outsourcing, we present in section 3.3 some evidence that the underlying driver for this difference may be the differential rates of substi-

[1] In California there are two major classes of public short-term general-care hospitals, district and county. These two types are discussed in detail below, but district hospitals outsourced a bit more than private non-profits and county hospitals outsourced the least of all.

tution between income and quality that we outline in our model. We investigate predictions on both sides of the trade-off. We begin by comparing outsourcing differences across services which differ in the importance of quality. We find that the differences in outsourcing between for-profits and private non-profits are much bigger for revenue-generating services in which quality may be more important (like cardiology or burn care) than non-revenue-generating services (like grounds keeping or parking). In fact, for nonrevenue-generating services in which quality may be less important, there are no significant differences in the extent of outsourcing between for-profit and private non-profit hospitals. Public hospitals, by contrast, do not seem to be very differentially responsive to quality concerns: they consistently outsource less than for-profits across both classes of services.

A second prediction the arises in the model is that non-profits should come to look more like for-profit with respect to the trade-off between costs and quality as a fixed cost shock forces them to approach the shut-down constraint. We test this prediction by observing how the difference in outsourcing responds to an exogenous shock to fixed costs hospitals incurred due to the California seismic retrofitting requirements. We also find non-profit and public hospitals that are forced by regulatory mandate to absorb the cost of a large seismic retrofitting project respond by bringing their outsourcing decisions more in line with for-profits' decisions than those with no such cost shock (Chang and Jacobson 2011).

Our investigation of this phenomenon contributes to at least two literatures. First, there is a very well-developed literature on the "make-or-buy" decision. The majority of this literature has focussed on for-profit firms (for a review, see Lafontaine and Slade (2007)), but there is a burgeoning literature using similar techniques and models to understand the method by which public entities provide services (Hart, Shleifer and Vishny 1997, Martimort and Pouyet 2008, Levin and Tadles 2010). Hospitals are a particularly intriguing organization to investigate, because the organizational forms span for-profit, private non-profit, and various sorts of publicly-owned institutions. Nearly every empirical investigation of outsourcing has focused on one ownership type, so there is real novelty in the ability to compare and contrast the decisions in this industry in order to understand to what degree the make-or-buy decision is driven by the essentially "public" or "non-profit" character of the firm and to what degree it is driven by those economic conditions that are the primary determinants in the for-profit case. We find large differences by ownership type and show that those differences are consistent with a model in which non-profits are induced by non-distribution constraints to trade-off costs versus quality at a different rate than for-profit firms do.

Second, there is a large literature on the effects of non-profit status on the behavior

of firms, in general, and hospitals, in particular.[2] This literature has been particularly concerned with the effect of ownership on the provision on quality service (Sloan, Picone, Jr. and Chou 2001, Picone, Chou and Sloan 2002, Eggleston, Shen, Lau, Schmid and Chan 2008), but also on the role of competition (Duggan 2002), and the deeper question of what drives non-profit behavior, more generally (Deneffe and Masson 2002, Horwitz and Nichols 2009, Chang and Jacobson 2011). We discuss several of these papers in detail, below, but the paper most related to ours, both in context and approach, is Chang and Jacobson (2011), which looks at hospitals in California and also uses seismic retrofitting as a exogenous cost shock. While they are concerned with the deep question of "what non-profits maximize," we have a much more defined goal of looking at one aspect of the production decision, outsourcing, to highlight an under-appreciated difference in the way non-profit firms conduct their affairs. We see our work as complementary to theirs, as we identify an additional dimension along which "perquisite maximizing" non-profits differ from their "profit-maximizing" kin.

2 Institutional Background and A Model of Outsourcing

In the first two sub-sections we provide some background on the structure of the California hospital system, what is known about for-profit and non-profit firm behavior, and briefly review the relevant literature about the drivers of the make-or-buy choice. In the third, we present a model of the outsourcing behavior of for-profit and non-profit hospitals and derive a number of testable implications.

2.1 The Hospital Industry and For-Profit and Non-Profit Behavior

With the exception of federally operated hospitals like the VA, short-term general care hospitals in California are organized in one of four forms: for-profit, nonprofit, county, and district. For-profit hospitals have a private residual claimant on profits, either shareholders or some limited partnership. Private non-profits are 501(c)(3) registered charitable organizations. To qualify for federal tax-exempt status, they must demonstrate that they operate for a"charitable purpose," and that no part of the organization's net earnings accrue to the

[2]For a nice synthetic summary of the general issue of non-profit behavior, see Malani and David (2003). The particular issues in the context of hospitals are nicely summarized by Sloan (2000).

benefit of any private shareholder or individual. Public county hospitals are operated as part of the budget of the county, usually overseen by a board appointed by the county board of supervisors. Public district hospitals are controlled by a board of directly elected representatives by the residents on one of California's 85 health districts (although not every district operates a hospital). They are funded by taxes at the district level, patient receipts, and intergovernmental transfers, and they are part of a network of public health care providers within the district.[3]

The diversity of hospital ownership types, coupled with the importance of the services they produce, has led to a large literature on the effects of ownership type on behavior. In particular, the question of whether for-profit or non-profit hospitals provide higher quality service is one that has invited intense scrutiny in the health economics literature. There is broad evidence that non-profit hospitals provide higher quality service than their for-profit peers along a number of dimensions. In a 2008 review, Eggleston et al. (2008) found 31 empirical studies that addressed the question of the relation between hospital ownership and quality. Pooling all these studies into a meta-analysis, they conclude that "Studies representative of the US as a whole tend to find lower quality among for-profits than private non-profits." Rosenau and Linder (2003) perform a more qualitative meta-analysis of nearly 150 studies, and conclude that non-profits perform higher quality treat in 59% of the cases, while for-profits are superior only 12 % of the time (the remainder is no difference). Picone et al. (2002) find that U.S. hospitals converting from non-profit to for-profit status reduce quality on dimensions that are difficult for outsiders to observe, such as patient mortality. But these findings are not universal. Sloan et al. (2001) finds little evidence of differences between nonprofits and for-profits in either quality or cost.

In addition to differences in "quality", the literature has investigated a number of other dimensions along which non-profit and public hospitals differ from for-profit hospitals in their production choices. Horwitz (2007) finds that non-profit firms offer a broader range of services than for-profit, especially those that have smaller profit margins. In contrast, Castaneda and Falaschetti (2008) finds that the scope of services is little related to ownership type, but is instead primarily determined by local demographics. Bayindir (2012) finds that non-profits are more likely to use costly procedures to treat uninsured patients than for-profits, with public hospitals being even more likely still (note, however, that Joseph J. Doyle, Graves, Gruber and Kleiner (2012) finds little relationship between "appropriate care", as

[3]In fact, the situation is even more complicated by the fact that certain Districts license non-profit or for-profit providers to operate hospitals for them. We code these as for-profit or non-profit, since the licensees are residual claimants on profits and have managerial discretion in structuring operations. For more detail about the governance structures employed by California public hospitals, see http://www.chcf.org/publications/2009/05/governance-models-among-california-public-hospitals

measured by procedures, and patient outcomes). Ballou and Weisbrod (2003) find that non-profit hospitals incentivize their senior leadership very differently from how for-profit hospitals do. Non-profits pay higher fixed salaries and rely much less on bonus incentives. Furthermore, when they do pay bonuses, non-profits reward quality of care rather than financial performance. Public hospitals hardly ever offer bonuses.

A related question is how firms with different ownership types respond to changes in their economic environment. Duggan (2002) finds that not-for-profit hospitals begin to act more like for-profits, in terms of attracting high-value patients, when they come into greater competition with for-profits. Chang and Jacobson (2011) find that private non-profits increase their performance of profitable services when they are hit with a fixed cost shock, while public hospitals decrease their provision of charity care, both coming more in line with for-profits. Clark and Milcent (2011) find that French public hospitals employ more people than either private type, and uniquely increase employment as the local unemployment rate rises.

Finally, there is the big picture question of "what non-profit firms maximize" (Deneffe and Masson 2002, Horwitz and Nichols 2009, Bayindir 2012, Chang and Jacobson 2011). For a summary, see Malani and David (2003). Of course, every paper that examines differences in behavior touches on this question, at least implicitly. The vast evidence of real differences in behavior certainly suggests that non-profits are different in some significant way (not simply "for-profits in disguise"). Similarly, the fact that negative market shocks lead nonprofits to look more like for-profits suggests that they are not best modeled as "pure altruists." This leaves two dominant models of non-profit behavior, "Output maximizers" (Newhouse 1970), in which non-profits care about output per-se, and "Perquisite Maximizers" (Glaeser and Shleifer 2001), in which non-profit managers cannot consume profits, per se, and must instead use excess revenues to purchase perquisites, the marginal utility of which diminishes at a more rapid rate than profits. As Chang and Jacobson (2011) note, these two models are very difficult to disentangle, once we take into account that "output" includes both quality and quantity dimensions. Basically, "gold plating" style perquisites are very difficult to tell apart from high quality output, especially in contexts where some perquisites, like first rate facilities, are actually productive put perhaps inefficiently so. MORE???

2.2 Make or Buy

The so-called "Make or Buy" question is one of the oldest in economics. Economists have studied the determinants of the boundary of the profit-maximizing firm for many decades, and the theoretical and empirical literature is very robust and developed (Lafontaine and

Slade 2007). The positive and normative analysis of the boundaries of other sorts of organizations is not nearly as well developed. Some of the techniques developed in our theory of the firm have been modified to shed light on the boundaries of the government (Hart et al. 1997, Hart 2003, Martimort and Pouyet 2008, Iossa and Martimort 2012). The boundaries of other sorts of organizations, such as non-profit firms, have hardly been explored at all.[4]

Much, if not all, of the empirical work on the make-or-buy decisions of non-profit organizations has focused on public non-profits. These studies of the "boundary of the government" have looked at polities' decisions on the method of service provision: provision with public employees, contracting with other public providers, contracting with private providers, or private-public partnerships (Nelson 1997, Lopez de Silanes, Shleifer and Vishny 1997, Brown and Potoski 2003, David and Chang 2009, Levin and Tadles 2010). For a summary and meta-analysis of one of the major branches of this literature, municipal service provision, see Bel and Fageda (2009). In broad brush, these studies seem to find that fiscal constraints, economies of scale, interest groups, and ease of contracting all play a role, but the importance of these factors varies with context. The most common conclusion is that both politics and economic efficiency matter for driving outsourcing choices.

To illustrate, consider a recent paper by Levin and Tadles (2010). They build an incomplete-contracting model of outsourcing, in which outsourcing induces strong incentives for cost savings but requires significant contracting costs. On a sample of about 1000 U.S. municipalities they find evidence for the most direct implications of the model–that services that are more difficult to specify contractually or for which citizens are most sensitive to quality are most likely to be done in house. Moving beyond the formal implications of the model, they also find contracting out more prevalent in cities that are new, large, fiscally constrained, and run by professional managers. Furthermore, they find that large and new cities are more responsive to the economic factors (in the sense that they adjust their outsourcing behavior more as contracting gets more difficult).

An obvious question to ask is the extent and direction that the decisions these non-firm organizations deviate from the profit-maximizing choice, but these studies are unable to address that question. In other words, addressing what is essentially "public" or "non-profit" about their choices is difficult. Since these studies lack a control group of profit-maximizers, the analyses are necessarily comparative static in nature. If a factor changes that makes

[4]We differentiate between the question of how non-profit firms decide whether to outsource or not and the question of what sort of firm an outsourcing entity chooses to contract with. Bennett and Iossa (2010) have looked at the advantages of choosing a non-profit as the contracted provider of government services, but since we have no data on the identity of the contracted provider, we cannot address this question

contracting more costly, we see less contracting, presumably because of efficiency concerns. But without a baseline measure of the profit-maximizing outsourcing decision and how a profit-maximizer reacts to shifts the underlying contracting environment, it is difficult to make much of the levels or to see if the reaction is different from than that we would expect from a profit-maximizer.

The one study that can make some comparisons is Coles and Hesterly (1998), looking, as we do, at outsourcing in hospitals. Although their primary interest is to test whether a transaction-costs model can explain the pattern of outsourcing across services, they do a brief contrast between the outsourcing decisions of public and private hospitals. In one specification, they estimate the effects of TCE drivers of outsourcing for public and private hospitals separately, and they find that public firms are less responsive to TCE drivers of contracting out than private firms. Although we do not have service-specific measures of contracting costs, we also find that public non-profits are less responsive to the factors that seem to drive outsourcing among private non-profits, like the importance of quality and cost shocks that tighten of the budget constraint.

2.3 A Theoretical Framework

Consider a model of non-profit behavior that borrows heavily from Glaeser and Shleifer (2001), but adds an outsourcing decision. Assume firms solve

$$\max_{\pi,Z,q} u(\pi, Z, q) = \pi + v(Z) + bq,$$

subject to

$$\pi + Z \leq I(q) - F,$$

where $I(q)$ is income, net of variable costs, as a function of quality (q); $v(Z)$ is the increasing and concave returns to perquisites (Z), with $v'(0) = 1$; b is a preference for quality, and π is profits. As a normalization, let $q = 0$ represent the income-maximizing quality level, so $I(q)$ is concave and decreasing in q.[5] Finally, nonprofits have an additional constraint to set profits at zero, so they must consume income as perquisites.

Let q^{fp} and q^{np} represent the maximizing choices for firms of each type of firm, and the

[5]Since their interest is in explaining why some firms choose the be non-profit, Glaeser and Shleifer (2001) model quality as non-contractible and focus on weakened incentives among non-profit to reduce costs as a commitment device for maintaining high quality. In equilibrium, this leads to higher revenues, which can make up for the requirement to consume revenues through perquisites. We ignore the complication of non-contractible quality to keep the model stark, but the key results below would still hold in the context of non-contractible quality.

associated incomes $I^j \equiv I(q^j) - F$. Figure 1 represents the optimal income/quality choice of each type of firm. Quality appears on the $x - axis$ and income on the $y - axis$. The solid black curve is the in-house production possibilities, and the optimal choices of each firm type are given by the black dots on that production curve. The indifference curves of the for-profit firm that deliver that choice are given by the straight black lines with slope $-b$, and the indifference curves for the non-profit firm are given by the red curved lines that begin with the same slope as the for-profit, but get steeper as income increases. The familiar tangency condition assures that $q^{fp} < q^{np}$. Inuitively, since the marginal value of perquisites is always less than that marginal value of profits, nonprofits choose higher quality than for-profits do.

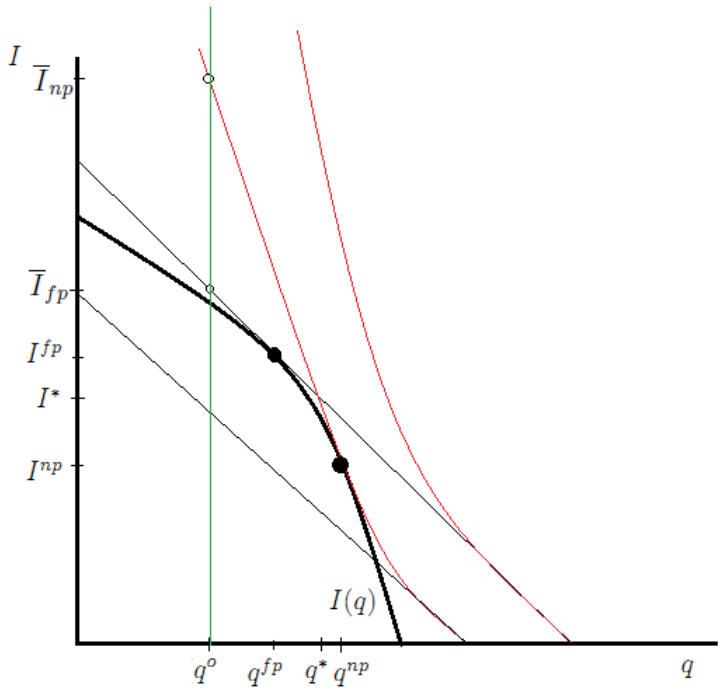
Outsourcing Assume now that instead of producing in-house, the firm could choose to outsource production to some third party. Given some q, let $\overline{I}_j(q)$ represent the cutoff income such that a firm of type j would choose the pair (q, I) over in-house production for any $I \geq \overline{I}_j(q)$. Figure 1 illustrates these cutoffs for one particular quality level, labeled q^o. For that quality level, $\overline{I}_{np}(q_o) > \overline{I}_{fp}(q_o)$, so the for-profit would find outsourcing at this quality level more attractive than the non-profit would (in the sense that he would require lower income to choose it over own-production).

Since non-profit firms and for-profits firms trade off between quality and income at different rates, the non-profits will be more attracted to an offer with relatively high quality production, even if it has relatively low income, and vice versa. Intuitively, the optimal internal production of a firm of type j lies on some indifference curve, which we are labeling $\overline{I}_j(q)$. Since the marginal rate of substitution between quality and income for the for-profit firm is always smaller (in absolutely size) than that of the non-profit firm, these two indifference curves cross exactly once and the crossing occurs between their optimal points. The following proposition formalizes this intuition. Proofs for all propositions are in the Appendix.

Proposition 1 *This offer consists of a frontier of income-quality pairs $I^o(q)$. There is a unique combination (q^*, I^*) such that $u(0, I^*, q^*) = u(0, I^{np}, q^{np})$ and $u(I^*, 0, q^*) = u(I^{fp}, 0, q^{fp})$. This combination is bracketed by the other two, in the sense that $q^{fp} < q^* < q^{np}$ and $I^{fp} > I^* > I^{np}$. Furthermore,*

1. *If $q \geq q^*$ then $\overline{I}_{np}(q) \leq \overline{I}_{fp}(q)$.*
2. *If $q \leq q^*$ then $\overline{I}_{np}(q) \geq \overline{I}_{fp}(q)$.*

Figure 1: Optimal In-House Production and Outsourcing Income Threshold by Firm Type

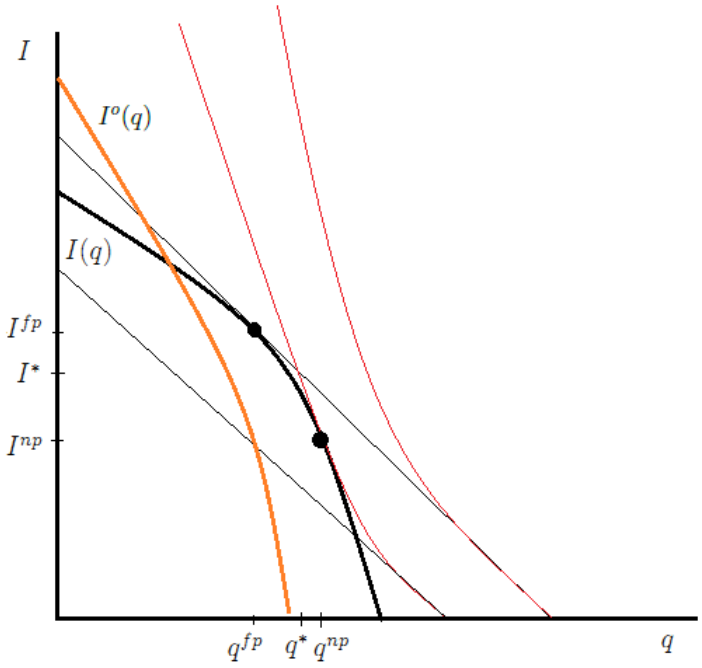


Finally, let $I^o(q)$ represent the frontier of income-quality pairs available through outsourcing. A firm of type j will outsource if and only if there is some quality level such that $I^o(q) > \overline{I}_j(q)$.

From this proposition, we can characterize when to expect non-profit firms to outsource more than for-profits and vice-versa. Intuitively, if outsourcing is the low-cost and low-quality option, we should see for-profit firms outsourcing at a higher rate. If outsourcing is the high-cost and high-quality option, we should see non-profit firms outsourcing at a higher rate. It goes without saying that if outsourcing is both low-cost and high-quality, everyone will outsource, and if it is high cost and low quality, no one will.

Figure 2 represents a situation in which the outsourcing opportunity is relatively efficient for low quality output, but producing in-house is relatively efficient for high-quality output. The orange frontier labeled $I^o(q)$ represents the outsourcing opportunities. It is above the in-house production frontier (labeled $I(q)$) only for low-quality outputs. Given this arrangement of production possibilities, there are outsourcing opportunities above the for-profit firm's relevant indifference curve, but all outsourcing opportunities are below the non-profit firm's relevant indifference curve. Thus, the for-profit firm chooses to outsource, while a non-profit firm does not.

Figure 2: Outsourcing Opportunity Set Where For-Profit Firm Outsources but Non-Profit Firm Does Not



The following corollary formalizes these ideas.

Corollary 1 *If $I^o(q) > I(q)$ only if $q < q^*$, then a non-profit firm will outsource only if an otherwise identical for-profit firm does. If $I^o(q) > I(q)$ only if $q > q^*$, then a for-profit firm will outsource only if an otherwise identical non-profit firm does.*

In addition to the direct contrast in outsourcing behavior for fixed parameters, the comparative statics differ by firm type. As quality becomes more important (b increases), a larger income advantage must be available to induce firms to outsource to a low-quality producer. Of course, since non-profits must consume this income through perquisites, the effect is more pronounced for them.

In a very similar way, a shock to fixed costs (F increasing) will differentially affect the two firm types. For profit-maximizing firms, changes in fixed costs have no effect on behavior (assuming profits remain non-negative). But a non-profit firm's marginal benefit of increasing income depends on the level of fixed costs. If F rises, the marginal benefit of additional perquisites rise. An opportunity to outsource to a low-quality/high-income producer becomes differentially attractive to a non-profit firm an fixed costs rise.

The following proposition formalizes these two comparative statics.

Proposition 2 *If $q < q^*$, then $\overline{I}_{NP}(q) - \overline{I}_{FP}(q)$ is positive and increases in b and decreases in F.*

Obviously we cannot observe the actual cutoffs, but we interpret proposition to mean that the difference between nonprofit and forprofit firms' outsourcing behavior should increase in the importance of quality and decrease in fixed cost shocks. In the next section, we will test these propositions.

3 Outsourcing and Ownership

3.1 Data Description and Summary

We examine the determinants of outsourcing behavior on an unbalanced panel of 423 short-term care general services hospitals that operated in California during 1996-2008. These data come from the Annual Financial Data series from the California Office of Statewide Health Planning and Development (OSHPD). For each hospital, we know a wide variety of ownership, financial, and operating characteristics, including ownership class, number of licensed and staffed beds, patient mix, and location. There are 103 unique services, excluding

several broad catch-all categories and all medical research and education services, although not every hospital has every service. The median hospital has 56 services while the mean has 54.

The OSHPD divides services into revenue-generating and non-revenue-generating services, and further divides them into 6 broad categories. Among the revenue-generating services, they demarcate 23 "Daily Hospital Services," including things like coronary care, pediatric intensive care, and burn care; 11 "Ambulatory Services"– emergency services, observational care, and home health care; and 33 "Ancillary Services"– anesthesiology, echocardiology, and radiology. Among the non-revenue-generating services, they demarcate 15 "Administrative Services"– public relations, medical records, utilization management; 16 "General Services"– printing and duplicating, security, plant operations; and 5 "Fiscal Services"– general accounting, credit and collection, and admitting.

We used a cost-based measure of service-specific outsourcing. These data include service-specific cost and output figures, including a breakdown of costs into ten broad categories. Two of these cost categories, "Purchased Services" and "Professional Fees", include contracts for service provision by outside providers.[6] For each service-hospital-year observation, we form our measure of outsourcing,

$$PctOut_{hst} \equiv \frac{PurchasedServices_{hst} + ProfFees_{hst}}{TotalDirectCost_{hst}} \times 100.$$

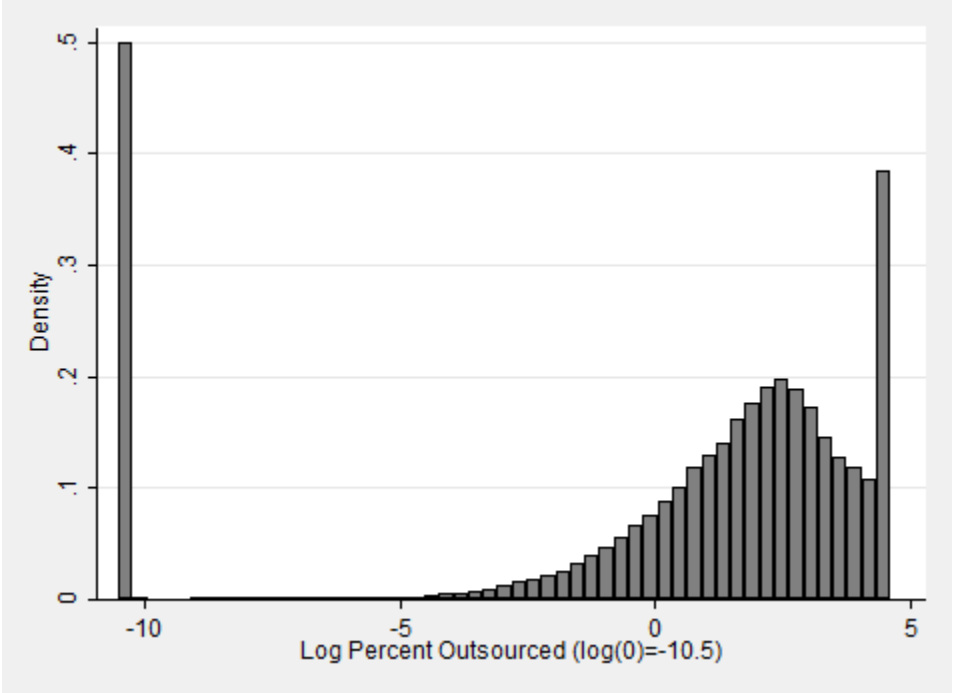
Our goal is to explore how and why this measure varies by hospital ownership form.

Services vary considerably in the average degree of outsourcing. "Renal Dialysis" is the most outsourced service in our sample, with an average of 75.9 percent of costs going to outside providers, while "Medical Supplies Sold to Patients" is the least outsourced. Considered in a different way, "Satellite Ambulatory Surgery" is the service that the most hospitals outsource to any degree, while "Drugs Sold to Patients" is the service done completely in house more often than any other. The distribution of the natural log of this outsourcing measure is presented in a histogram in Figure 3, where $log(0) \equiv -10.5$, just below the lowest non-zero observation. It is obviously highly skewed with a large mass at zero, so we will investigate both the intensive and extensive margins, where we define $AnyOut_{hst}$ as indicator variable that is one whenever $PctOut_{hst} > 0$ and zero otherwise.

OSHPD also reports service-specific output. The specific measure of output varies con-

[6]The Purchased Services category includes medical, repairs and maintenance, medical school contracts, management services, collection agencies, and other purchased services. The Professional Fees category includes physician's fees, therapist fees, consulting and management fees, legal, audit, registry nursing personnel, other contracted services, and other professional fees.

Figure 3: Distribution of Outsourcing (log(pctout))



siderably by service. For example, the measure of output for all daily hospital services is "patient days", and for most ambulatory services it is "visits", but for ancillary services it is very service-specific: deliveries, operating minutes, tests, or sessions. For the non-revenue-generating services, it also varies a lot. The measure for the printing and duplicating service is "reams of paper," while that for the social work services is "number of personal contacts."[7] Since these measures are not commensurable, we will also allow the coefficient on output in any regression to vary by service.

For hospital covariates we included various measures of size, scope, and mission. We include the number of staffed beds and number of services offered as a time-varying measure of the size of the hospital, as well as year and service fixed-effects. We include the fraction of patient days that are from Medicare and Medical patients, since different patient mix may lead to different activities, even without our service measures. We include a dummy for the hospital having a residence program, since they may give a particular incentive to do work in house, for training purposes. We also include a dummy for whether the state of California considers the hospital to be "rural", since the opportunities to outsource may be less in a less developed market. We will also include county fixed-effects to control for the general

[7] A complete list of services and output measures available at http://www.oshpd.ca.gov/HID/Products/Hospitals/AnnFinanData/Manuals/index.html

market in which the hospitals find themselves.

To capture a fixed-cost shock, we use a regulatory requirement that was enacted in California in 1994 and went into effect in 1998 requiring short-term general care hospitals in earthquake zones to meet relatively strict engineering standards (SB 1953). The first deadline for this mandate for meeting the loosest standard (no SPC-1, extremely vulnerable, buildings) was January, 2008. A stricter standard (no SPC-2, vulnerable, buildings) was mandated for January, 2030. For many hospitals, meeting this requirement involved very extensive retrofitting of existing buildings, and most have preferred to construct new buildings, at costs of tens to hundreds of millions of dollars (Meade and Hillestand 2007). In practice, these deadlines have been extended for hospitals making progress toward the goal. The actual costs incurred to retrofit or construct new buildings that meet the mandate will be endogenously determined by the firm, but the extent of seismic safety requirements is primarily determined by the peak ground acceleration in the location– a measure of earthquake risk (Meade, Kulick and Hillestand 2002). It is this exogenous characteristic we will use as our measure of fixed costs, where we measure peak ground acceleration as the maximum fraction of the acceleration of gravity that will occur with a 10-percent probability over the next 50 years. Higher peak ground acceleration means a larger cost shock. See Chang and Jacobson (2011) for an extensive discussion of the implementation of the mandate, and an overview of the relationship between peak ground acceleration and costs.[8]

Finally, we include market-level characteristics covering population, socioeconomic characteristics, and demographics. Market characteristics were taken from the U.S. Census Records for the years 1996-2006 and from the American Community Survey for 2006-2010. Census and ACS variables were matched at the zipcode level into corresponding hospital service areas of each hospital. Hospital service areas (HSAs) are local health care markets for hospital care. An HSA is a collection of zipcodes whose residents receive most of their hospitalizations from the hospitals in that area. HSAs are defined by assigning zipcodes to the hospital area where the greatest proportion of their Medicare residents were hospitalized, with minor adjustments for geographic continuity. To control for the size of market, we include total population estimates. Socioeconomic and demographic characteristics include median household income, education attainment, and race percentages within the total population. We also have, from the Bureau of Labor Statistics, the average unemployment rate for the year in the hospital's county.

Table 1 summarizes these variables by ownership class. We present results for all 103 services, but in the appendix we replicate these results by limiting the analysis to the 36

[8]Chang and Jacobson provided us with this acceleration measure, for which we are very grateful.

most common services, which are offered by 3000 hospital/year combinations. They are completely consistent with the full-sample results. In the summary statistics, all hospital-level variables are weighted by the number of services, since they will naturally weighted in that way in the regressions.

Differences in outsourcing behavior between non-profit and for-profit hospitals are distinct already in the summary statistics. For-profit hospitals have higher average outsourcing, at 25.7 percent of costs, compared to less than 19 percent on average for private non-profit hospitals. District and county hospitals also outsource less on average than for-profit hospitals, with district hospitals averaging 20.6 percent outsourced and county hospitals averaging 17.9 percent of costs outsourced. The fraction of services which are completely outsourced varies in a very similar way. For-profit facilities are the most likely to outsource a service completely, with on average 5.5 percent of services completely outsourced, as compared to only 3 percent for nonprofits, 3.5 in district hospitals and 2.3 percent in county hospitals. The ownership types are much more similar when looking along the extensive margin, however. All types, from for-profit to county hospitals, average about 86 percent of services outsourced to some degree.

The next few rows describe the characteristics of the hospitals. Nonprofit and county hospitals are the largest and offer the most services. Nonprofit hospitals average 225 beds and 59 services, while county hospitals average 270 beds and 58 services. For-profit hospitals are the next largest at 144 beds on average and 54 services. District hospitals are the most limited with an average of 127 beds and 53 services. The patient mixes are also markedly different. The public hospitals have many more MediCal patients than the private hospitals do, with county hospitals having the most and private nonprofits the least. Medicare patients go in exactly the opposite direction, with private nonprofits having the most and county hospitals the least.

The mix of services is also different among hospital types. A "common service" is one that is offered by at least 3,000 hospital-years in the sample. Approximately 60 percent of the services offered by nonprofit and County hospitals are common services, while for district and for-proft hospitals it is 64 and 65 percent, respectively. Nonprofit and County hospitals have the highest percentage of revenue generating services, at approximately 52 percent each. For-profit hospitals average 49.5 percent revenue generating services and District hospitals only 47.4 percent.

Finally, there are two other generic hospital characteristics that may affect outsourcing that we examine: residency programs and rural location. County hospitals are by far the most likely to have a residency program. More than 81 percent of the county observations

are in hospitals that have a residency program. Nonprofit hospitals offer residencies at a rate of 47 percent. For-profit and district hospitals are least likely to offer residency programs, at 38.5 percent and 34.7 percent, respectively. District hospitals, which were originally set up to be rural, continue to lead in rural care, with over 57 percent of the observations in rural locations. At the opposite extreme, for-profit hospitals have only 5 percent of observations in rural hospitals. Private nonprofit and county hospitals are in between, with about 12 percent of facilities located in rural settings.

The average market characteristics also vary among ownership types. Demographic and population size data maps into the rural/urban divides described above. The most urban hospital type, for-profit hospitals, also had the largest total population size on average, over 500,000 and the second largest percent of black residents at 6.9 percent and residents below the poverty line at 14.5 percent. County hospitals have the second largest average total population they serve, dropping down to nearly 434,000 on average, and the largest percentages on average of black and poor residents at 7.8 and 14.9, respectively. District hospitals, largely rural, serve the smallest populations, with the lowest black population, 3.2 percent on average, but over 14 percent of the District hospital population is below the poverty line. Finally, nonprofit hospitals average 343,000 total population, with 5.26 percent black and 13.2 percent poor. The pattern of median household earnings is a bit different, with district hospitals being considerably lower than the others, at about $38k/year, followed by county hospitals at $42.5k/year, and both private hospital types at about $46k/year. The education attainment scores are relatively similar among the for-profit, nonprofit, and County hospitals, at approximately 21 percent with only high school degrees, and about 23 percent with a college degree or higher. The District hospitals have slightly larger percentage of high school graduates, at 25 percent, and only 18 percent with a college degree or higher. Finally, the private hospitals are located in counties with lower employment rates, with for-profit hospitals having the lowest average rate and district hospitals the highest.

The differences in outsourcing behavior among ownership types motivates a further investigation, but the important differences in observables means that a careful econometric approach will be required to assure that the differences in outsourcing is not being driver entirely by differences in circumstance. The following section provides that analysis.

3.2 Econometric Specification

The distribution of outsourcing presented in Figure 3 suggests that the decision to perform a service entirely in-house is not a smooth transition from low-levels of outsourcing. Instead, we will model both the extensive decision of whether to outsource and, conditional on

Table 1: Summary Statistics by Ownership Type, Weighted by Number of Services.

	For-Profit	Private NFP	District	County
Percent Outsourced	25.69	18.92	20.58	17.91
	(33.90)	(28.57)	(30.44)	(27.57)
Service Completely Out	0.0554	0.0291	0.0449	0.0233
	(0.229)	(0.168)	(0.207)	(0.151)
Service Any Out	0.864	0.866	0.867	0.877
	(0.343)	(0.341)	(0.339)	(0.328)
Staffed Beds	144.2	225.4	126.6	269.3
	(92.83)	(149.5)	(107.1)	(213.9)
Services Offered	54.00	59.08	52.92	58.20
	(8.846)	(10.42)	(10.66)	(8.688)
Pct. MediCal	26.57	20.15	38.47	52.90
	(21.55)	(15.88)	(25.65)	(13.81)
Pct. Medicare	42.69	45.08	37.02	16.33
	(18.60)	(14.05)	(19.43)	(10.96)
Common Service	0.652	0.594	0.644	0.596
	(0.476)	(0.491)	(0.479)	(0.491)
Pct. Rev. Gen.	0.495	0.520	0.474	0.521
	(0.500)	(0.500)	(0.499)	(0.500)
Residency Program	0.385	0.472	0.347	0.815
	(0.487)	(0.499)	(0.476)	(0.388)
Rural	0.0521	0.119	0.577	0.122
	(0.222)	(0.324)	(0.494)	(0.327)
Peak Acceleration	0.496	0.476	0.465	0.527
	(0.142)	(0.227)	(0.257)	(0.225)
Pop. in HSA	502479.9	343674.1	131187.7	434246.8
	(641713.3)	(429074.1)	(170279.7)	(501361.4)
Pct. Black in HSA	6.902	5.256	3.231	7.828
	(7.999)	(6.336)	(4.242)	(9.870)
Pct. Poor in HSA	14.46	13.19	14.68	14.93
	(6.916)	(6.065)	(6.230)	(6.406)
med. HH Earn in HSA	45914.0	45824.6	38013.3	42592.3
	(15259.7)	(14570.9)	(11250.0)	(13143.5)
HS Grad in HSA	21.22	21.65	25.07	21.89
	(5.031)	(5.795)	(5.689)	(5.395)
Some Col. in HSA	25.77	26.61	27.45	25.59
	(8.396)	(8.985)	(9.402)	(9.350)
Pct Bach. in HSA	15.96	16.79	12.30	14.48
	(6.648)	(7.455)	(5.627)	(7.360)
Pct Grad/Prof in HSA	7.981	8.643	5.796	7.332
	(4.796)	(6.072)	(3.386)	(4.354)
County Unemp.	5.833	6.290	7.886	7.429
	(1.864)	(2.334)	(3.868)	(4.081)
n	62k	136k	28k	15k

Sample means and standard deviations in parentheses at the service x hospital x year level.

outsourcing, the intensive decision of how much outsourcing to do.

We will model the decision between producing entirely in-house and outsourcing to any degree with a Probit model. In particular, let y_{sht} represent the payoff to firm h in year t from outsourcing service s in the most efficient way, relative to the zero-normalized payoff of producing that service entirely in house. The actual payoff, y_{hst}, is unobservable, but we can observe whether is exceeds 0, since in that case the firm will decide to outsource. Our empirical model for this outsourcing payoff will be

$$y_{hst} = \sum_j \beta_j Own_{ht}^j + \gamma_{1s} + \gamma_{2s} Output_{hst} + \Gamma X_{ht} + \epsilon_{hst}, \tag{1}$$

where Own_{ht}^j is a dummy taking a value of 1 if hospital h is of ownership type j in year t, the γ's are service-specific intercepts and output slopes, and X_{ht} is a set of controls that vary across hospitals and years, but not within services. These include the log of the number of staffed beds, the number of services offered, the patient mix, the presence of a residency program, whether the hospital is rural, the socioeconomic and demographic characteristics of the market listed in Table 1, and county-specific intercepts. We assume the Probit form (i.e., $\epsilon_{hst} \sim iidN(0,1)$), but will adjust the standard errors to account to heteroscedasticity and autocorrelation within hospitals.

The simple dichotomous decision to produce completely in house or not may be interesting, but the sample statistics suggests that the biggest difference among ownership types comes from differences in the intensity of outsourcing. For this reason, we will also explore this intensive margin, conditional on outsourcing at all. In particular, we model the underlying preference for outsourcing intensity as follows

$$log(PctOut_{hst}) = \sum_j \beta_j Own_{ht}^j + \gamma_{1s} + \gamma_{2s} Output_{hst} + \Gamma X_{ht} + \epsilon_{hst}, \tag{2}$$

where the dependent variable is the natural log of the percent of costs due to outside contracts, and the independent variables are identical to those in 1. Of course, we only observe the intensive margin in the cases where the hospital decides to outsource at all, a selected sample of the population. It is well known that a naive regression that ignores the sample selection can lead to biased estimates. Under joint normality, the bias can be corrected by jointly estimating equations (1) and (2) using a maximum likelihood estimator (Heckman 1979). In our particular context, however, this potential selection bias is not

evident. Table 2 shows the results of the a full estimation of the Heckman selection model (columns 1 and 3), and from a naive Fixed-Effects OLS estimate of the intensive margin (Column 2). The Probit results in column 1 are presented as marginal effects at the mean. The results of the two methods are identical through all economically significant figures, as was as statistically indistinguishable. For this reason, we will ignore selection effects and estimate the two stages independently henceforth.

The results for ownership are generally in accord with the model. Nonprofits are slightly less likely than for-profit hospitals to outsource a given service at all, the extensive margin, by about 0.8 percentage points. On the intensive margin, when deciding how much to outsource, nonprofit hospitals outsource about 8 percent less than for-profits. Adjusting the model in a Heckman selection framework does not affect this estimate. District hospitals are indistinguishable from private non-profits. County hospitals, by contrast, are much less likely to outsource on both margins. In the decision to outsource a given service at all, County hospitals are 1.5 percentage point less likely to outsource than for-profits. The big difference emerges on the intensive margin, however, where County hospitals outsource nearly 40 percent less than for-profit hospitals , using both the OLS estimates and the Heckman selection model.

The hospital-level control variables affect outsourcing in the ways we might expect. On the choice to outsource at all, significant variables are those dealing with size and scope of hospital operations. Larger hospitals are less likely to outsource services. A ten percent increase in the number of staffed beds is associated with a decrease in the probability of outsourcing any particular service of about 0.4 percentage points and a decrease in the intensity of outsourcing by about 0.6 percent. This is evidence for economies of scale in hospital operations. Hospitals that offer more service are slightly more likely to contract any given service out, but to a lesser extent, on average. This is probably a compositional effect. Offering more services makes it more difficult for a hospital to provide all services in house, so economies of scope may not be as important as those of scale. A hospital with a residency program is also less likely to outsource services, by 2.5 percentage points. The intensive margin moves in the same way, but it is not statistically significant. This pattern is consistent with the mission of residency programs as places for students to learn, so some services will be kept in-house. Alternatively, residents may be a source of cheap labor, making in-house production more attractive

Hospitals serving MediCal and Medicare patients were slightly more likely to outsource services. A one standard-deviation increase in either of these variables would be associated with a increase in the probability of outsourcing of about 2 percentage points. Demographic variables were not significant in the either of these regressions, likely because most important

Table 2: Outsourcing and Ownership Type: Extensive and Intensive Margins

	Extensive	Intensive	Heckman
	Outsourced	*log(pctout)*	*log(pctout)*
Non-Profit(d)	-0.007	-0.082^{*}	-0.082^{*}
	(0.007)	(0.046)	(0.046)
District(d)	-0.010	-0.112^{*}	-0.113^{*}
	(0.010)	(0.069)	(0.069)
County(d)	-0.014	-0.389^{***}	-0.389^{***}
	(0.018)	(0.089)	(0.089)
Staffed Beds	-0.041^{***}	-0.057^{**}	-0.058^{**}
	(0.006)	(0.030)	(0.030)
Services Offered	0.009^{***}	-0.006^{***}	-0.006^{***}
	(0.001)	(0.003)	(0.003)
Pct. MediCal	0.001^{***}	0.001	0.001
	(0.000)	(0.001)	(0.001)
Pct. Medicare	0.001^{***}	0.000	0.000
	(0.000)	(0.001)	(0.001)
Residency Program(d)	-0.025^{***}	-0.025	-0.026
	(0.008)	(0.034)	(0.034)
Rural(d)	0.007	0.016	0.016
	(0.011)	(0.066)	(0.066)
Pop. in HSA	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)
Pct. Black in HSA	-0.001	0.003	0.003
	(0.000)	(0.003)	(0.003)
County Unemp.	-0.006^{***}	-0.006	-0.006
	(0.002)	(0.009)	(0.009)
Pct. Poor in HSA	-0.001	-0.007	-0.007
	(0.001)	(0.005)	(0.005)
HS Grad in HSA	-0.000	-0.003	-0.003
	(0.001)	(0.004)	(0.004)
Some Col. in HSA	0.000	-0.005	-0.005
	(0.001)	(0.003)	(0.003)
med. HH Earn in HSA	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
county FE	yes	yes	yes
service FE	yes	yes	yes
service-specific output	yes	yes	yes
n	234k	202k	234k

Extensive margin regression presents the marginal effects of a Probit estimation, at the mean, where 1 indicates outsourced to any degree. Intensive margin and Heckman regression have as a dependent variable the natural log of the percent of costs that are outside contracts. (d) indicates a dummy variable. Standard errors, clustered by hospital, in parentheses. $***\ p < 0.01$, $**\ p < 0.05$, $*\ p < 0.10$.

differences were controlled for already with county fixed effects. Since this will be generally true throughout, we will not always report these coefficients. Furthermore, since the Heckman estimation of the intensive margin is always practically identical to OLS, we will simply report OLS from now on.

3.3 Importance of Quality

Our model of non-profit versus for-profit outsourcing behavior implies bigger differences among ownership types when quality is particularly important. This implication is made explicit in Proposition 2. In this section we will test that implication by looking at how outsourcing decisions vary by service. Table 3 presents the results for variations of regressions (1) and (2) in which we interact ownership type with an indicator for whether the service is a revenue-generating medical service.

For non-revenue-generating services, private non-profit hospitals outsource at rates that are no different from for-profits, either economically or statistically, along either the extensive or the intensive margin. We attribute this lack of difference to the fact that quality may not be independently important for reasons other than net revenues for services like grounds-keeping or parking. For revenue-generating medical services, by contrast, quality may have real bite. For these services, non-profit hospitals outsource much less than for-profit hospitals do, along both the extensive and intensive margins. Nonprofits are 1.5 percentage point less likely to outsource any given revenue-generating service than for-profits, and they outsource the average revenue generating service 16 percent less than a similarly situated for-profit does.

For public hospitals, the pattern is quite different. For county hospitals, there is no discernable difference in their outsourcing behavior between revenue-generating and non-revenue-generating services, in the sense that the interaction terms are small and statistically insignificant. Regardless of service type, county hospitals outsource much less intensely than for-profit hospitals do, up to 40 percent less. This suggests to us that, unlike for non-profit hospitals, the low levels of outsourcing in county hospitals is not obviously driven by a differential cost/quality tradeoff. In fact, they outsource considerably less than private non-profits for both service types, but the difference is more than twice as big for things like grounds-keeping and security as is for things like burn care and radiology.

The results for district hospitals are a little muddled. We can never reject the null of them acting the same as for-profits at traditional levels of statistical significance (although for revenue-generating services the p-value along the intensive margin is 0.11), but the difference along the intensive margin is about 10 percent, which is pretty large. A fair conclusion may

Table 3: Outsourcing and the Importance of Quality

	Extensive *Outsourced*	Intensive *log(pctout)*
Non-Profit x Rev(d)	-0.015^{**}	-0.153^{***}
	(0.007)	(0.063)
District x Rev(d)	-0.001	-0.032
	(0.009)	(0.093)
County x Rev(d)	-0.002	-0.007
	(0.014)	(0.122)
Non-Profit(d)	-0.001	-0.005
	(0.008)	(0.051)
District(d)	-0.009	-0.096
	(0.012)	(0.086)
County(d)	-0.013	-0.387^{***}
	(0.017)	(0.095)
Staffed Beds	-0.041^{***}	-0.056^{*}
	(0.006)	(0.030)
Services Offered	0.009^{***}	-0.006^{***}
	(0.001)	(0.003)
Pct. MediCal	0.001^{***}	0.001
	(0.000)	(0.001)
Pct. Medicare	0.001^{***}	0.000
	(0.000)	(0.001)
Residency Program(d)	-0.025^{***}	-0.024
	(0.008)	(0.034)
Rural(d)	0.007	0.014
	(0.011)	(0.066)
County Unemp.	-0.006^{***}	-0.006
	(0.002)	(0.009)
HSA controls	yes	yes
county FE	yes	yes
service FE	yes	yes
service-specific output	yes	yes
n	234k	202k

Extensive margin regression presents the marginal effects of a Probit estimation, at the mean, where 1 indicates outsourced to any degree. Intensive margin has as a dependent variable the natural log of the percent of costs that are outside contracts, and includes only those observations with positive outsourcing. HSA controls include population, percent black, percent poor, median household earnings, and four educational mix variables. (d) indicates a dummy variable. Standard errors, clustered by hospital, in parentheses. $***$ $p < 0.01$, $**$ $p < 0.05$, $*$ $p < 0.10$.

be that they look a bit like the county hospitals, in the sense that they outsource less across the board, but not quite so much so.

3.4 Fixed-Cost Shock

A further implication of our model, also given in Proposition 2, is that these two ownerships types should respond differentially to a shock to fixed costs. This prediction arises directly from the concavity of the non-profit's utility from perquisites. If there is a large fixed cost shock, the amount available to spend on perquisites is relatively low, and the marginal value to the non-profit firm of an extra dollar to spend on perquisites is high. If outsourcing is a tradeoff between cost and quality (the only time the decisions of the two types differ), the decisions of the different firm types become more similar as the budget tightens. Table 4 presents the results for variations of regressions (1) and (2) in which we interact ownership type with the peak ground acceleration experienced by the hospital, as a measure of fixed-cost shocks. The prediction is that the difference between non-profit and for-profit hospitals should be apparent when acceleration is small.

The first thing to note in Table 4 is coefficients on the non-interacted ownership indicators. These are the predicted differences among ownership types for a hypothetical hospital that experienced absolutely no earthquake risk. They are very consistent with everything we have already seen. Nonprofits outsource less than for-profits, especially along the intensive margin, while county hospitals outsource still less, along both margins. District hospitals line up in between, although again the standard errors are big.

The second thing to note is that the non-interacted peak ground acceleration variable is correlated with outsourcing along the extensive margin. This means that for-profits hospitals subject to a fixed cost shock are outsourcing a smaller share of their services. The effect is small. Increasing the peak ground acceleration by a standard deviation decreases the probability of outsourcing by about one percentage point, but it is inconsistent with our model, which would posit no effect. One possibility is that, similar to Chang and Jacobson (2011), we are finding that a shock leads for-profits to shut down some services and those marginal services are outsourced more than average.

Finally, note the large positive coefficients on the interaction terms. There effects are best seen in a figure. Figure 4 represents the predicted difference between the outsourcing behavior of hospitals of the indicated ownership type and a similarly situated for-profit hospital, along the intensive margin, as a function of the peak ground acceleration. A negative number along the $y - axis$ means that hospitals of the indicated type outsource less intensely than for-profits do. Consistent with the table, this is true for all three hospital

Table 4: Outsourcing and Seismic Cost Shocks

	Extensive *Outsourced*	Intensive *log(pctout)*
Non-Profit x Acc	0.041	0.253
	(0.042)	(0.207)
District x Acc	0.051	0.215
	(0.043)	(0.287)
County x Acc	0.185***	0.277
	(0.063)	(0.448)
Non-Profit(d)	−0.027	−0.214**
	(0.022)	(0.110)
District(d)	−0.036	−0.227
	(0.033)	(0.144)
County(d)	−0.177**	−0.527**
	(0.079)	(0.269)
Peak Acceleration	−0.070**	−0.103
	(0.036)	(0.221)
Staffed Beds	−0.040***	−0.060**
	(0.006)	(0.030)
Services Offered	0.009***	−0.006***
	(0.001)	(0.003)
Pct. MediCal	0.001***	0.001
	(0.000)	(0.001)
Pct. Medicare	0.001***	0.000
	(0.000)	(0.001)
Residency Program(d)	−0.025***	−0.025
	(0.008)	(0.034)
Rural(d)	0.004	0.026
	(0.011)	(0.069)
County Unemp.	−0.006***	−0.004
	(0.002)	(0.009)
HSA controls	yes	yes
county FE	yes	yes
service FE	yes	yes
service-specific output	yes	yes
n	232k	202k

Extensive margin regression presents the marginal effects of a Probit estimation, at the mean, where 1 indicates outsourced to any degree. Intensive margin has as a dependent variable the natural log of the percent of costs that are outside contracts, and includes only those observations with positive outsourcing. HSA controls include population, percent black, percent poor, median household earnings, and four educational mix variables. (d) indicates a dummy variable. Standard errors, clustered by hospital, in parentheses. $***$ $p < 0.01$, $**$ $p < 0.05$, $*$ $p < 0.10$.

types when the peak ground acceleration is zero (the dotted lines are 95-percent confidence intervals). But as peak ground acceleration grows, the predicted difference declines. Recall that the mean peak ground acceleration is approximately 0.5, at which point we can reject no difference for the private non-profits and the county hospitals, but not for the district hospitals. In fact, by the time we reach $pga = 1$, in only the county hospital does the prediction difference remain negative.

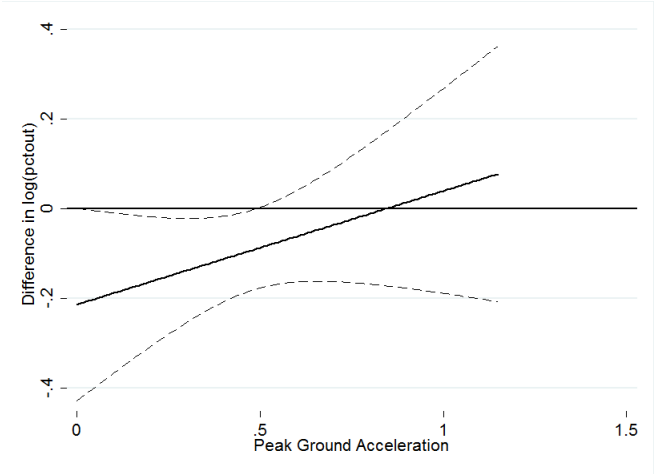
This pattern is exactly what the model predicts.

4 Discussion/Conclusion

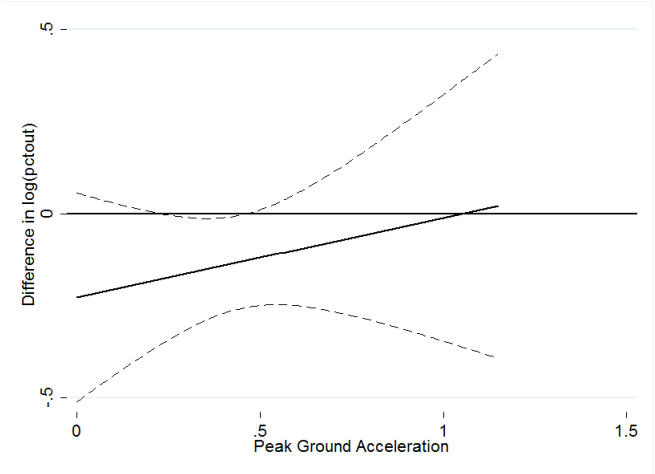
To sum up, we find that private non-profit, public, and for-profit hospitals consistently and significantly differ from each other in the extent to which they outsource services. Controlling for a variety of potential confounders, for the average service, non-profit and district hospitals outsource less than for-profits, and county hospitals outsource least of all. The difference between non-profits and for-profits seems to be entirely driven by services for which quality is particularly important, while the difference between public hospitals and for-profits does not seem to be a function of the importance of quality. Finally, both non-profit and public hospitals come to look more like for-profits if they are hit with a large fixed cost shock. For the private non-profits, all of these results are consistent with a model in which a non-distribution constraint leads non-profits to trade off between costs and quality at a different rate than for-profits do. The lack of differentially response to services where quality is important by public hospitals suggests that the model is either inappropriate for understanding the public hospitals' decisions or that public hospital managers do not have differential sensitivity to quality among these two service classes.

These findings shed new light on two literatures: the differential behavior of non-profit versus for-profit versus public firms and the determinants of the make-or-buy decision in organizations other than traditional profit-maximizing firms.

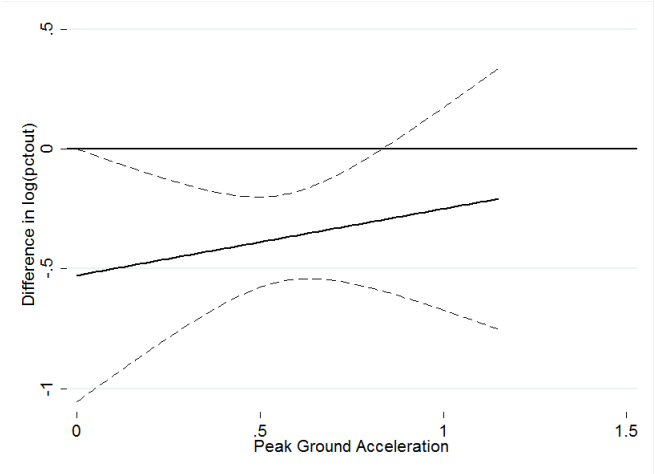
First, in terms of the make-or-buy literature, we provide the first empirical demonstration that there are is an economically significant divergence between the way for-profit firms draw their firm boundaries and the way that similarly situated non-profit and public firms do. This difference is there both in terms of levels and in terms of how the boundaries move in response to cost shocks. Furthermore, it is not simply a difference between non-profit and for-profit, because the difference between public non-profits and private non-profits is just as big as the difference between private for-profits and private non-profits. The differences between non-profits and for-profits seem to be induced by the difference in the rate at which the



(a) Non-Profit



(b) District



(c) County

Figure 4: Intensive Margin Ownership Effects as Function of Cost Shocks

firm types are willing to trade-off between net revenues and something else (here, defined as quality). In brief, if we think about outsourcing as a tradeoff between cost and control, non-profits seem to value cost relatively less and control relatively more, at least as long as they are not close to their shut-down constraint. One way of putting the public hospitals into this story is that they value control *much* more than they value costs, even for services for which quality is not that important.

The extent to which models of outsourcing behavior derived in the for-profit context can be directly applied to the decisions of public and non-profit organizations seems to depend on the economic circumstances in which these organizations find themselves. When there their budgets are relatively tight, non-profit firms seem to make outsourcing decisions in much the same was as for-profit firms do. But when they are far from their shut-down constraint they seem to deviate more strongly from for-profits.

In terms of non-profit versus for-profit behavior, we provide a new sort of evidence on the quality-difference debate. If we believe that it is more difficult contract for high levels of quality than low levels (**?**), so outsourcing is relatively advantaged for low quality services, and we believe that quality is more important for revenue-generating medical services than for non-revenue generating services like mowing the grass, then we have evidence that, compared to for-profits, private non-profits are choosing the higher-cost and higher-quality option when quality is important. And it is this differential choice that drives differences in their outsourcing behavior. There is no evidence for this pattern among public firms, so quality differences are unlikely drivers of their outsourcing behavior.

We also provides new evidence about other dimensions of production differences across ownership types. Non-profits not only do a broader range of services (Horwitz 2007), they do a larger fraction of those services themselves. Finally, consistent with much of the literature (Chang and Jacobson 2011, Duggan 2002), we find that the three ownership classes react very differently to economic shocks. It particular, non-profits and for-profits react quite similarly along the extensive margin (much like they do along the shut-down margin (Chang and Jacobson 2011)), but react very differently along the intensive margin. This is more evidence that non-profits act very much like budget-limited consumers, and not like unconstrained profit maximizers.

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5 Appendix

5.1 Proofs

Lemma 1: $q^{fp} \leq q^{np}$ The q^{fp} satisfies $I'(q^{fp}) = -b$, while q^{np} satisfies $v'(I(q^{np}))I'(q^{np}) = -b$. Aince $v' < 1$, by assumption, the non-profit's condition requires $I'() < -b$, and by the concavity of I that requires $q > q^{fp}$.

Proposition and Corollary 1 Using the $\overline{I}_j(q)$ notation, we know by revealed preference that $\overline{I}_{np}(q^{np}) \leq \overline{I}_{fp}(q^{np})$ and $\overline{I}_{fp}(q^{fp}) \leq \overline{I}_{np}(q^{fp})$. It follows immediately from the continuity of the indifference curves that there exists a $q \in [q^{fp}, q^{np}]$ such that $\overline{I}_{fp}(q) = \overline{I}_{np}(q)$. Since the non-profit firm has strictly convex indifference sets, the curves can cross only once, yielding uniqueness. Once existence and uniqueness are established, the enumerated conditions are immediate. Finally, the condition for outsourcing follows from the definition of $\overline{I}$. The corollary follows from the fact that $\overline{I}_j(q) \geq I(q)$, so if the outsourcing production frontier is outside the own-production frontier only when $q < q^*$, then for the range of interest $\overline{I}_{np} > \overline{I}_{fp}$ and for-profits will outsourcing whenever non-profits do. The other case is similar.

Proposition 2 For some set of parameters, take some $q < q^*$. From Proposition 1, $\overline{I}_{np}(q) - \overline{I}_{fp}(q) > 0$. $\overline{I}_{np}(q)$ is defined implicitly by

$$v(\overline{I}_{np}(q) - F) + bq = v(I_{np} - F) + bq^{np}$$

. The implicit function theorem allows us to calculate the derivative of $\overline{I}_{np}(q)$ with respect to F:

$$\frac{\partial \overline{I}_{np}(q)}{\partial F} = \frac{v'(\overline{I}_{np}(q) - F) - v'(I^{np} - F)}{v'(\overline{I}_{np}(q))} < 0, \tag{3}$$

where the sign of the numerator comes from the fact that v' is decreasing and $\overline{I}_{np}(q) > I^{np}$, since $q < q^* < q^{np}$. Note, we use the envelope theorem here to ignore the effect F through q_{np}. We can perform a similar exercise to calculate the derivative with respect to b:

$$\frac{\partial \overline{I}_{np}(q)}{\partial b} = \frac{q^{np} - q}{v'(\overline{I}_{np}(q))} > q^{np} - q., \tag{4}$$

where the final inequality holds since $v' \leq 1$.

$\overline{I}_{fp}(q)$ is given by

$$\overline{I}_{fp}(q) - F + bq = I_{fp} - F + bq^{fp},$$

and can by solved for explicitly as $\overline{I}_{fp}(q) = I_{fp} + b(q^{fp} - q)$. The derivative with respect to F is zero, while the derivative with respect to b is $q^{fp} - q$. Comparing these derivatives to those derived above for the non-profit gives the results of the proposition. For F, it is immediate. For b, it follows from the that that $q^{np} \geq q^{fp}$.

5.2 Limit to Big Services

Table 5: Summary Statistics by Ownership Type, Weighted by Number of Services. (Big Services)

	For-Profit	Private NFP	District	County
Percent Outsourced	23.91	19.07	17.76	19.15
	(31.83)	(27.97)	(26.81)	(27.62)
Service Completely Out	0.0337	0.0228	0.0287	0.0137
	(0.181)	(0.149)	(0.167)	(0.116)
Service Any Out	0.863	0.857	0.868	0.886
	(0.344)	(0.350)	(0.338)	(0.317)
Staffed Beds	136.4	214.2	116.9	258.3
	(90.28)	(145.0)	(102.6)	(209.9)
Services Offered	52.89	57.77	51.52	57.25
	(9.171)	(10.82)	(10.87)	(8.939)
Pct. MediCal	27.18	20.00	40.24	53.44
	(21.87)	(16.19)	(26.38)	(14.50)
Pct. Medicare	42.59	45.34	35.89	16.50
	(18.87)	(14.30)	(19.77)	(11.20)
numbig	34.28	34.07	32.84	33.95
	(2.735)	(3.278)	(3.244)	(2.183)
Pct. Rev. Gen.	0.402	0.415	0.392	0.403
	(0.490)	(0.493)	(0.488)	(0.490)
Residency Program	0.385	0.465	0.347	0.800
	(0.487)	(0.499)	(0.476)	(0.400)
Rural	0.0557	0.133	0.617	0.140
	(0.229)	(0.339)	(0.486)	(0.347)
Peak Acceleration	0.493	0.471	0.457	0.522
	(0.143)	(0.227)	(0.250)	(0.228)
Pop. in HSA	510725.9	334752.5	126232.4	402526.5
	(648322.3)	(421023.8)	(171192.8)	(474383.7)
Pct. Black in HSA	6.888	5.144	3.207	7.376
	(7.792)	(6.192)	(4.192)	(9.598)
Pct. Poor in HSA	14.59	13.17	14.84	14.65
	(6.950)	(6.038)	(6.278)	(6.283)
med. HH Earn in HSA	45664.5	45645.9	37635.8	42571.4
	(15203.0)	(14559.4)	(11132.5)	(13307.5)
HS Grad in HSA	21.28	21.79	25.22	22.10
	(5.093)	(5.825)	(5.801)	(5.649)
Some Col. in HSA	25.67	26.66	27.36	25.79
	(8.400)	(9.027)	(9.438)	(9.432)
Pct Bach. in HSA	15.84	16.71	12.13	14.53
	(6.635)	(7.444)	(5.632)	(7.471)
Pct Grad/Prof in HSA	7.948	8.539	5.727	7.285
	(4.945)	(6.022)	(3.408)	(4.399)
County Unemp.	5.869	6.311	7.968	7.433
	(1.886)	(2.358)	(3.833)	(4.066)
n	41k	81k	18k	9k

Sample means and standard deviations at the service x hospital x year level. Limited services with offered in $>$ 3000 hospital/years.

Table 6: Outsourcing and Ownership Type: Extensive and Intensive Margins (Big)

	Extensive	Intensive	Heckman
	Outsourced	*log(pctout)*	*log(pctout)*
Non-Profit(d)	−0.004	−0.064	−0.064
	(0.008)	(0.045)	(0.045)
District(d)	−0.002	−0.161***	−0.161***
	(0.010)	(0.067)	(0.067)
County(d)	0.003	−0.345***	−0.345***
	(0.015)	(0.092)	(0.092)
Staffed Beds	−0.045***	−0.022	−0.022
	(0.006)	(0.030)	(0.030)
Services Offered	0.008***	−0.004	−0.004
	(0.001)	(0.003)	(0.003)
Pct. MediCal	0.001***	0.001	0.001
	(0.000)	(0.001)	(0.001)
Pct. Medicare	0.001***	−0.001	−0.001
	(0.000)	(0.001)	(0.001)
Residency Program(d)	−0.028***	−0.005	−0.005
	(0.008)	(0.038)	(0.038)
Rural(d)	−0.002	0.037	0.037
	(0.012)	(0.071)	(0.071)
Pop. in HSA	−0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
Pct. Black in HSA	−0.000	0.002	0.002
	(0.000)	(0.003)	(0.003)
County Unemp.	−0.006***	−0.002	−0.002
	(0.002)	(0.009)	(0.009)
Pct. Poor in HSA	−0.000	−0.005	−0.005
	(0.001)	(0.005)	(0.005)
HS Grad in HSA	−0.000	−0.003	−0.003
	(0.001)	(0.004)	(0.004)
Some Col. in HSA	0.000	−0.005*	−0.005*
	(0.001)	(0.003)	(0.003)
med. HH Earn in HSA	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
county FE	yes	yes	yes
service FE	yes	yes	yes
service-specific output	yes	yes	yes
n	144k	124k	144k

Limited services with offered in > 3000 hospital/years. Extensive margin regression presents the marginal effects of a Probit estimation, at the mean, where 1 indicates outsourced to any degree. Intensive margin and Heckman regression have as a dependent variable the natural log of the percent of costs that are outside contracts. (d) indicates a dummy variable. Standard errors, clustered by hospital, in parentheses. $***$ $p < 0.01$, $**$ $p < 0.05$, $*$ $p < 0.10$.

Table 7: Outsourcing and Revenue Generation (BIG)

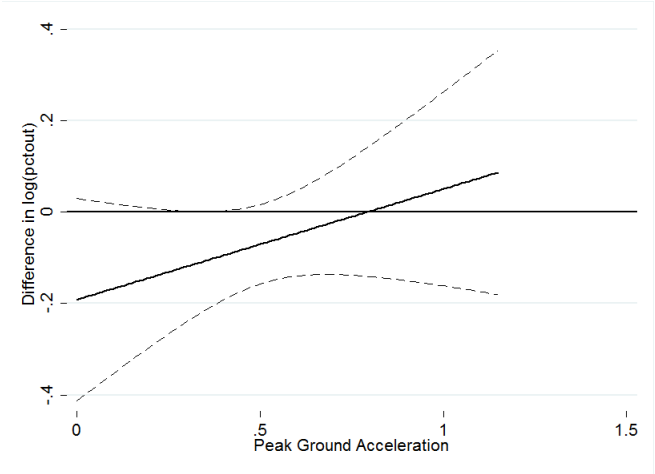
	Extensive	Intensive
	Outsourced	*log(pctout)*
Non-Profit x Rev(d)	-0.006	-0.168^{***}
	(0.007)	(0.062)
District x Rev(d)	-0.008	0.012
	(0.011)	(0.088)
County x Rev(d)	-0.006	-0.103
	(0.017)	(0.152)
Non-Profit(d)	-0.002	0.000
	(0.009)	(0.054)
District(d)	0.001	-0.165^{**}
	(0.011)	(0.081)
County(d)	0.005	-0.304^{***}
	(0.014)	(0.113)
Staffed Beds	-0.045^{***}	-0.019
	(0.006)	(0.030)
Services Offered	0.008^{***}	-0.004
	(0.001)	(0.003)
Pct. MediCal	0.001^{***}	0.001
	(0.000)	(0.001)
Pct. Medicare	0.001^{***}	-0.001
	(0.000)	(0.001)
Residency Program(d)	-0.028^{***}	-0.005
	(0.008)	(0.038)
Rural(d)	-0.002	0.036
	(0.012)	(0.072)
County Unemp.	-0.006^{***}	-0.002
	(0.002)	(0.009)
HSA controls	yes	yes
county FE	yes	yes
service FE	yes	yes
service-specific output	yes	yes
n	144k	124k

Limited services with offered in $>$ 3000 hospital/years. Extensive margin regression presents the marginal effects of a Probit estimation, at the mean, where 1 indicates outsourced to any degree. Intensive margin has as a dependent variable the natural log of the percent of costs that are outside contracts, and includes only those observations with positive outsourcing. HSA controls include population, percent black, percent poor, median household earnings, and four educational mix variables. (d) indicates a dummy variable. Standard errors, clustered by hospital, in parentheses. $***$ $p < 0.01$, $**$ $p < 0.05$, $*$ $p < 0.10$.

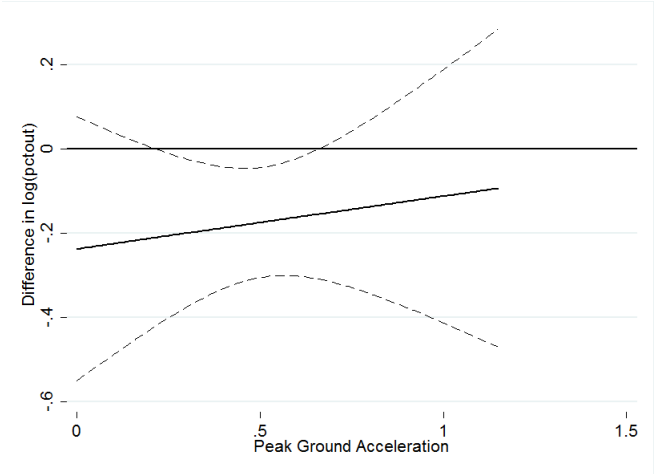
Table 8: Outsourcing and Seismic Cost Shocks (BIG)

	Extensive *Outsourced*	Intensive *log(pctout)*
Non-Profit x Acc	0.045	0.242
	(0.047)	(0.202)
District x Acc	0.063	0.125
	(0.049)	(0.283)
County x Acc	0.210***	0.173
	(0.062)	(0.425)
Non-Profit(d)	−0.025	−0.192*
	(0.026)	(0.113)
District(d)	−0.033	−0.238
	(0.037)	(0.159)
County(d)	−0.190**	−0.422*
	(0.084)	(0.261)
Peak Acceleration	−0.081**	0.065
	(0.040)	(0.222)
Staffed Beds	−0.044***	−0.027
	(0.006)	(0.031)
Services Offered	0.009***	−0.004
	(0.001)	(0.003)
Pct. MediCal	0.001***	0.001
	(0.000)	(0.001)
Pct. Medicare	0.001***	−0.001
	(0.000)	(0.001)
Residency Program(d)	−0.028***	−0.003
	(0.008)	(0.038)
Rural(d)	−0.006	0.062
	(0.013)	(0.076)
County Unemp.	−0.006***	−0.000
	(0.002)	(0.009)
HSA controls	yes	yes
county FE	yes	yes
service FE	yes	yes
service-specific output	yes	yes
n	144k	124k

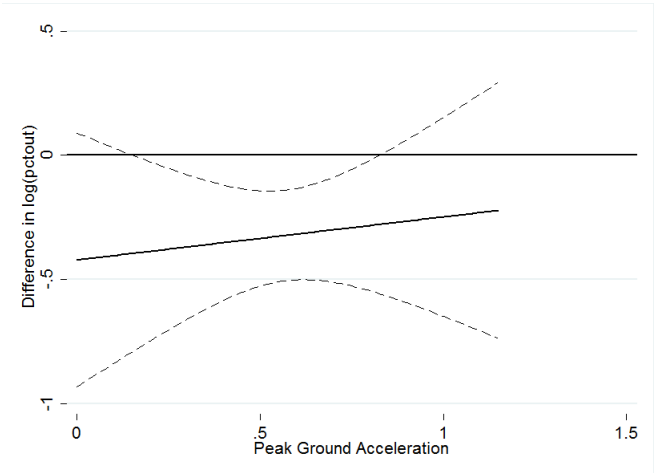
Limited services with offered in $>$ 3000 hospital/years. Extensive margin regression presents the marginal effects of a Probit estimation, at the mean, where 1 indicates outsourced to any degree. Intensive margin has as a dependent variable the natural log of the percent of costs that are outside contracts, and includes only those observations with positive outsourcing. HSA controls include population, percent black, percent poor, median household earnings, and four educational mix variables. (d) indicates a dummy variable. Standard errors, clustered by hospital, in parentheses. $***$ $p < 0.01$, $**$ $p < 0.05$, $*$ $p < 0.10$.



(a) Non-Profit



(b) District



(c) County

Figure 5: Intensive Margin Ownership Effects as Function of Cost Shocks (Big)