Three Essays on Finance and Health Care Organizations

by

Sheng-Hsiu Huang

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Doctoral Committee:

Professor Richard A. Hirth, Chair
Assistant Professor Kenneth R. Ahern, University of Southern California
Associate Professor Amy K. Dittmar
Professor Edward C. Norton
Professor Dean G. Smith
Professor John R.C. Wheeler

For my parents

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CHAPTER I

Introduction

This dissertation includes three essays that examine the interactions between financial arrangements and product market outcomes in the health care industry theoretically and empirically. Integrating finance and health economic theories, particularly the coexistence of mixed ownerships and the private provision of public goods, my dissertation presents unique opportunities to explore the interaction of the fields of health care finance and industrial organization.

Chapter 2 includes an evaluation of nursing home quality, which provides a valuable opportunity to clarify the cyclical fluctuation of quality and the role of financial constraints in explaining such fluctuation. As such, I use local unemployment rates to provide exogenous cost shocks. During recessions, lower labor costs ease financial constraints and thus lead to higher nurse staffing, lower employee turnover, and better quality. Such counter-cyclical quality fluctuation is most profound among financially constrained facilities that tend to be more leveraged. This counter-cyclical quality is also more pronounced among nursing homes that are for-profit, belong to multi-facility chains, and focus largely on Medicaid residents. Overall, I find that financial constraints hinder quality, nursing home quality is counter-cyclical, and financial constraints slightly amplify counter-cyclical quality fluctuations.

Chapter 3 examines the impacts of financial leverage on hospitals technology

adoptions. To account for the potential endogeneity between financing and producing decisions, the California Seismic Retrofit Mandate is used as an exogenous financial shock that crowds out hospitals financial resources. Surprisingly, I did not find significant results to identify the association between financial leverage and technology adoption.

Using a unique 8-year nursing home CEOs compensation dataset, I make inferences of the objective functions of for-profit and not-for-profit organizations, particularly the differential weights of financial and altruistic (quality) performance. Surprisingly, I find that compensation is not tied to performance. Rather, managers are compensated for more concrete measures including the size of the nursing home, payer-mix, and manager experience. I further separate managers into three groups (not-for-profit managers, for-profit and owner-managers, and for-profit and non-owner managers). Among these three types of managers, I find consistently significant evidence that owner-managers earn significantly higher compensation than do the other two types of managers.

The center theme of this volume is to address the public good perspective of corporate finance decisions (e.g. capital structure and corporate governance). In health care industries, these finance issues can have strong influences on public welfare, in quality of care and services provisions. On the other hand, the mix of ownership types and the incomplete quality information provide health care markets as unique opportunities to examine financial principles in a different setting.

CHAPTER II

Financial Constraints and Counter-Cyclical Nursing Home Quality

Financial constraints occur when a firm faces limited access to external financing resources because of either high cost of capital (price rationing) or shortage of credit supply (quantity rationing). When a firm is financially constrained, it becomes more dependent on internal cash flows. This dependency may affect its investment and production decisions. A recent study by Campello and colleagues (2010) shows that financially constrained firms are more likely to cut capital and marketing expenditures, technology investment, and number of employees. Perhaps due to the difficulty of measuring and quantifying quality differences, the impacts of financial constraints on product and service quality are dimensions that are less frequently discussed in the literature. Financial constraints are also viewed as an important *accelerator* that amplifies cyclical economic fluctuations. Bernanke and colleagues (1996) theorize that financial constraints amplify modest monetary shocks to large pro-cyclical fluctuations of investments and outputs. Chevalier and Scharfstein (1996) and Khanna and Tice (2004) provide both theoretical and empirical evidence that financial constraints explain and exacerbate counter-cyclical markups in the supermarket industry. This paper extends the literature to investigate the importance of financial constraints by identifying their impact on the counter-cyclical behaviors of

nursing home quality, a context in which the consumers can not perfectly observe service quality but do bear significant switching costs. The result also provides an alternative explanation for counter-cyclical health outcomes that were observed by Ruhm (2000) and Stevens et al.(2011).

Nursing homes play important roles in providing necessary care to institutionalized elderly and adults with impaired functionality. However, such important roles can be compromised if the homes are financially constrained. Nursing facilities have several characteristics that mark them as likely to be financially constrained. Whited and Wu(2006) conclude that the firms that are smaller, have low or no research coverage by equity analysts, and do not have corporate bond ratings are more likely to be financially constrained. Most nursing homes satisfy these criteria. In addition, Jaffee and Russell (1976), Keeton(1979), Stiglitz and Weiss (1987), and Whited (1992) view information asymmetry between the lenders and the borrowers as a primary cause of financial constraints and credit rationing. Asymmetric quality information between nursing facilities and creditors can hinder the creditors' willingness to provide inexpensive and long-term capital to the nursing facilities. Asymmetric information reinforces the effects of unfavorable firm characteristics and subsequently causes nursing homes to face stricter limitations to external capital. Asymmetric quality information has another impact on the product market. As noted by Arrow (1963), information asymmetry is the prominent characteristic of the medical care market and often leads to loss of consumer welfare. Information asymmetry can distort the incentives of financially constrained nursing homes to provide socially optimal quality. The effects of asymmetric information on both credit and product markets make nursing homes more vulnerable to financial constraints, but the negative consequences and welfare losses as a result of financial constraints may be even more serious than those encountered in other industries.

To motivate the empirical analysis, I construct a theoretical model to formalize

the complex relationships among financial constraints, asymmetric information, and nursing home quality. Based on the work by Klemperer (1995) and Chevalier and Scharfstein (1996), the model has the flexibility to explain counter-cyclical quality fluctuations. This model is also the first to provide a theoretical foundation for research of financial conditions and quality of care. To empirically test the theoretical predictions, I follow the approach used by Campello (2003), Khanna and Tice (2004), and Zhu (2011). Regional and local business cycles are used to create the exogenous cost shocks which nursing home managers do not fully expect when they make ex-ante financial arrangements. Local business cycles are exogenous from the existing financial leverage because it is impossible to perfectly forecast economic fluctuations. Even if the managers can foretell the recessions and booms, the adjustments of capital structure are both expensive and time consuming; a significant adjustment of capital structure often involves the redirection or restructuring of corporate strategies. Local business cycles also directly affect internal cash flows through impacts on labor markets. The majority of the nursing home workforce is comprised of nurse aides (about 65% of the nurse hours[1]). They earn low hourly wages ($7.5; *Yamada*, 2002) and have a lower skill set compared to other types of nurses. When the economy is booming and unemployment rates are low, outside employment options for the nurse aides become more attractive. While nursing home wages might be more rigid because of fixed public reimbursement rates, during economic booms nurse aides can earn significantly higher wages at alternative work sites, such as restaurants and department stores (*Cawley et al.*, 2006). In addition, with their salaries, educational attainments, and demographics (*Yamada*, 2002), nurse aides are more likely to be the secondary source of their household incomes. Therefore, they may withdraw from the nursing homes workforce during economic booms when their spouses or other family members have stable jobs and earn promising incomes. Of course, such labor mar-

[1]My calculation based on nursing homes in the sample

ket impacts are not equal across all nursing homes. Financially constrained nursing homes may have particular difficulty keeping up with wages and retaining their nurse aides. Ex-ante financial leverage serves as the primary proxy for financial constraints. With different levels of financial leverage, the differential responses to exogenous cost shocks are interpreted as causal impacts of financial constraints on quality.

To assess nursing home financial constraints at the facility level, I collect audited nursing home financial statements from several state health planning agencies.[2] These audited financial statements provide detailed information on balance sheets, cash flow, and employee turnover, which are essential to this study but not available from Medicare Cost Report and Online Survey, Certification and Reporting (OSCAR) data. Using this large and unique dataset (comprising more than 3,500 nursing homes in six states from year 2000 to 2011), I investigate the causal relationship between financial constraints and nursing home quality. I also provide evidence about the dynamics between financial constraints and counter-cyclical quality. Quality measures include deficiencies, bed sores, physical restraint, nurse staffing, and nurse turnover. County-level unemployment rates are the proxies to measure both the cross-sectional and time-series variations of business cycles. [3] Results show that financial constraints impair nursing home quality and that nursing home quality is obviously counter-cyclical. Financial constraints also act as the *accelerators* that amplify the counter-cyclical quality. The estimated interaction term between ex-ante financial leverage and business cycles measures suggest that compared to the quality of less constrained nursing homes, the quality of more financially constrained nursing homes decreases slightly further during economic booms and also improves slightly more during recessions.

[2]e.g. OSHPD at California

[3]I also use Metropolitan Statistical Area (MSA) level GDP growth rates to perform similar analysis. The results are no major qualitative difference and will be available upon request

2.1 Financial Constraints, Nursing Homes, and Counter-cyclical Quality

2.1.1 Financial Constraints and Cyclical Accelerators

Financial constraints, whereby firms have limited access to external financial resources, occur due to *capital market imperfections* that results from asymmetric information, transaction costs, and agency problems related to debt finance (*Fazzari et al.*, 1988). Asymmetric information between creditors and borrowers leads to well-known *lemon problems* (*Akerlof*, 1970) – even good quality borrowers can face credit rationing. Tirole (2006) incorporates moral hazard and agency cost to explain that high-debt firms will be more likely to be credit constrained because over-leverage may distort the incentives of the entrepreneurs to misbehave at the cost of the lenders. These imperfections cause external financing to fail to perfectly substitute for internal cash flows, a result contrasting with Modigliani-Miller's hypothesis of the irrelevance of financial structure (*Modigliani and Miller*, 1958). Financially constrained firms therefore are more sensitive to internal cash flows, consequently leading to various impacts on operating and production decisions, be it regarding investments, pricing, competition, and entry and exit. Yet, despite a long list of seminal work (*Fazzari et al.*, 1988; *Kaplan and Zingales*, 1997; *Blanchard and Lopez-de Silane*, 1994; *Lamont*, 1997), the empirical evidence of financial constraints on product and service quality is rather sparse. The lack of reliable measures of quality may be the primary obstacle to demonstrate the dynamics between financial constraints and product quality. Maksimovic and Titman (1991) theorize that financial constraints can cause a leveraged firm to lower product quality to increase internal cash-flows. Matsa (2011) studies the frequency of inventory shortfalls in the supermarket industry and provides one of the few empirical studies that supports the idea that financial constraints lead to lower product quality. Matsa shows that the supermarkets undergoing leveraged

buyouts (LBO) experienced more frequent inventory shortfalls, a measure of lower product quality.

Financial constraints are also considered as the *cyclical accelerator* that magnifies the initial small variations to large fluctuations. The fundamental insight is that, in an ideal world without financial constraints, a firm that experiences temporary demand or cost shocks should be able to substitute for internal cash shortfalls with external financing. If there were no financial constraints, any transitory demand or cost shocks should not affect firms' investments and outputs, a producer's analogy of permanent income hypothesis (*Friedman*, 1957). Yet, the economic data from business cycles suggest exactly the opposite: small shocks often evolve into disproportionally large fluctuations. Bernanke and colleagues (1996) adopt the agency-principal model between the borrowers and lenders to outline the problem of financial constraints. They provide empirical evidence that financial constraints can propagate an initial shock to large swings of sales and inventories. Bernanke and Gertler (1989), Calomiris and Hubbard (1990), Greenwald and Stiglitz (1993), Sharpe(1994), and Lamont (1995) also provide theoretical and empirical support for the claim that balance sheet strength and financial conditions are important to cyclical behaviors. This paper adopts the concept of financial accelerators to examine whether financial constraints amplify counter-quality fluctuations.

2.1.2 Nursing Homes and Counter-Cyclical Quality

Nursing homes fullfill an important role, providing care to the elderly who have impaired functioning abilities. According to the most recent estimation, the U.S. spends $139 billion on nursing home services annually and 3.3 million people live in nursing facilities (*CMS*, 2010). Several unique characteristics (including incomplete information, high switching costs, and regulated prices) make nursing homes a valuable site at which to investigate the impact of financial constraints on counter-cyclical

quality. Two distinct forms of incomplete information reinforce each other and result in inefficiencies in the credit and product markets. The first form of incomplete information occurs in the lending market. Because the creditors can not perfectly observe the borrowers' expected profitability and the underlying business risks, this discourages lenders from providing long-term capital at low interest rates or low required rates of returns. Since learning business risks requires certain fixed costs, the average cost of lending to a smaller firm is higher. Thus, smaller firms, or firms that do not publicly disclose their information, are more likely to be financially constrained. This form of incomplete information is significant in the nursing home industry. The annual revenue for an average nursing home is only about $4 million. The majority of nursing homes are not listed on the stock exchange; only a small fraction of nursing homes issue corporate bonds (10% [4]).

The second form of incomplete information takes place in the product market. The asymmetric quality information between nursing homes and consumers distorts the incentives for providing good quality care. Nursing home care can be viewed as a type of experience good, the true quality of which is only revealed after purchase and consumption. Because consumers can only respond to *observed* quality before entering a specific nursing facility, nursing homes are not fully rewarded by providing good quality and are not fully penalized by providing lower quality. Even if consumers realize the *true* quality after choosing a nursing home, the high switching costs of changing to another nursing facility further distorts the incentives to provide good quality of care. Particularly, the explicit and implicit switching costs are higher among the population who have difficulty accessing and processing the quality information. Hirth and colleagues (2000) find that residents who are younger, healthier, and have more generous coverage are more likely to transfer between nursing facilities for better quality. The combination of asymmetric quality information and high

[4]From author's calculation using California sample. There is a possibility that the bonds are issued by the owner corporation and the bond information is not reflected in each nursing facility.

switching costs lowers the quality elasticity of demand. This conjecture can be supported by recent studies on consumer response to nursing home quality reporting. In 2002, Center of Medicare and Medicaid Services (CMS) began the Nursing Home Quality Initiative (NHQI) to improve the transparency of nursing home quality. Yet, recent studies have revealed that the quality program only achieves minor or no results, and consumers rarely respond to public quality reporting (*Clement et al.*, 2011; *Werner et al.*, 2012; *Hirth and Huang*, 2012). The combination of asymmetric quality information and high switching costs exacerbates the negative impacts of financial constraints on quality. When external financing is not feasible, financially constrained nursing homes need to alter their production process to maintain a certain level of cash flow. Depending on the quality elasticity of demand, a nursing home may improve its quality to expand markets and boost revenues or lower its quality to save operating costs. Based on the various nursing home literature mentioned above, it is reasonable to assume that quality elasticity of demand is quite low. Thus, when financial constraints are present, nursing homes will be more likely to lower quality and cut operating costs in order to provide sufficient cash flows.

The relationship between financial constraints and quality can differ across business cycles. Regulated prices and stable demand are two determinants of countercyclical nursing home quality. Government insurance programs are the largest payers for nursing home services. Medicare- and Medicaid-covered services combined account for the majority of nursing home markets[5]. The demand for skilled nursing care is relatively inelastic because a large portion of expenditure is covered by the government program and also because the utilization of skilled nursing services is usually not discretionary. Therefore, when faced with major cost shocks, nursing homes can hardly pass the increasing operating costs to the consumers and must either improve operating efficiency or reduce quality. From the nursing home perspective, the

[5]The calculation is based on the nursing homes included in this study.

combination of incomplete information and high switching costs can make quality reduction more appealing than efficiency improvement.

Counter-cyclical nursing home quality results from the pro-cyclical operating costs and relatively inelastic demands. During economic recessions, unemployment rates are high and outside wages and options for the nurse aides are low and limited. Nursing homes can hire nurses with lower wages or pay the same wages to hire more skilled nurses. Thus the operating costs are lower for the nursing homes to provide a certain level of quality. Because the nursing home prices are highly regulated across business cycles, nursing homes cannot *cost shift* higher operating costs into higher prices. If nursing homes want to provide equivalent quality during boom periods, the operating margins will decrease and internal cash flows from operating profits will also dwindle. Incomplete quality information and high switching costs encourage nursing homes to lower quality during economic booms. Recall how financial constraints amplify cyclical behaviors. Nursing homes that have high existing financial leverage and poor financial conditions will have more volatile quality fluctuations. Several studies suggest counter-cyclical nursing home quality. Both Goodman (2006) and Yamada (2002) have observed that employment in hospitals and nursing homes is counter-cyclical. Stevens et al. (2011) find that, during recessions, nursing homes have higher nurse staffing which explains the lower elderly mortality rates during the recession. This paper extends previous research by examining comprehensive quality measures and formalizing financial constraints as the main driver for counter-cyclical quality.

Standardized quality measures are another empirical justification for using the nursing home industry to investigate the relationship between financial constraints and quality. Nursing home quality has long been the center of policy focus, mainly because the quality is not fully observed by the consumers and most consumers belong to vulnerable populations who have a limited ability to process any partially

observed quality. This paper uses quality measures published by NHQI. The quality measures include health deficiencies, the use of physical restraint, the prevalence of bed sores, nurse staffing, and other outcome measures.

2.2 The Model of Financial Constraints and Counter-Cyclical Quality

In this section, I use a simple theoretical model to illustrate the relationships among financial constraints, asymmetric quality information, and equilibrium quality. The model also demonstrates counter-cyclical fluctuations of quality. To provide a comparison benchmark, I start with a model in which the nursing homes solely use internal cash flows to finance their operations. I then introduce a model with differential access to external financial resources and compare the equilibria from both models.

2.2.1 Asymmetric Quality Information and Consumer Demand

This basic model is built on the work of Chevalier and Scharfstein (1996) with substantial modifications. First, in nursing home markets, standard price competition does not apply because the largest two payers, Medicare and Medicaid, account for the majority of the skilled nursing days. For modeling convenience, I assume that a nursing home receives fixed reimbursement price $\overline{P}$. Second, consumers only have incomplete quality information and they choose nursing homes based on *observed quality* and transportation costs. When asymmetric quality information is severe, consumers will have a more difficult time observing the true quality difference. I assume the market demand for nursing home care is relatively stable and mostly de-

pends on demographics and population factors[6]. The basic setup follows the linear city model by Hotelling (1929). For simplicity, I assume two nursing homes, A and B, that compete for two periods, t=1,2. Consumers are geographically distributed uniformly at $y \in$[0,1]. Since consumers choose nursing homes based on *observed quality* and transportation costs, the consumer's demand of nursing home A and B for consumer y in the first period can be defined as follows:

$$\begin{aligned} D^A_{y,1} &= 1 \quad if \quad \beta Q^A - Ty \geq \beta Q^B - T(1-y) \\ D^B_{y,1} &= 1 \quad if \quad \beta Q^A - Ty < \beta Q^B - T(1-y) \end{aligned} \tag{2.1}$$

Where $D^A_{y,1}$ is the demand of consumer y for nursing home A ; T can be interpreted as the real transportation cost or an abstract concept of the switching cost; β is between $\in$ [0,1] and represents the severity of incomplete information. Because of asymmetric medical knowledge and hidden information between providers and consumers, it is often difficult for consumers to immediately observe the true quality differences among the providers (*Arrow*, 1963). Consumers will only fully realize the underlying quality in the second period and β will be equal to 1. The market share of nursing home A in the first period, σ^A_1 and in the second period σ^A_2, can be defined as:

$$\begin{aligned} \sigma^A_{1_{(Q^A,Q^B)}} &= \frac{1}{2} + \frac{\beta(Q^A - Q^B)}{2T} = 1 - \sigma^B_{1(Q^A,Q^B)} \\ \sigma^A_{2_{(Q^A,Q^B)}} &= \frac{1}{2} + \frac{(Q^A - Q^B)}{2T} = 1 - \sigma^B_{2(Q^A,Q^B)} \end{aligned} \tag{2.2}$$

[6]The provision of informal care during recessions may substitute away some deamds for nursing home care. I acknowledge this limitation in this study.

2.2.2 Nursing Home and Profit-Maximizing Quality

2.2.2.1 Internally Financed-Only Model

The benchmark model assumes that nursing homes use internal funds to finance the initial start-up costs and investments in facilities, so both nursing homes A and B are 100% equity financed with zero liabilities. The firms receive fixed reimbursement rate $\overline{P}$ and choose profit-maximizing quality Q. Notice that operating cost is a monotonically increasing function of quality; thus, $C(Q)\prime > 0$. Quality is an increasing function of labor (L) and capital (K) inputs. $\frac{\partial Q(L,K)}{\partial L} > 0$ and $\frac{\partial Q(L,K)}{\partial K} > 0$. I further assume that nursing homes (not the consumers) have perfect and complete information and the model is simplified as a two-period static game. θ is the realization of operating costs across business cycles. θ_H and θ_L represent the costs to produce one unit of quality during booms and recessions, respectively. θ_H is larger than θ_L because operating costs are higher during economic booms than in recessions. Because the economic outlook is uncertain, $\overline{\theta}$ represents the *expected* cost to produce unit quality. δ is the discounting operator to discount future profits to its net present value, and $\delta \in [0, 1]$. Since the major difference between the first and second period is the severity of asymmetric quality information, δ can be interpreted as a representation how quickly the consumers learn the true quality. For instance, a nursing home that focuses on short-stay consumers may have a larger δ because the higher resident turnover facilitates quality information to be updated faster. Therefore, the magnitude of δ can be firm specific and depends on the resident turnover of and hence the composition of nursing home residents. For a facility with more post-acute short-stay patients, its δ can be larger than the facility whose residents are mostly chronically ill and long-stay consumers. Nursing home As maximizing problem can be written

as follows:

$$Max_{[Q^A]}\Pi_{(Q^A,Q^B)} \quad : \quad (\overline{P} - C^A_{(\overline{\theta}Q^A)})\sigma^A_{1_{(Q^A,Q^B)}} + \delta(\overline{P} - C^A_{(\overline{\theta}Q^A)})\sigma^A_{2_{(Q^A,Q^B)}} \tag{2.3}$$

For convenience, assume for linear cost function that $C = \overline{\theta}Q$. Taking partial derivative with respect to Q^A leads to the first-order condition:

$$\begin{aligned} \frac{\partial\Pi_{(Q^A,Q^B)}}{\partial Q^A} &= -\overline{\theta}(\frac{1}{2} + \frac{\beta}{2T}Q^A - \frac{\beta}{2T}Q^B) + \frac{\beta}{2T}(\overline{P} - \overline{\theta}Q^A) \\ &\quad -\delta\overline{\theta}(\frac{1}{2} + \frac{1}{2T}Q^A - \frac{1}{2T}Q^B) + \delta\frac{1}{2T}(\overline{P} - \overline{\theta}Q^A) \end{aligned} \tag{2.4}$$

Hypothesis 1:

Assuming that both nursing homes A and B are identical, symmetric Nash equilibrium of market quality is $Q^{A^*} = Q^{B^*} = [\frac{\overline{P}}{\overline{\theta}} - \frac{(1+\delta)}{(\beta+\delta)}T]$. *When the consumers observe less quality (smaller* β*) and when the resident turnover is lower (smaller* δ*), both facilities will provide lower quality. Furthermore, when the economic outlook is optimistic and expected operating cost is higher (larger* $\overline{\theta}$*), the quality is lower.*

Proof 1: See Appendix A.

2.2.2.2 Differential Access to External Financing

Building on the basic model, I introduce the concept of external financing and financial constraints. Nursing homes have different capital structure decisions and have different financial leverage (measured as debt over asset) ratios. Various factors can result in different financial leverage ratios. For example, information asymmetry between the lenders and the entrepreneurs can affect access to external

financing resources; the CEO and CFO styles (*Bertrand and Schoar*, 2003 ; *Cronqvist et al.*, 2009) may affect the trade-off between risk and returns and hence affect the capital structure. The presence of financial constraints causes the highly levered nursing home to have to rely on internal cash flows to repay the debt and crowd out the financial resources available for operating activities. Therefore, holding all factors equal, nursing homes with higher ex-ante financial leverage are more likely to cut down operating expense and result in lower quality.

Hypothesis 2:

Compared to unconstrained nursing homes, financially constrained nursing homes will provide lower quality.

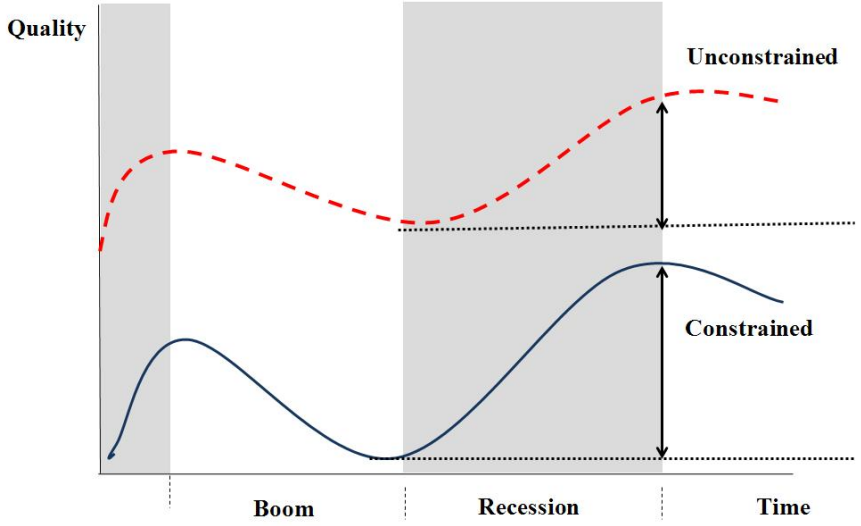
2.2.2.3 The Interaction Effect of Business Cycles and Financial Constraints

To make the case interesting, for highly leveraged nursing homes, there is a probability μ of being in recessions, during which the operating cost is low and the highly leveraged nursing home can generate sufficient profits for debt service. By contrast, there is a probability 1-μ of not being in a recession so that the nursing home will not generate sufficient cash-flows to repay its debt and will have to close. Thus, with the probability 1-μ, the nursing homes have to lower their quality to lower their operating expense and generate cash flows for debt service. It should be noted that nursing homes with higher existing debt may lower their quality more than the less leveraged homes. This leads to the third hypothesis.

Hypothesis 3:

Financial constraints can amplify the counter-cyclical quality fluctuations.

Figure 2.1: Financially Constrained and Unconstrained NH Quality Over Time



2.2.2.4 For-profit Status and Counter-cyclical Quality

Nursing home care is an industry with mixed ownership in which both for-profit and not-for-profit organizations have significant presence. Among the nursing homes in the analytic sample, 77%, are for-profit. It is well documented theoretically and empirically that not-for-profit nursing homes provide higher quality than for-profit nursing homes (*Hirth*, 1999 ; *Grabowski and Hirth*, 2003). Building on the literature, I extend the understanding of ownership differences by investigating whether for-profit nursing homes have different cyclical-quality fluctuation compared to not-for-profit nursing homes. Because not-for-profit enterprises cannot distribute residual profits to their shareholders, Hansmann (1980) theorizes that not-for-profit health organizations mitigate the agency contracting failure and ensure quality. Building on Hansmann's explanation, the interaction between financial constraints and business cycles will have stronger impacts on the quality of for-profit nursing homes than not-for-profit ones. For instance, during booms, when operating costs are high, the financially constrained nursing homes have stronger incentives for lowering quality to maintain the profits that will be distributed to the shareholders.

Hypothesis 4:

Counter-cyclical quality fluctuation is more pronounced among for-profit nursing homes

2.2.2.5 System Affiliation

The U.S. nursing home industry provides an exciting opportunity to examine the effects of chain affiliation on financial constraints and on cyclical quality behaviors. About 50% of the nursing homes in the sample belong to multi-facility chains. At the individual facility level, system affiliations can have two opposite effects on financial constraints. First, the internal capital markets hypothesis suggests that nursing homes that belong to multi-facility chains will be less likely to be financially constrained. The internal capital markets within the nursing home system enables individual facilities to borrow at lower rates from the headquarters (*Lamont*, 1997). Furthermore, as shown by Hoshi et al. (1991), firms that belong to large industrial groups are less likely to be financially constrained in comparison to independent firms. Similarly, nursing home chains can also exercise their bargaining power to raise external capital collectively for individual nursing facilities. These two hypotheses suggest that system-affiliated nursing homes are less financially constrained and that their quality is less cyclical. Alternatively, anecdotal evidence from nursing home managers suggests that chain-affiliated homes may need to distribute certain levels of profits to their headquarters. This relocation of cash flows away from individual facilities leads to an opposite prediction that chain-affiliated nursing homes can be more financially constrained and have more volatile quality fluctuation.

Hypothesis 5:

System affiliation can either amplify or alleviate quality fluctuation

2.2.2.6 Private-pay revenue share

In Section 3.1, the theoretical predictions suggest that nursing homes will provide lower quality when consumers have lower quality elasticity of demand. Subsequently, the quality of such nursing homes will be more counter-cyclical. When operating costs rise during economic booms, nursing homes with low quality elasticity of demand can lower quality without losing too much market share, at least in the short term. While the theoretical implications are clear, empirical assessment is challenging because quality elasticity is not perfectly measurable. Therefore, I use private-pay revenue shares as proxies for quality elasticity of demand at the nursing home level. Most nursing homes' revenues are composed of three payer types: Medicaid, Medicare, and private pay. Compared to public markets, private-pay markets can be more quality elastic. Private-pay residents may have superior abilities to process quality information, and they may be more likely to be able to afford switching costs of transfers.

Hypothesis 6:

Nursing homes focusing on private-pay residents have milder quality fluctuation

2.3 Data Sources and Empirical Strategy

I obtained audited nursing home financial information from six state health planning agencies from 2000 to 2011. Using the Medicare provider number, I then merged the financial information with CMS's NHQI files which contain a rich set of nursing home quality measures. I also include local employment information from Area Resource Files (ARF) and other databases collected by the Bureau of Labor

Statistics.

2.3.1 Nursing Home Financial Data:

The lack of reliable financial information is a major challenge to empirical examination of the impacts of financial constraints on nursing home quality. Most nursing homes are relatively small and most are not publicly listed on a stock exchange market. Hence, most are not required to provide annual financial reports to the public. Medicare Cost Reports and OSCAR, two popular data sets providing detailed nursing facilities information, only contain profitability measures and do not include balance sheets and cash flow information. To overcome this issue, I obtained audited nursing home financial reports from state health planning agencies of Arizona, California, Illinois, Massachusetts, New York, and Ohio from 2000 to 2011 (See Table 2.1). Nursing homes in these states are required to disclose their audited annual financial statements and submit them to state health planning agencies. This unique compiled data set comprises about 3,500 nursing facilities, which is about 20% of all of the nursing facilities in the U.S. The analytic sample is about 28,000 nursing home-year observations. I exclude these nursing facilities in the analysis, because the interpretation of their financial information and patient mixes are different from nursing facilities that are not within hospitals. Although each state has a different format of the nursing home financial report, the basic and fundamental categories and variables in the balance sheet are consistent across states.

2.3.1.1 Measures of Financial Constraints

I use the financial leverage ratio as the primary proxy for financial constraints because, with high existing leverage, the nursing homes will be less likely to raise additional capital. The financial leverage ratio is defined as *total debt-over-total asset*, a broad definition of financial leverage. The leverage ratio measures financial

constraints in two ways. First, the financial constraints of a nursing home with high existing leverage is more likely binding. A highly leveraged nursing home has more difficulty borrowing new funds (*Tirole*, 2006). Second, a highly leveraged nursing home may use a higher portion of its cash flows for interest expenses and debt services. When facing unexpected shocks, a nursing home with higher ex-ante leverage has less financial resources to respond to the shocks. Instead of using market values, I use book values to calculate the leverage, because most nursing homes are not publicly listed on stock exchanges, and their market values are simply not available. Compared to more short-term financial measures, total liability over total asset ratio is less sensitive to the fluctuations of profits and less sensitive to the time-variant unobservable.[7] Since there has been a long debate in the literature regarding the correct measures for financial constraints (*Fazzari et al.*, 1988; *Kaplan and Zingales*, 1997; *Hadlock and Pierce*, 2010), I also used working capital (defined as the difference between current asset and current liability) and Current Ratio (current asset over current liability) to check the robustness of the results [8].

2.3.1.2 Measures of Nursing Home Quality

Quality measures are extracted from the CMS' Nursing Home Compare website. The website describes comprehensive quality measures for all Medicare certified nursing homes. The quality measures include nurse staffing ratios, deficiencies identified by regulators, the prevalence of physical restraint, the prevalence of pressure sores, and other health measures. These quality measures are widely used in studies of nursing home quality. Inspection deficiency measures become available in 2001, and other quality measures become available from 2003 to 2010. Every 12-15 months, state health personnel inspect all nursing homes and report any deficiencies and their

[7]The correlation between financial leverage ratio and 1 year lag financial leverage ratio is 0.84. This suggests that when facing unexpected macro shocks, the nursing home managers are not able to adjust the financial leverage ratio in a short period of time.

[8]The results of working capital are not reported in the paper for brevity.

severities. I use two deficiency measures. The first measure, *Deficiency Count*, is the number of deficiencies a nursing home has. I count the number of deficiencies for each nursing home in the most recent survey. Second, I weigh each deficiency by its severity and create a *Deficiency Score* variable that aggregates all of the severity-weighted deficiencies. The higher the deficiency score, the lower the quality. Other quality measures are reported quarterly, and I use the fourth-quarter figures to proxy the latest quality in each year. High prevalence of restraint use and pressure sores in general represent low quality. In addition to measures of physical quality, I include measures of the mental health of nursing home residents. Each nursing home is assessed according to the percentage of its residents who are more depressed or anxious. A detailed description of quality measures appears in Appendix B. I use the Medicare provider number to merge nursing home financial information and the corresponding quality measures.

Detailed nurse staffing hours and employee turnover provide important information to validate the mechanism that causes nursing home quality fluctuation. Nurse staffing measures include Registered Nurses (RN) hours per patient day, Certificated Nurse Aides (CNA) hours per patient day, and total nurse hours per patient day. CNAs compose the most important workforce in the nursing home industry, accounting for 65% of nurse hours. Employee turnover is another mechanism by which business cycles can affect the quality of care. Turnover is calculated by dividing the total number of employees during a year by the number of employees by the end of year. High turnover suggests that, on average, the employees have shorter tenure for the same nursing facilities. This can lead to less training and unfamiliarity with specific needs of individual residents. Turnover information is not available from the CMS' NHC website and is only available through nursing home financial reports from Arizona, California, New York, and Ohio [9].

[9]Ohio nursing homes provide retention rates instead of turnover rates. I create the proxy for turnover by subtracting retention rates from 1. This proxy underestimates the real turnover.

2.3.1.3 Additional Control Variables

The NHC dataset also provides several important nursing home-level and market-level control variables. Nursing home ownership types, sizes, payer-mixes, and system affiliation are the key variables to control for the nursing home heterogeneity. In the sample, 70% are for-profit and about 19% of them are not-for-profit. The median nursing home has 113.2 beds and 47% of the nursing homes are affiliated with multi-facility systems. Market-level covariates include median household income and population above 65 years old per square mile. The county is used as the primary definition of nursing home market. To control for the intensity of market competition, I construct a Herfindahl-Hirschman index (HHI) by summarizing the squares of nursing home market shares in each county. [10]

2.3.2 Empirical Strategy

The basic specification uses pooled sample ordinary least squares and control for the state-fixed effects, the linear time trend, and the state-specific time trend.

$$Q_{i,t} = FL_{i,t-1}\beta + NH_{i,t}\lambda + M_{m,t}\Theta + S + T + SXT + \epsilon \tag{2.5}$$

where $Q_{i,t}$ is quality for nursing home i and at year t. $FL_{i,t-1}$ is one year lagged log financial leverage used as the proxy for financial constraints for nursing home i at year t. Because the distribution of financial ratios is known to be positively skewed, I take log transformation on the financial variables. NH is a vector of nursing home characteristics that include ownership types (e.g., for-profit and not-for-profit), size (number of beds), system affiliation, occupancy rate, and public and private payer mixes. M is nursing home market level characteristics[11], such as the HHI concentration level and demographic variables (median household income) for

[10] Market share is calculated by the number of nursing home beds in each county

[11] nursing home market level characteristics are calculated at the county level.

market m and at year t. S is the state indicator variable that controls for state-fixed effects. T represents linear trends to capture unobservable changes over time. SXT represents the state-specific time trend. [12]

2.3.3 Regional Recession and Local Unemployment Rates:

Measures of local business cycles serve two important purposes. The decision of quality directly affects the financial constraints. Therefore, to deal with this endogeneity issue, I use a set of instruments to identify business cycles at the local or regional levels. These business cycle measures provide both cross-sectional and time-series variations. I obtain unemployment rates at the county level from the ARF and from the Bureau of Labor Statistics. Similarly, I use the regional economic accounts from the Bureau of Economic Analysis to obtain GDP growth rates for each Metropolitan Statistical Area (MSA). In addition, county-level variables such as median income, population age above 65 years old per square mile, and unemployment rates are obtained from the ARF[13]. Because the financial constraints and choice of nursing home quality could be endogenous to each other, exogenous shock that only affects one but not the other is desired to establish clear causal relationship. Unexpected changes of the market environments include other instruments often used in the literature. Business cycle is a particularly popular one. Chevalier and Scharfstein (1996), Campello (2003), and Khanna and Tice (2004) all used the business cycle as an exogenous demand shock to study the effects of financial leverage on operating decisions. Zhu (2011) used commodity prices as exogenous cost shocks to examine the impacts of financial constraints on product market competition. These papers adopt the assumption that the fluctuation of the economy is not perfectly foreseen

[12] I also run a year-fixed-effect model as a robustness check. The results are consistent with the results from the linear time trend specification. The time trend model is preferred, because it enables the use of variations both across counties and across years.

[13] The unemployment rates of 1999, 2010, and 2011 are directly downloaded from the Bureau of Labor Statistics

by the managers when financial leverage decisions were made and the adjustments of financial leverage are not always feasible. I use business cycles as a surrogate for exogenous cost shock to the nursing home industry. The empirical specification with exogenous cost shock can be defined as follows:

$$Q_{i,t} = FL_{i,t-2}\beta + BC_{m,t-1}\gamma + FL_{i,t-2}XBC_{m,t-1}\tau + NH_{i,t}\lambda + M_{m,t}\Theta + S + T + SXT + \epsilon \tag{2.6}$$

Notice that in this specification, BC represents the regional and local market condition for market m and at time t. I use the MSA-level GDP growth rates and the county-level unemployment rates to provide continuous measurements capturing both time-series and geographical variations of business cycles. The key variables of interest are lagged financial leverage, the interaction terms of lagged financial leverage, and business cycle measures. Compared to the literature on cyclical behaviors, business cycle has a distinct impact on the nursing home industry. Because wages account for about two-thirds of the nursing home operating cost, operating cost is low during a recession when unemployment rate is high. Holding all else equal, the operating cash flows will be higher during recessions than in booms. Therefore, nursing homes with high existing financial leverage will face the most severe liquidity constraint when the economy grows rapidly. Stevens et al. (2011) find that, during the recession, nursing homes have higher nurse staffing and lower mortality. In addition, Cawley and colleagues (2006) find that local wage levels inversely affect nursing home quality. Therefore, to incorporate differential local responses to the business cycle, real GDP growth rates for each MSA are used to measure the regional business cycle.

2.3.4 Structure of Time Lag:

When unemployment rates are high, nursing homes may hire more nurses and have lower employee turnover. This change of nursing home workforce leads to better nursing home quality. However, the time lag between the change of local market condition and the reflection in quality improvement is unknown. I specify preferred time lags for quality measures based on when these measures were inspected and reported. First, nursing homes are inspected, and any deficiencies (both health and fire safety) are reported at least once for every 12-15 months. For example, 2008 deficiencies data may be reported anytime from September 2007 to December 2008. This creates large variations of when the nursing homes are actually inspected. Second, nursing homes report quarterly on the prevalence of physical restraint, the prevalence of pressure sores, and the mental health conditions of residents. Third, nurse staffing hours and employee turnover are reported by each calendar quarter or at the end of the year. To allow sufficient time for the changes in labor market to be reflected in nursing home quality, I examine the impacts of one-year lagged unemployment rates on all quality measures.

Such lag structures between quality measures and unemployment rates, accordingly, affect the lag structure of financial leverage ratios. To account for the reverse causality and simultaneity issues between financial arrangements and local unemployment, financial leverage ratios will indicate a one-year lag of unemployment rates in every empirical specification.

2.4 Empirical Results and Discussion:

In this section, I first present the empirical results to show the effects of financial constraints and unemployment rates on nurse staffing and turnover. It provides clear evidence that local business cycles directly affect nursing home quality through

the change in labor markets. Second, I run the same regressions on health deficiencies, the prevalence of physical restraint, and the prevalence of pressure sores, which are considered to be more sensitive to labor inputs. The results of labor inputs and these quality measures are consistent with the theoretical predictions. For a robustness test, I also run the same empirical specifications on the quality measures that are either more capital intensive or requiring more complex management. Local unemployment should only affect this set of quality measures if recessions ease the financial constraints. I close with the analysis of differential effects by ownership, system affiliation, and private-pay revenue share. The differential cyclical patterns between for-profit and not-for-profit nursing homes are striking and particularly interesting.

2.4.1 The Counter-Cyclical Nurse Staffing and Turnover

The theoretical prediction that nursing home quality is counter-cyclical relies on the assertion that, during a recession, worse labor markets limit the availability of alternative jobs and make the alternatives less monetarily appealing, particularly when some of the alternatives are pro-cyclical. Therefore, during economic downtimes, nursing homes can increase their nurse staff numbers, hire more experienced and skillful nurses, and face less nurse turnover. Such improvements in the nursing home workforce should lead to better nursing home quality. To verify that nursing home labor inputs are an important mechanism that explains counter-cyclical quality, I directly examine the impacts of unemployment rates on nurse staffing hours and turnover. Because nurse turnover data are not available for all states, only nursing homes in Arizona, California, New York, and Ohio are included in the turnover analysis. Nurse staffing hours are extracted from NHC website and, to account for different mixes of nurse specialties, I run separate regressions on certificated nurse aide (CNA) hours per patient, registered nurse (RN) hours per patient, and total nurse hours per patient. The results are shown in Table 2.3. From column (1) to column (4), results

from all specifications provide statistically significant evidence ($p<0.01$) that nurse staffing hours and turnover are counter-cyclical: higher nurse staffing hours and lower turnover exist during recessions. Comparing the effects of change of unemployment rates on labor inputs, I find that the magnitudes are larger for employee turnover than for nurse staffing hours. For a nursing home with an average financial leverage, a 5 percentage point increase in unemployment rates can lower turnover by 4.35%. This is about 11.4% of the mean and 13.56% of the standard deviation. The same changes only increase CNA hours by 0.07 hours and total nurse hours by 0.145 hours. On the other hand, the effects of financial constraints are less robust. While the estimated coefficients of lagged financial leverage are negative for all nurse staffing measures, it is only statistically significant on CNA hours at the 5% level. However, the coefficient of lagged financial leverage on turnover is statistically significant at the 1% level. The coefficients of the interaction term between lagged financial leverage and unemployment rates are mostly statistically insignificant and magnitudes are relatively small. Overall, the analysis of nurse staffing and turnover provides consistent and strong evidence that both nurse hours and turnover are counter-cyclical. This supports the hypothesis that the pro-cyclical labor markets may explain the counter-cyclical nursing home quality.

2.4.2 Financial Constraints and Counter-Cyclical Quality

Empirical results in Table 2.4 present consistent evidence that financial constraints lead to lower nursing home quality and that nursing home quality is counter-cyclical. My interpretation focuses on the estimated marginal effects of lag financial leverage, change in unemployment rates, and the interaction term between lag financial leverage and change in unemployment rates. The coefficients of lagged financial leverage and change in unemployment rates are statistically significant at the 1% level for all quality measures. The signs of the estimates are consistent with the the-

oretical predictions: more financially constrained nursing homes have lower quality, and higher unemployment rates lead to better nursing home quality. The magnitudes are substantial. One standard deviation of higher financial leverage increases health deficiency scores by 1.9 and the number of deficiencies by 0.44, leading to higher prevalence of physical restraint by 0.35 percentage points and of pressure sores by 0.30 percentage points. On the other hand, when unemployment rate increases by 5 percentage points, the health deficiencies score decreases by 2.4, and number of the deficiencies decreases by 0.585. A 5 percentage point increase in unemployment rates also reduces the prevalence of physical restraint by 1.19 percentage points and the prevalence of pressure sores by 0.69 percentage points. The coefficients of the leverage and unemployment interaction term provide empirical evidence that financial constraints amplify counter-cyclical quality fluctuations. I find weak evidence that supports this hypothesis. The coefficients of the interaction term are negative across all regressions, but are not statistically significant for the deficiency score and counts. In addition, the magnitudes of the marginal effects are small even when they are statistically significant.

While the results of labor inputs and labor sensitive quality measures provide strong evidence that quality is counter-cyclical, the results also suggest a discrepancy that financial constraints may have significant impacts on quality measures but not on labor inputs. The concept of diminishing marginal productivity of labor may help to explain this discrepancy. Descriptive statistics suggest that highly leveraged nursing homes on average have lower staffing hours, higher turnover, and lower quality. Applying the law of diminishing marginal productivity of labor to quality, despite the same improvements of nurse staffing hours and turnover, the marginal quality improvement of financially constrained nursing homes will be larger than the unconstrained ones. However, this hypothesis cannot be empirically tested without knowing the nursing home production function. This would require structural estimation of

the functional form of the production process and is beyond the scope of this study.

2.4.3 Alternative Hypothesis of Leverage

There is a concern that nursing homes with high existing leverage might have better access to debt finance. The highly leveraged nursing homes could be actually less financially constrained. If this assertion is true, when labor costs increase during economic booms, highly leveraged nursing homes should have better access to external capital markets than those with low existing leverage. Therefore, one should expect that quality of highly leveraged nursing homes to be less counter-cyclical. The results clearly reject this hypothesis.

2.4.4 Alternative Quality Measures: Fire Safety and Compliance of Vaccination

An alternative to drawing the causality between financial constraints and quality is to examine the effects of unemployment rates on a different set of quality measures that are not directly affected by the change of nursing home workforce. This set of quality measures includes deficiencies that undermine fire safety and compliance with vaccination recommendations. These two measures may be considered more capital-intensive or more complex to practice than previous labor sensitive measures. For instance, fire safety deficiencies involve investments to upgrade and renovate the infrastructure, and vaccination compliance may require longer reimbursement cycles and more complex coordination. Therefore, higher unemployment may improve these quality measures because lower labor costs ease the financial constraints and thus lead to higher/better investments in fire safety and vaccinations. The results in Table 2.5 provide statistically significant ($P<0.01$) and consistent evidence that recessions ease financial constraints and lead to better investment in quality improvement.

2.4.5 Differences between for-profit and not-for-profit ownerships

Results in Table 2.6 provide evidence supporting this hypothesis. I split the sample into Panel A (for-profit) and Panel B (not-for-profit) and repeat the same analysis on two subsamples separately. Notably, financial constraints and unemployment have larger and more statistically significant ($P<0.01$) effects on the quality of for-profit homes. Surprisingly, in Panel B, the effects of unemployment rates on not-for-profit homes are insignificant and even positive. For this comparison, financial constraints have stronger impacts on the quality of for-profit nursing homes than of not-for-profit ones. More interestingly, only for-profit nursing homes have counter-cyclical quality. These results provide a new perspective of the differences between for-profit and not-for-profit ownerships and also provide additional explanations regarding why not-for-profit organizations are essential and prevalent in health care markets.

2.4.6 Competing Hypotheses on System Affiliation

I present the results in Table 2.7. Across most regressions, financial constraints and business cycles have stronger and more statistically significant effects on system-affiliated facilities than on independent facilities. The estimated interaction effects are only statistically significant for the use of physical restraint and the prevalence of pressure sores ($P<0.05$). Overall, the regression results from the split sample reject the internal capital market hypothesis and favor the alternative that system affiliation causes individual nursing homes to be more financially constrained.

However, there is a major limitation that the system-level leverage measurement is not available. It is possible that nursing home chains use higher leverage, and thus affiliated homes are more sensitive to the change of operating cash flows over the business cycles. If this is true, the internal capital hypothesis can also explain the results that system-affiliated nursing homes are more financially constrained.

2.4.7 The Role of Private-Pay Revenue Shares

I split the sample into Panel A, which includes nursing homes with private-pay revenue share below the median (12.97%), and Panel B, which includes that above the median[14]. The results are presented in Table 2.8. The coefficients of the interaction term between financial leverage and unemployment rates are only statistically significant for Panel A but not for Panel B. In addition, the magnitudes of the interaction effects in Panel A are more than twice those in Panel B. This provides supportive evidence that nursing home quality is more cyclical for those facilities that have less private-pay residents. Also, financial constraints only amplify the counter-cyclical quality fluctuation for the nursing homes with fewer private-pay residents. However, I acknowledge that I cannot rule out the alternative hypothesis that nursing homes can increase private prices when operating costs are high and hence can maintain more stable quality across business cycles.

2.4.8 Pro-cyclical Mental Health

Interestingly, I find that mental health demonstrates cyclical patterns opposite those of physical health. I use the percentage of residents becoming more depressed or anxious as a proxy for mental health. As shown in Table 2.9, the empirical results are consistent with Ruhm (2000) that mental health is strongly pro-cyclical ($P<0.01$); residents are more depressed during recessions than during booms. This result is particularly interesting, because nursing home residents, by definition, are institutionalized and most of them live on public insurance programs. During recessions, not only do they receive better care, but they are also almost isolated from the negative impacts of unemployment. Several potential explanations for this are available. For example, social contagion (*Eisenberg et al.*, 2012) from the more depressed

[14]I also attempt to run a triple-interaction model among financial leverage, unemployment rates, and private-pay revenue share. However, I do not have sufficient statistical power to do so.

nursing home workers or concerns for their beloved adult children might provide directions for future research. Further empirical analysis will require detailed information of mental health status at the individual level and is beyond the scope of this study.

2.5 Concluding Remark

I provide both theoretical arguments and empirical evidence that nursing home quality is counter cyclical and that financial constraints lead to lower quality. Somewhat weaker evidence also suggests that financial constraints amplify counter-cyclical quality fluctuations. Interestingly, these findings are particularly prominent among for-profit nursing homes, which also largely focus on Medicaid residents and are more likely to belong to multi-facility chains. This sharp contrast of cyclical quality fluctuations between for-profit and not-for-profit nursing homes provides new evidence for the difference between for-profit and not-for-profit ownerships.

In contrast to public perception, nursing home quality significantly improves during economic downturns and worsens during economic booms. The fundamentals lie in the interplay among regulated prices, relatively stable market demands, and labor market fluctuations. During economic recessions, nurse staffing hours increase and employee turnover decrease. I propose that such changes in the workforce lead to the observed quality fluctuations. The deficiencies, physical restraint, pressure sores, and compliance with vaccination demonstrate significant improvements during economic downturns. Such strong counter-cyclical quality suggests that managers and policy makers should be more concerned about nursing home quality when and where the economy is rapidly growing. While this paper focuses on the quality of nursing homes, the theoretical predictions and empirical findings may be generalized and applied to hospitals, education, public services, and other industries that share common attributes.

Financial constraints reduce nursing homes investments in quality across many

dimensions. The results are robust and consistent when using financial leverage, the cash flow sensitivities, and the current ratio as the proxies for financial constraints.

Strong implications can be derived from the results. First, our economy is heading toward recovery from the Great Recession and the financial burdens to hire and maintain skillful workforce will become even greater. Second, more than 10% of unique nursing homes have becomed involved in highly leveraged transactions by private equity firms in the past decade (*Stevensons and Grabowski*, 2008; *GAO*, 2010); these highly leveraged nursing facilities more likely exhausted their external financial resources. Because the adjustments of capital structure are not always feasible, aggressive financial arrangements can lead to suboptimal quality when facing economic and regulatory uncertainties. A special program might be desirable to provide alternative credit channels for efficient but financially constrained nursing homes.

Although nursing home quality has improved significantly in the past decade, continuous quality improvement is of concern because of the interplay among economic recovery, highly leveraged transactions, and government fiscal difficulty. The beginning of economic recovery is also the beginning of the challenge.

Figure 2.2: Avg. county unemployment rates by state over sample periods

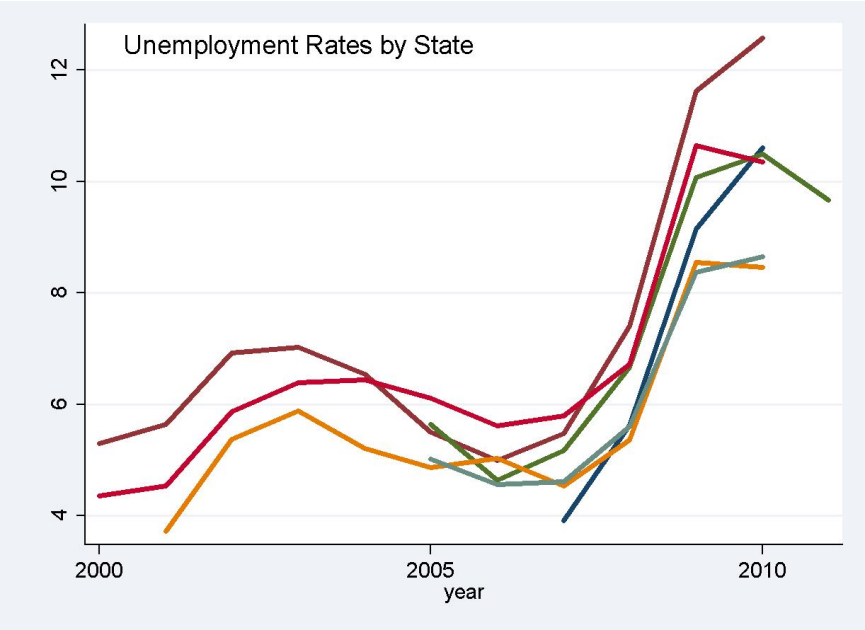


Figure 2.3: Nurse Aide Hrs per Patient Day and 1 yr lag Δ Unemployment Rate

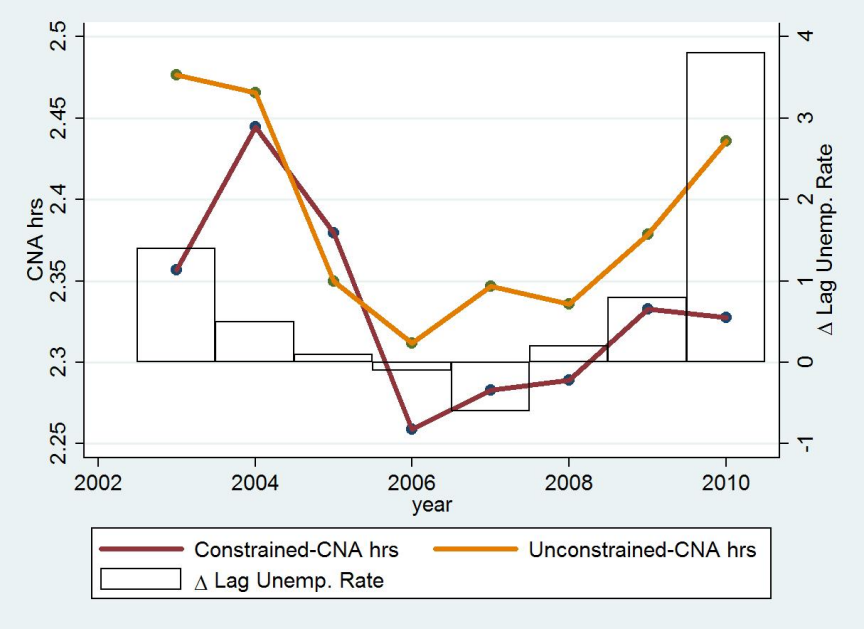


Figure 2.4: Employee Turnover and 1 yr lag Δ Unemployment Rate

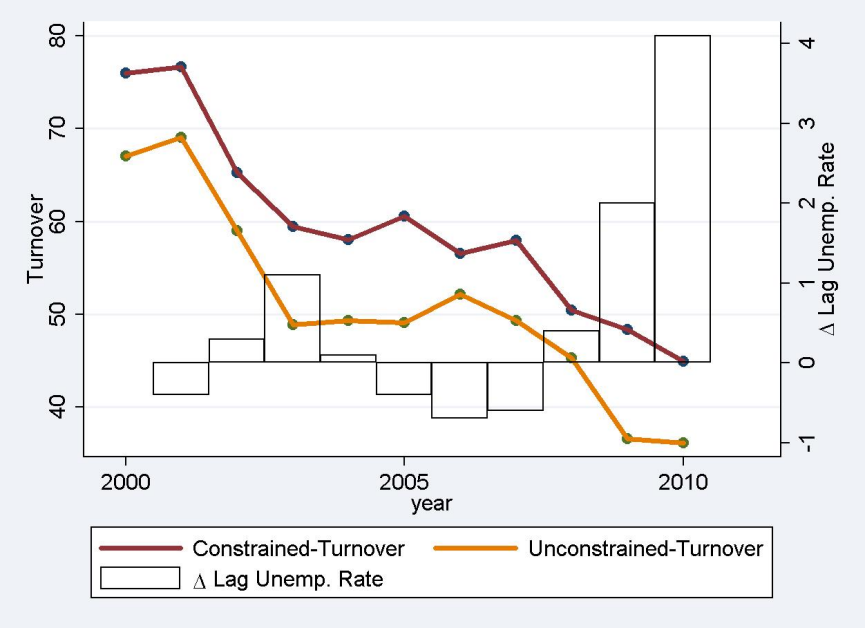


Figure 2.5: Number of Health Deficiency and 1 yr lag Δ Unemployment Rate

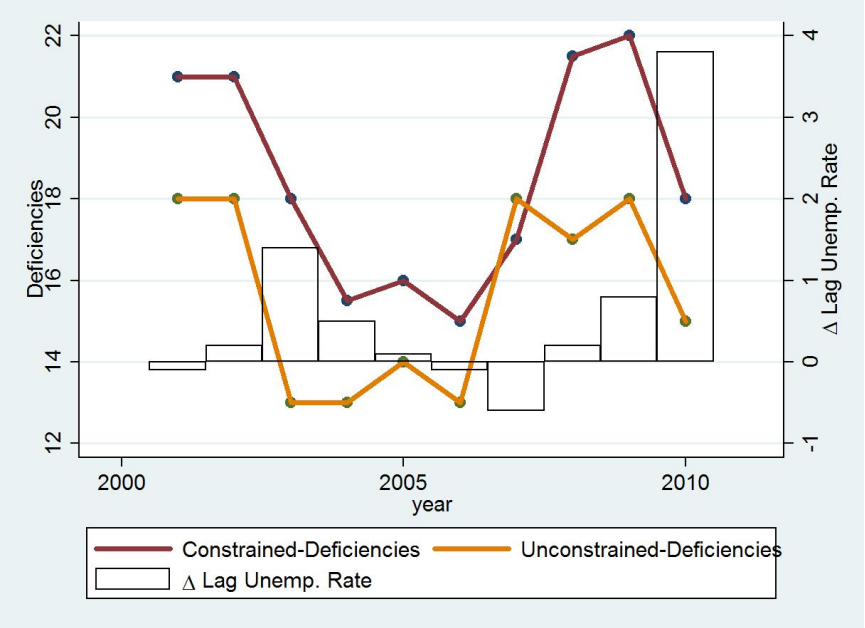


Figure 2.6: Prevalence of Physical Restraint and 1 yr lag Δ Unemployment Rate

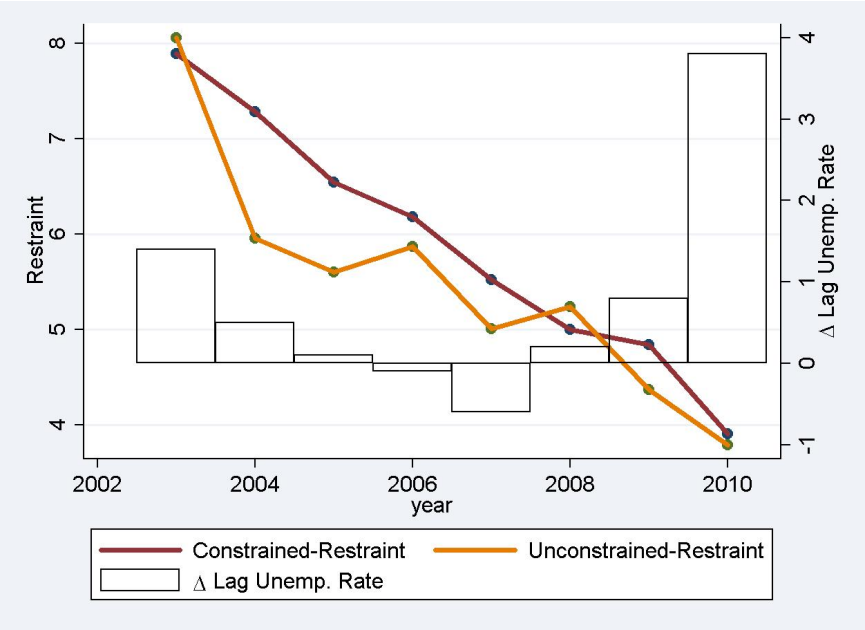


Figure 2.7: Prevalence of Pressure Sores and 1 yr lag Δ Unemployment Rate

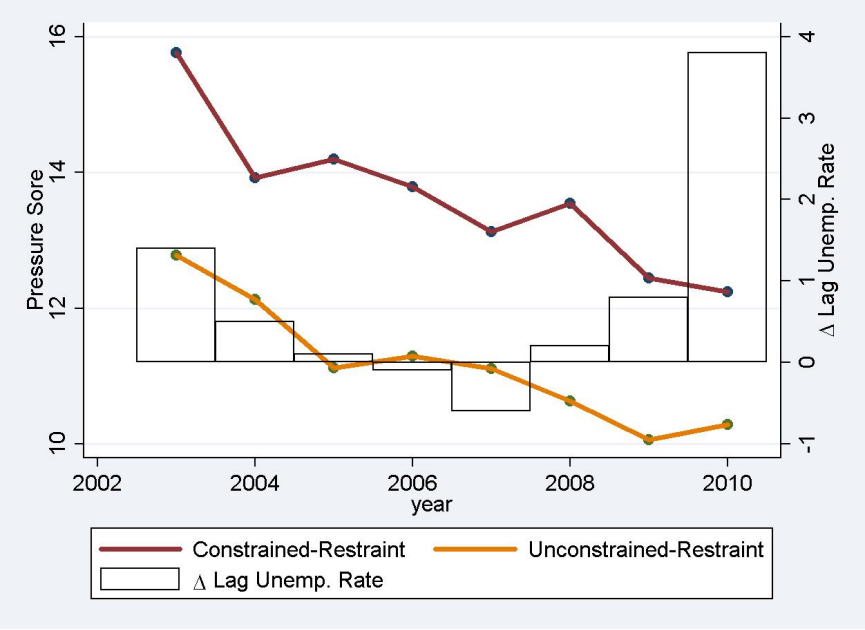


Table 2.1: Sample Composition by State and by Year

State	**Years**	**Countys**	**MSAs**	**Facility-Years**	**CON Moratorium**
Arizona	2007-2010	15	6	435	NO
California	2000-2010	57	26	10,017	NO
Illinois	2005-2011	102	11	4,535	NO
Massachusetts	2001-2010	14	6	2,671	YES
Ohio	2001-2010	88	16	8,668	YES/NO
New York	2005-2010	62	12	3,269	NO
Total		338	77	28,944	

Note 1: I used lagged financial measures so the observations in the first year of each state will not be included in the analysis.

Table 2.2: Summary Statistics

	Mean	Std	Min	Max	*N*
Labor Inputs:					
Registered Nurse (hrs/Patient Day)	0.61	0.38	0	12.62	23893
Certified Nurse Aides (hrs/Patient Day)	2.37	0.60	0	17.29	23893
Total Nurse (hrs/per Patient Day)	3.75	0.87	0.04	22.86	23893
Employee Turnover	39.78	33.45	-1	1133.33	16524
Labor-sensitive Quality Measures					
Health Deficiencies					
Severity-Weighted Score	29.22	26.91	0	280	28141
Count	7.12	6.27	0	52	28141
Percent of Physical Restraint	7.08	8.41	0	100	24313
Percent of Pressure Sores	12.99	7.21	0	95	19713
Percent of Moderate/Severe Pain	4.92	5.20	0	70	24144
Broader Quality Measures					
Fire and Life Safety Deficiencies					
Severity-Weighted Score	15.00	16.22	0	126	26597
Count	3.40	3.43	0	25	26597
Pneumococcal Vaccination Compliance					
Percent of Long-Stay Patients	81.75	21.80	0	95	23269
Percent of Short-Stay Patients	77.69	23.66	0	95	21062
Mental Health					
Percent of More Depressed or Anxious	14.23	9.08	0	76	24178
Independent variables					
Financial Leverage	1.35	35.20	0.00	5699	28141
Ln(Financial Leverage)					
Current Ratio					
Ln(Current Ratio)					
ΔUnemployment Rates	0.62	1.44	-8	9	28141
GDP Growth Rates	0.98	2.86	-10	13	22199
For-Profit	0.77	0.42	0	1	28141
Govt Owned	0.02	0.15	0	1	28141
System Affiliation	0.50	0.50	0	1	28141
Occupancy Rate	86.65	12.49	1	100	28141
ResidentOnly	0.60	0.49	0	1	28141
# of Beds	116.97	70.36	6	889	28141
Private-pay share	0.17	0.17	-1.92	2.32	28141
MedicaidOnly	0.02	0.13	0	1	28141
MedicareOnly	0.02	0.13	0	1	28141
ln (Household Income)	10.82	0.22	10.21	11.46	28141
HHI Index	0.09	0.13	0.00	1	28141
per SqueMile 65	0.29	0.76	0.00	9.16	28141

Table 2.3: Counter-cyclical Labor Inputs

	Nurse Hours per Patient Day			
	CNA hrs	RN hrs	Tot Nurse hrs	Turnover
	(1)	(2)	(3)	(4)
Ln(Levg)$_{t-2}$	**-0.024****	**-0.003**	**-0.006**	**1.651*****
	[0.006]	**[0.004]**	**[0.009]**	**[0.335]**
ΔUnempR$_{t-1}$	**0.014*****	**0.021*****	**0.029*****	**-0.907*****
	[0.003]	**[0.002]**	**[0.004]**	**[0.197]**
Ln(Levg)$_{t-2}$	**0.002**	**0**	**0.001**	**-0.004**
XΔUnempR$_{t-1}$	**[0.002]**	**[0.001]**	**[0.003]**	**[0.111]**
For-profit	-0.260***	-0.082***	-0.375***	5.888***
	[0.022]	[0.011]	[0.029]	[0.765]
Govt Owned	-0.01	-0.021	-0.044	0.059
	[0.048]	[0.026]	[0.061]	[1.619]
System-affiliated	-0.136***	0.012	-0.151***	-1.718**
	[0.013]	[0.008]	[0.019]	[0.695]
Occupancy Rate	-0.003***	-0.003***	-0.009***	-0.104***
	[0.001]	[0.000]	[0.001]	[0.032]
Resident Only	0.001	-0.001	0.012	-0.351
	[0.012]	[0.007]	[0.017]	[0.632]
Number of Beds	-0.001***	-0.000***	-0.001***	-0.023***
	[0.000]	[0.000]	[0.000]	[0.005]
Private pay share	0.147*	0.071**	0.200*	-11.093***
	[0.085]	[0.028]	[0.107]	[2.071]
Medicaid Only	-0.036	-0.086***	-0.103	2.941
	[0.067]	[0.030]	[0.114]	[5.013]
Medicare Only	0.220***	0.323***	0.673***	-2.012
	[0.077]	[0.064]	[0.123]	[2.259]
Ln(Income)	-0.008	0.242***	0.126***	-5.964***
	[0.034]	[0.020]	[0.049]	[1.682]
HHI Index	0.086	-0.068**	-0.102	-1.891
	[0.055]	[0.030]	[0.071]	[2.788]
Pou. above 65	0.001	0.021***	-0.041**	-1.335***
per mile^2(,000)	[0.011]	[0.006]	[0.015]	[0.434]
Constant	2.781***	-1.560***	3.324***	71.250***
	[0.369]	[0.216]	[0.525]	[18.480]
State Fixed Effect	√	√	√	√
State Time Trend	√	√	√	√
R^2	0.141	0.141	0.153	0.360
N	20647	20647	20647	14878

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) all standard errors are clustered at the facility level to account for within facility heterogeneity. Note (3) Turnover regression only includes facilities in Arizona, California, and Ohio States.

Table 2.4: Labor-sensitive Quality Measures - Δ Unemployment Rates

	Health Deficiency		Health Outcome		
	Score	Count	Restraint	Pressure Sores	Pain
	(1)	(2)	(3)	(4)	(5)
Ln(Levg)$_{t-2}$	**2.240*** **	**0.494*** **	**0.413*** **	**0.371*** **	**0.205*** **
	[0.285]	**[0.064]**	**[0.120]**	**[0.092]**	**[0.066]**
ΔUnemR$_{t-1}$	**-0.480*** **	**-0.117*** **	**-0.238*** **	**-0.138*** **	**-0.100*** **
	[0.149]	**[0.033]**	**[0.040]**	**[0.043]**	**[0.028]**
Ln(Levg)$_{t-2}$	**-0.065**	**-0.016**	**-0.067***	**-0.096*** **	**-0.040** **
XΔUnemR$_{t-1}$	**[0.117]**	**[0.027]**	**[0.035]**	**[0.035]**	**[0.020]**
For-profit	3.424***	0.884***	1.067***	1.600***	0.359**
	[0.756]	[0.176]	[0.245]	[0.251]	[0.174]
Govt Owned	-1.545	-0.354	0.726	0.462	0.435
	[1.380]	[0.309]	[0.570]	[0.578]	[0.321]
System-affiliated	0.197	0.028	-0.689***	-0.362*	-0.027
	[1.457]	[0.330]	[0.615]	[0.626]	[0.346]
Occupancy Rate	-0.122***	-0.027***	-0.020**	-0.042***	-0.034***
	[0.022]	[0.005]	[0.008]	[0.008]	[0.006]
Resident Only	0.619	0.166	-0.529***	-0.122	0.280***
	[0.460]	[0.105]	[0.192]	[0.166]	[0.106]
Number of Beds	0.064***	0.015***	0.002	0.005***	-0.001
	[0.005]	[0.001]	[0.002]	[0.002]	[0.001]
Private pay share	-6.035*	-1.447*	0.464	-1.436	-0.86
	[3.521]	[0.848]	[0.303]	[1.179]	[0.713]
Medicaid Only	-2.503	-0.94	-0.361	-1.869	-0.499
	[2.785]	[0.577]	[1.767]	[1.989]	[0.879]
Medicare Only	-7.326***	-1.892***	-0.9	-1.294	-0.037
	[2.004]	[0.493]	[1.707]	[2.208]	[0.647]
Ln(Income)	3.767***	0.825***	-0.981*	-0.669	-0.178
	[1.401]	[0.320]	[0.563]	[0.497]	[0.319]
HHI Index	7.262***	1.298***	-0.277	-5.897***	1.395**
	[2.160]	[0.479]	[0.842]	[0.837]	[0.637]
Pou. > 65	-2.579***	-0.591***	-0.728***	0.684***	-0.130**
per mile^2(,000)	[0.342]	[0.076]	[0.125]	[0.161]	[0.061]
Constant	-12.842	-2.763	15.368**	23.346***	8.568**
	[15.239]	[3.463]	[6.130]	[5.404]	[3.457]
State Fixed Effect	√	√	√	√	√
State Time Trend	√	√	√	√	√
R^2	0.171	0.224	0.268	0.077	0.137
	22934	22934	21285	17363	21149

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) all standard errors are clustered at the facility level to account for within facility heterogeneity.

Table 2.5: Broader Quality Measures - Δ Unemployment Rates

	Fire Safety Deficiency		Pneumococcal Vaccination	
	Score	Count	Long Stay	Short Stay
	(1)	(2)	(3)	(4)
Ln(Levg)$_{t-2}$	**0.605*** **	**0.142*** **	**-0.611** **	**-0.658***
	[0.147]	**[0.033]**	**[0.305]**	**[0.355]**
ΔUnempR$_{t-1}$	**-0.137**	**-0.088*** **	**1.906*** **	**2.772*** **
	[0.096]	**[0.021]**	**[0.163]**	**[0.196]**
Ln(Leveg)$_{t-2}$	**-0.002**	**0.005**	**0.319*** **	**0.193** **
XΔUnempR$_{t-1}$	**[0.072]**	**[0.016]**	**[0.090]**	**[0.108]**
For-profit	0.22	0.052	-4.376***	-4.500***
	[0.384]	[0.081]	[0.566]	[0.726]
Govt Owned	1.124	0.214	1.515	2.966*
	[0.947]	[0.190]	[1.308]	[1.790]
System-affiliated	0.213	0.071	-2.483***	-3.528***
	[0.294]	[0.064]	[0.557]	[0.658]
Occupancy Rate	-0.052***	-0.011***	0.062**	0.026
	[0.014]	[0.003]	[0.024]	[0.029]
Resident Only	1.075***	0.246***	0.81	0.87
	[0.270]	[0.059]	[0.520]	[0.623]
Number of Beds	0.016***	0.004***	-0.038***	-0.039***
	[0.003]	[0.001]	[0.005]	[0.006]
Private pay share	-1.389	-0.294	12.951***	19.042***
	[0.895]	[0.197]	[1.769]	[2.238]
Medicaid Only	-1.172	-0.193	2.347	
	[1.100]	[0.271]	[3.327]	
Medicare Only	-2.482***	-0.607***	1.971	4.435**
	[0.887]	[0.209]	[1.611]	[1.969]
Ln(Income)	3.602***	1.094***	0.739	0.689
	[0.762]	[0.165]	[1.238]	[1.569]
HHI Index	10.293***	2.213***	23.647***	25.790***
	[1.595]	[0.324]	[2.156]	[2.854]
Pou. > 65	-0.678***	-0.126***	-0.131	-0.064
per mile^2(,000)	[0.175]	[0.039]	[0.265]	[0.349]
Constant	-16.195*	-7.622***	71.908***	68.182***
	[8.383]	[1.810]	[13.593]	[17.284]
State Fixed Effect	√	√	√	√
State Time Trend	√	√	√	√
R^2	0.155	0.144	0.151	0.145
N	21419	21419	16142	14069

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) all standard errors are clustered at the facility level to account for within facility heterogeneity. Note (3) the results using GDP growth rates are qualitative similar. The results are available upon request.

Table 2.6: Split Sample by Ownership Types

	Panel A - For-profit					Panel B - Not-for-profit				
	Health Deficiency		Health Outcome			Health Deficiency		Health Outcome		
	Score	Count	Restraint	P. Sores	Pain	Score	Count	Restraint	P. Sores	Pain
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ln(Levg) $_{t-2}$	2.233***	0.494***	0.442***	0.387***	0.253***	2.225***	0.502***	0.226	0.161	0.03
	[0.322]	[0.072]	[0.141]	[0.103]	[0.075]	[0.605]	[0.142]	[0.204]	[0.194]	[0.154]
$\mathbf{\Delta UnempR}_{t-1}$	-0.699***	-0.167***	-0.237***	-0.178***	-0.109***	0.454	0.099	-0.206**	0.117	-0.057
	[0.169]	[0.038]	[0.045]	[0.050]	[0.031]	[0.306]	[0.069]	[0.092]	[0.095]	[0.066]
Ln(Levg) $_{t-2}$	-0.095	-0.022	-0.078*	-0.145***	-0.063***	0.14	0.025	0.005	0.193**	0.027
$\mathbf{X\Delta UnempR}_{t-1}$	[0.137]	[0.032]	[0.042]	[0.038]	[0.024]	[0.276]	[0.065]	[0.062]	[0.096]	[0.044]
State Fixed Effect	√	√	√	√	√	√	√	√	√	√
State Time Trend	√	√	√	√	√	√	√	√	√	√
R^2	0.169	0.219	0.275	0.072	0.126	0.104	0.14	0.189	0.088	0.178
N	18062	18062	16805	13542	16688	4443	4443	4056	3435	4037

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) all standard errors are clustered at the facility level to account for within facility heterogeneity.
Note (3) Government owned nursing homes are excluded in this analysis.

Table 2.7: Split Sample by System Affiliation

	Panel A - System-Affiliated					Panel B - Not System-Affiliated				
	Health Deficiency		Health Outcome			Health Deficiency		Health Outcome		
	Score	Count	Restraint	P. Sores	Pain	Score	Count	Restraint	P. Sores	Pain
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ln(Levg) $_{t-2}$	2.330***	0.532***	0.630***	0.385***	0.229***	2.082***	0.430***	0.061	0.213	0.159
	[0.362]	[0.081]	[0.147]	[0.107]	[0.084]	[0.425]	[0.097]	[0.176]	[0.153]	[0.100]
$\mathbf{\Delta UnempR}_{t-1}$	-0.715***	-0.174***	-0.273***	-0.127**	-0.075**	-0.197	-0.046	-0.191***	-0.139**	-0.127***
	[0.202]	[0.045]	[0.055]	[0.058]	[0.036]	[0.218]	[0.049]	[0.062]	[0.069]	[0.044]
$\mathbf{Ln(Levg)}_{t-2}$	-0.189	-0.05	-0.108**	-0.128***	-0.046*	0.146	0.041	-0.002	-0.04	-0.027
$\mathbf{X\Delta UnempR}_{t-1}$	[0.149]	[0.034]	[0.045]	[0.042]	[0.025]	[0.189]	[0.044]	[0.051]	[0.063]	[0.034]
State Fixed Effect	√	√	√	√	√	√	√	√	√	√
State Time Trend	√	√	√	√	√	√	√	√	√	√
R^2	0.173	0.224	0.237	0.068	0.138	0.179	0.233	0.319	0.1	0.142
N	11875	11875	11093	9237	11039	11059	11059	10192	8126	10110

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) all standard errors are clustered at the facility level to account for within facility heterogeneity.
Note (3) System affiliation is defined as belongs to any multi-facilities nursing chains.

Table 2.8: Split Sample by Private-pay shares (Below or Above Median)

	Panel A - Below Median					Panel B - Above Median				
	Health Deficiency		Health Outcome			Health Deficiency		Health Outcome		
	Score	Count	Restraint	P. Sores	Pain	Score	Count	Restraint	P. Sores	Pain
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Ln(Levg) $_{t-2}$	2.776***	0.610***	0.486***	0.230*	0.347***	1.437***	0.316***	0.351**	0.471***	0.016
	[0.420]	[0.094]	[0.175]	[0.132]	[0.086]	[0.338]	[0.077]	[0.142]	[0.117]	[0.088]
$\mathbf{\Delta UnempR}_{t-1}$	-0.782***	-0.180***	-0.240***	-0.151**	-0.106***	-0.134	-0.04	-0.222***	-0.125**	-0.102***
	[0.218]	[0.048]	[0.056]	[0.062]	[0.039]	[0.190]	[0.044]	[0.059]	[0.061]	[0.040]
Ln(Levg) $_{t-2}$	-0.104	-0.027	-0.099**	-0.133***	-0.067***	-0.004	0.003	-0.018	-0.061	-0.018
$\mathbf{X\Delta UnempR}_{t-1}$	[0.163]	[0.037]	[0.050]	[0.047]	[0.026]	[0.155]	[0.036]	[0.042]	[0.053]	[0.033]
State Fixed Effect	√	√	√	√	√	√	√	√	√	√
State Time Trend	√	√	√	√	√	√	√	√	√	√
R^2	0.145	0.192	0.264	0.07	0.144	0.154	0.207	0.282	0.072	0.148
N	11847	11847	11100	8844	11016	11087	11087	10185	8519	10133

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) all standard errors are clustered at the facility level to account for within facility heterogeneity.
Note (3) Private-pay share is calculated on all nursing homes across all states and all years. The median is 12.97 %.

Table 2.9: Pro-cyclical Mental Health

	More Depressed or Anxious	
	(1)	(2)
$\mathbf{Ln(Levg)}_{t-2}$	-0.251***	-0.323****
	[0.091]	[0.099]
$\mathbf{\Delta UnempR}_{t-1}$	0.216****	
	[0.045]	
$\mathbf{Ln(Leverage)}_{t-2}$	0.027	
$\mathbf{X\Delta UnempR}_{t-1}$	[0.037]	
$\mathbf{GDP\ Growth\ Rate}_{t-1}$		-0.073**
		[0.029]
$\mathbf{Ln(Leverage)}_{t-2}$		0.026
$\mathbf{XGDP\ Growth\ Rate}_{t-1}$		[0.022]
State Fixed Effect	$\surd$	$\surd$
State Time Trend	$\surd$	$\surd$
R^2	0.241	0.231
N	21172	17044

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) all standard errors are clustered at the facility level to account for within facility heterogeneity.
Note (3) Both specifications control for nursing home and market characteristics as in the previous tables.

Table 2.10: Robustness Check - Current Ratio

	Health Deficiency		Health Outcome			Fire Safety Deficiency		Pneumococcal Vaccination	
	Score	Count	Restraint	PressureSores	Pain	Score	Count	Long Stay	Short Stay
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$\mathbf{Ln(CurrRatio)}_{t-2}$	2.076***	0.472***	0.318***	0.358***	0.248***	0.633***	0.139***	-0.548**	-0.939***
	[0.265]	[0.060]	[0.100]	[0.087]	[0.062]	[0.135]	[0.030]	[0.278]	[0.326]
$\mathbf{\Delta UnempR}_{t-1}$	-0.525***	-0.134***	-0.206***	-0.175***	-0.124***	-0.051	-0.069***	2.072***	2.907***
	[0.179]	[0.040]	[0.049]	[0.053]	[0.032]	[0.117]	[0.025]	[0.184]	[0.223]
$\mathbf{Ln(CurrRatio)}_{t-2}$	-0.03	-0.014	-0.005	-0.078**	-0.029	0.092	0.021	0.318***	0.225**
$\mathbf{X\Delta UnempR}_{t-1}$	[0.097]	[0.022]	[0.030]	[0.031]	[0.019]	[0.061]	[0.013]	[0.079]	[0.092]
State Fixed Effect	√	√	√	√	√	√	√	√	√
State Time Trend	√	√	√	√	√	√	√	√	√
R^2	0.171	0.224	0.267	0.078	0.142	0.154	0.143	0.15	0.144
N	23027	23027	21420	17522	21284	21456	21456	16246	14144

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) all standard errors are clustered at the facility level to account for within facility heterogeneity.

CHAPTER III

Financial Leverage and Hospital Technology Adoption

3.1 Introduction

The Detroit Medical Center (DMC) says that while it has made money for seven years, it can't attract donor or investment money for key projects it needs to renovate its aging facilities or to build new ones, such as Cardiovascular Institute or expansion of Children's Hospital of Michigan. As a result, 40% of the people who live near the DMC campus or near its Sinai-Grace Hospital in northwest Detroit leave for care in the suburbs - even though the DMC has some of the state's top ranked physicians.

Detroit Free Press, March 20th 2010

This paper investigates the effects of financial leverage on hospitals' production decisions, particularly on the adoption of capital-intensive technology. One consequence of using high financial leverage is that it may deplete borrowing capacity and face the difficulty of raising additional funds. In addition, high interest expenses can also crowd out the funds for other operating activities. For example, Matsa (2011) finds that high leverage undermines supermarket firms product quality. In the hospital industry, high financial leverage can also hinder hospitals ability to replace

their aging facilities and outdated technology. A 2000 merger between Detroit Medical Center (DMC) and Vanguard Healthcare System demonstrated that in extreme cases the consequences can be so severe that they lead to an ownership transaction.[1]

While extensive studies have discussed the association between financial performance and undesired consequences, most focus on hospitals' profitability. Several studies have examined the effects of profitability on hospital performance and found weak or mild relationships. For example, Bazzoli and colleagues (2008) find a weak relationship between profitability and quality of patient care and Shen (2002) reports that hospitals with higher financial pressures have adverse health outcomes in the short run but not over the long term. Overall, in constrast to general perceptions, previous studies have concluded that profitability has only limited impacts on the delivery of health services.

Furthermore, it is not clear whether poor financial decisions lead to undesired health consequences or whether the causality actually goes in the opposite direction (i.e., the poor hospital operational performance leads to financial distress). This paper differs from the literature by investigating the casualty of financial leverage on hospital operations. In particularly, I focus on the impacts of financial leverage on adoption of capital-intensive technology.

To facilitate the empirical analysis, I obtain key financial information from a California hospital dataset and technology adoption variables from the American Hospital Association (AHA) Annual Survey. To establish a causal relationship between financial leverage and technology adoption, I also interact financial leverage with hospitals exposure to the California Seismic Retrofit Mandate. This approach is similar to Zingales's (1998) paper in which he uses Carter administration's deregulation to examine whether highly leveraged truck firms are more likely to be financially constrained. The retrofit mandate requires hospitals to replace or improve buildings

[1] Vanguard Healthcare System agreed to retire $368.1 million of DMC bonds and other long-term debt and invest up to $850 million in capital projects.

that are exposed to significant seismic risks. Because most hospitals were built before the mandate was enforced, the exposure to seismic risks serves as an exogenous financial shock that crowds out the financial resources available for operating activities and clinical investments. The interaction term between the existing financial leverage and exposure to seismic risks provides the information about whether the retrofit mandate has differential impacts for highly leveraged hospitals than for less leveraged hospitals.

Overall, I find no significant relationship between the level of financial leverage and adoption of radiology technology. The insignificant results are consistent for both simple probit regressions and the exogenous financial shock model. However, the results should be interpreted with caution. Only about 200 hospitals are available in this analysis. Therefore, it is possible that the insignificant results coming from the small sample size. Incorporating more hospitals in other states will be an important extension.

3.2 Conceptual Framework and Hypothesis Development

This paper focuses on one of the negative consequences of debt financing: High financial leverage can lead to financial constraints. Tirole (2006) provides the theoretical perspective in which he incorporates moral hazard and agency cost to explain that high-debt firms will be more likely to be credit constrained because over-leverage may distort the incentives of entrepreneurs to misbehave at the cost of lenders. If over-leverage does lead to financial constraints, a highly leveraged organization will have limited access to external capital to finance an investment project that would otherwise generate positive returns. Dranove et al. (2013) finds that hospitals are likely to postpone technology improvements when they face a lump-sum financial shock. Therefore, one may expect highly leveraged hospitals to be less likely

to adopt capital-intensive technology because they are more likely to be financially constrained and because interest expense can crowd out funds available for technology investments. This leads to the first hypothesis:

H1a: Hospitals with high existing financial leverage are less likely to adopt capital-intensive technology.

However, on the other hand, a highly leveraged hospital can be more aggressive in adopting technology to generate cash flows from the more profitable services. Because hospitals often have objectives beyond profit maximization, they provide both profitable and unprofitable services. Horwitz and Nichols (2009) identify relatively profitable and unprofitable hospital services. The more profitable services include computed-assisted tomography (CT) scans, diagnostic radioisotope facilities and the radiation therapy, positron emission tomography, and ultrasound. Most of these services require significant investments in medical technology. The relatively unprofitable services include the emergency department, hospice, and psychiatric services. Therefore, because of the difficulty of raising external capital, a highly leveraged hospital may actually be more likely to adopt medical technology to provide more profitable services and forgo less profitable services. This leads to a competing hypothesis as follows:

H1b: Hospitals with high existing financial leverage are more likely to adopt capital-intensive technology that are used for more profitable services.

3.2.1 Competitive Effects of Financial Leverage

An organizations leverage level does not affect only its own operating activities. Researchers have expressed interests in the implications of financial leverage on product market competition. For example, Chevalier and Scharfstein (1996) find that highly leveraged grocery stories face severe liquidity constraints and are more sensitive to operating cash flows. Compared to unconstrained stores, constrained stores charge higher prices and further soften the price competition in local markets. Furthermore, they find that new entrants also target the constrained incumbents and initiate price competition to force the latter to exit. Khanna and Tice (2004) use a different sample of discount department stores and find similar results. In contrast, Busse (2002) finds that airlines with poor financial condition are more likely to start price wars; Zingales (1998) uses data from the trucking industry and finds that when the market becomes more competitive, highly leveraged firms are associated with less capital expenditure and lower prices, and they are more likely to exit. Overall, the literature has documented that financial leverage interact with product market decisions but the specific impacts depend on the market structure and industry details. Following the literature, one may expect that highly leveraged hospitals are less likely to adopt medical technology and thus have a competitive disadvantage versus hospitals with a lower leverage level. This leads to hypothesis 2:

H2: Hospitals with high existing financial leverage are less likely to adopt capital-intensive technology that is used for profitable services.

3.2.2 For-Profit vs. Not-For-Profit Ownership

One prominent feature of the hospital industry is the mix between for-profit and not-for-profit ownership. In addition to many researchers who have studied the

differences among the objective functions of the two organizational forms, for-profits and not-for-profits also have their advantages and disadvantages in raising capital. Compared to for-profit hospitals, not-for-profits have the advantage of lower costs through tax-exempt debt financing and are mostly constrained for equity financing. Also, it is some what easier for not-for-profits to receive donations as an alternative method of financing. For-profit hospitals, like other for-profit corporations, can raise funds through both equity and debt markets. Despite these differences, because not-for-profits have more limited equity-financing channels, with equal financial leverage levels, not-for-profits are more likely to be financially constrained than for-profits. Reiter, Wheeler, and Smith (2008) finds that when borrowing capacity is binding, highly leveraged not-for-profit hospitals reduce their capital expenditures. Overall, one may expect to see that financial leverage has larger impacts on not-for-profits. Thus, I propose hypothesis 3:

H3: Highly leveraged not-for-profit hospitals are less likely to adopt medical technology than for-profits with an equal leverage level.

3.2.3 Revenue Growth

One way to examine whether financial leverage leads to competitive disadvantages is to compare the revenue growth between the highly leveraged and the less leveraged hospitals (Campello 2006; Zhu 2011). Much of the capital-intensive medical equipment is required for the hospitals to provide profitable services. Therefore, if financial leverage does hinder the adoption of medical technology, one should also observe slower revenue growth for highly leveraged hospitals. Thus, I propose hypothesis 4:

H4: The revenue growth of highly leveraged hospitals is slower than that of hospitals with low financial leverage.

3.3 Empirical Analysis

3.3.1 Data

As acknowledged in the field of health care finance, reliable and detailed hospital financial statement information has been the major challenge in conducting empirical analysis (Magnus and Smith 2000). Researchers often make the trade-off between the detailed but small state dataset and the large but unaudited national sample. This study focuses on California hospitals because of the availability of reliable hospital financial statement information and a potentially exogenous financial shock from the California Seismic Retrofit Mandate. In addition to financial data, I obtain technology adoption data from the AHA Annual Survey, which provides detailed information on the adoption of major medical technology, particularly on capital-intensive radiology services. I also include the Area Resource File to control for market-level variables such as the county median income. The Healthcare Cost and Utilization Project's State Inpatient Dataset (HCUP-SID) is also used to account for heterogeneous patient mixes among the hospitals.

3.3.2 Hospital Financial Data

California's Office of Statewide Health Planning and Development (OSHPD) has collected audited hospital financial statements annually since 1976 and this dataset has been used extensively in previous studies. I extract both financial and non-financial hospital variables from this dataset. The hospital characteristics include ownership type, number of hospital beds, and teaching or rural status. The system affiliation information is obtained from the California Hospital Project, administrated

by Center for Health Financing, Policy, and Management at University of Southern California. For meaningful comparison, I restrict the analysis sample to short-term general acute care hospitals (ST-GACs) because specialty hospitals and long-term GAC hospitals provide significantly different services. About 300 hospitals are in the sample and 67.1% of them are affiliated with healthcare systems. Of the hospitals 24.4% are for-profit and 70.6% not-for-profit. On average, a hospital has 199.2 available beds. Only 5.9% of the hospitals are teaching hospitals and 18.2% are rural.

3.3.3 Financial Performance

Financial leverage (debt-over-asset ratio) is the primary financial variable that is used in the analysis. Because I focus on financial constraints as the main consequences of financial leverage, I also use other financial measures, including cash flow from operating activities and interest expenses to examine whether the results from leverage analysis are consistent and robust.

3.3.3.1 Ex-ante financial leverage

The financial leverage ratio is defined as the total liability over the total asset, the broadest definition of financial leverage. Because the exogenous financial shock, the California Seismic Retrofit Mandate, has only been effectively enforced since 2001, I use the financial leverage ratio in 1999 as the proxy for the leverage level prior to the financial shock. California hospitals have financial leverage with a ratio of the mean of 0.63. About 68.6% of hospitals have a debt-to-assets ratio above 50% and 23.4% have negative equity value. California not-for-profit hospitals have slightly higher financial leverage than for-profits (0.58 vs. 0.65). The hospitals with higher financial leverage are generally smaller. Hospitals with negative equity value

have 177.4 available beds on average, compared to 199.2 available beds for the entire sample

3.3.3.2 Operating Cash Flow over Total Asset

I use the ratio of operating cash flow over assets to measure the ability to generate cash flow internally. According to *pecking order theory* (*Myers and Majluf*, 1984), with the presence of informational asymmetry between managers and investors, internal funds are preferred to external debt and equity financing. If financial leverage leads to financial constraints and cause a slower adoption of medical technology, one should expect to find that technology adoption is also positively related to operating cash flow. I divide net cash flow from operating activities by total assets. In the sample, the average ratio of operating cash flow over total assets is around 5.9%.

3.3.3.3 Interest Expense over Total Debt

Historical borrowing costs can be measured as the total interest expense over total debt. Because the calculation includes both old and new debt, the ratio does not necessarily reflect the present cost of borrowing. In addition, because the interest expense is a before-tax measure, the calculation does not take the tax-deduction benefits into consideration (for for-profit hospitals). However, all else being equal, the higher ratio may indicate higher financing costs in general for affected hospitals. These higher financing costs may reflect higher relative risk associated with these hospitals or serious imperfect information between these hospitals and lenders. In the sample, the interest rate of an average hospital is about 3.3%.

3.3.3.4 Measure of Profitability

To demonstrate that financial leverage has effects on technology adoption that are independent of profitability, it is important to control for the heterogeneous profitability among hospitals. I use the operating margin as the measure for hospital profitability. The ratio is defined as operating profits over revenue. It provides a basic understanding of the profitability of each hospital. In the sample, the average operating margin is -1.4%.

3.3.3.5 Technology Adoption

The main outcome of interest is the adoption of capital-intensive medical technology. In particular, I focus on the technology required for highly profitable services. Information about technology adoption is obtained from the AHA Annual Survey. I select four types of therapeutic and diagnostic technologies, including the shaped beam radiation system, stereotactic radiosurgery, 64 slice CT scan, and positron emission tomography. Such medical technologies can cost from several millions to hundreds of millions of dollars. Their prevalence is 22.3%, 21%, 19.7%, and 17.9%, respectively.

3.3.3.6 Market and Patient Characteristics

Other important control variables include market and patient characteristics. I use the health referral regions (HRRs) as the definition of hospital markets. The HRR data are obtained from the Dartmouth Atlas of Health Care and there are 28 HRRs in California. According to the Dartmouth Atlas, HRRs represent regional health care markets for tertiary medical care that generally requires the services of a major referral center. Because capital-intensive medical technology is often used in major procedures, HRRs are the preferred definition of hospital markets because the

regions are defined as where patients are referred for intensive procedures[2]. Because more than 60% of the hospitals are affiliated with multi-facility systems, I adjust for the system affiliation in calculating the Herfindahl-Hirschman Index (HHI). For example, two hospitals that belong to the same health system are combined as one organization in the calculation. The system-adjusted HHI is 0.35. From the Area Resource Files, I extract the county-level average income. The mean is about $37,309. I also use the HCUP inpatient dataset to control for several patient-level characteristics that are aggregated at the hospital-level. These variables include average patient age, percentage of patients who are female, and percentage of patient who are white. On average, the patients are 48.2 years old, 59.9% of them are female, and 51.4% of them are white.

3.3.4 Exogenous Financial Shock

The endogeneity problem between financial leverage and product market outcomes is well noted in the literature. Financial arrangements and product market decisions can affect each other and these two decisions are often made simultaneously. To account for endogeneity, previous studies have adopted exogenous shocks that affect either financial decisions or production choices, but not both. For example, Chevalier (1995; 1996) use leveraged buyouts (LBOs) in the supermarket industry to examine the effect of financial leverage on product markups. Zingales (1998) uses the Carter admnistration's deregulation to examine effects of market competition on highly leveraged and financially constrained trucking firms. Lamont (1997) uses the 1986 oil price decrease to examine the capital expenditure of nonoil subsidiaries of oil companies.

In the hospital context, all else being equal, less leveraged hospitals may have better access to external capital that can be used to renovate buildings and

[2]http://www.dartmouthatlas.org/data/region/

adopt capital intensive medical technology. Such activities provide the hospitals with product market advantages in competing with hospitals with high existing leverage. On the other hand, unfavorable product market situations can adversely affect the level of financial leverage. For example, chronic operating losses may erode equity and inflate the ratio of financial leverage; a pessimistic product market outlook may discourage equity investors and constrain the financing channels. These two forces can bolster each other and the causal relationship between financial leverage and product market outcomes becomes difficult to disentangle.

To account for the endogeneity problem, I follow Chang and Jacobson (2010), using the California Seismic Retrofit Mandate as the exogenous financial shock that applies to most of California's GACs. Because the financial burdens from this seismic retrofit mandate are independent of hospitals profitability and clinical performance, it is ideal for studying the effect of financial leverage on hospitals technology adoption decisions. This mandate requires GAC hospitals to improve building strength to fulfill earthquake safety requirements. Depending on the age and structure of the buildings and their geographic location, the government of California government has classified GAC hospitals into different risk categories. Each category requires different levels of capital expenditures to retrofit or rebuild the buildings to satisfy the safety requirements. Because the average building age can be potentially endogenous to whether the hospitals are financially constrained, I only use the geographic seismic risk factor as the proxy for the exogenous financial shock. As Chang and Jacobson did in their paper, I first use Geographic Information System (GIS) to determine each hospital's coordinates and use the coordinates to locate and calculate each hospital's peak ground acceleration (PGA) factor. Because the PGA factors highly correlate with the earthquake belt, the distribution of high-PGA hospitals is concentrated in certain areas (the Bay Area and Los Angeles). Therefore, most PGA hospitals will probably locate in the same areas and low-PGA hospitals will locate in the same

regions. To examine the market competition perspective of the seismic shock, I also calculate the relative risk measures that categorize the hospitals with a higher (lower) risk factor than the average seismic risk of the market in which the hospital resides. Both the absolute and relative values of the seismic risk are included in the analysis.

3.3.5 California Seismic Retrofit Mandate

This paragraph provides a description of key time lines and the magnitude of the retrofit mandate. SB 1953 originally passed in 1994 after the Northridge earthquake to regulate the safety of hospital buildings. The most seismic-vulnerable GAC buildings (SPC-1) had to be retrofit, replaced, or removed from GAC services by 2008. In the initial report in 2001, 1,027 hospital buildings fell into SPC-1 categories (total hospital buildings 2,627). In 2002, SB 1801 passed, which permits a five-year extension of the first deadline of 2008. Almost every hospital requested an extension of the deadline from 2008 to 2013. According to the OSHPD report [3], by the end of 2009, 70% of SPC-1 buildings were likely to comply, 13% were possible to comply, and 17% are possibly non-compliant. The non-compliant buildings have to be removed from general acute care services. Because the planning process and the actual construction time for hospital buildings can take several years, capital expenditures drastically increased as early as 2006 (See Figure 3.1). The estimated total capital expenditures related to the retrofit mandate varies and is as high as $41.7 billion (*Meade et al.*, 2002). Successful compliance with the seismic retrofit mandate not only ensures the continuation of hospital operations, it can also affect the cost of borrowing and the hospital's competitive advantage. For example, Moody's upgraded the bond rating of Good Samaritan Hospital in September 2011 because Good Samaritan satisfies the seismic safety requirement through 2030. Compliance with the seismic retrofit mandate is one of the important considerations in Moodys several bond rating reports.

[3]Seismic Safety Hearing (http://www.oshpd.ca.gov/SeismicSafetyHearing.pdf)

Furthermore, Sutter, University of California at Los Angeles Medical Center, and University of California at San Francisco Medical Center, which have the financial resources to comply with the retrofit mandates, have highlighted their successful compliance with the regulations on their web pages and in their annual reports. This might serve as a signal to payers and patients to differentiate between hospitals that have not or are not able to comply with the mandate.

3.3.6 Empirical Specification

I use two empirical specifications in the paper a simple lagged model and a model that interacts with the exogenous financial shock. The basic empirical specification is as follows:

$$Y_{i,t} = \beta FL_{i,t-7} + \gamma XH_{i,t-7} + \lambda M_{m,t-7} + \Theta P_{i,t} + \epsilon \tag{3.1}$$

Where $Y_{i,t}$ is the outcome of interest (prices or technology adoption) for hospital i at year t (2006). FL$_i, t$ is the financial leverage for hospital i at year t-7 (1999). Financial leverage is the primary variable of interest; thus, I also use the operating cash flow over assets ratio and interest expense over debt ratios as robustness checks. In the basic model, I use the financial leverage ratio in 1999, a year prior to the first evaluation of the exposure to seismic retrofit. Because the major construction has taken place since 2000, to some extent, the hospitals' financial leverage should be independent of their seismic risks. For the technology adoption variables, I use the prevalence in 2006 because the hospitals should already have started their seismic retrofit projects and the related financial shock should already be reflected in their decisions, regarding the adoption of medical technology. In addition, using the technology prevalence in 2006 also helps to avoid complications from the 2007 financial crisis. $XH_{i,t-7}$ represents the basic set of hospital characteristics including

ownership types (i.e., for-profit versus not-for-profit), the number of hospital beds, system affiliation, and teaching/rural status. These variables are based on the 1999 information because of the concern that hospital-level variables may change when the seismic retrofit construction projects begin. $M_{m,t-6}$ is the hospital market-level characteristics[4], such as the HHI concentration level and median county income. $P_{i,t+1}$ represents patient-level characteristics at 2006 to account for the differential patient case mix among hospitals.

The alternative specification interacts the seismic risk with the financial leverage before the mandate is effectively enforced. The focus is on the interaction term of the seismic risk and existing financial leverage.

$$Y_{i,t} = \beta FL_{i,t-7} + \delta HighRisk + \phi FL_{i,t-7} * HighRisk + \gamma XH_{i,t-7} + \lambda M_{m,t-7} + \Theta P_{i,t} + \epsilon \tag{3.2}$$

In this equation, *High Risk* represents two variables: the absolute and relative values of seismic risk. The absolute seismic risk is the hospitals PGA factor. For the relative seismic risk, a dummy variable that takes the value of 1 if the hospital has a higher seismic risk relative to the market average (hospital referral regions). The interaction term of financial leverage and seismic risk suggests that seismic risk may have disproportionate impacts on hospitals that use higher financial leverage. Furthermore, because hospitals that face high (low) seismic risk may have very different decision processes, I also run a fully interacted model to examine whether financial leverage has differential effects for hospitals facing high (low) fixed cost shocks. I split the sample into high and low seismic risk categories, in which the hospitals in the high (low) risk category face higher (lower) fixed cost shocks than their competitors within the same HRR. In this fully interacted model, I expect to see that financial leverage has negative consequences on technology adoption for hospitals that have

[4]hospital market level characteristics are calculated on all short-term GAC hospitals within each health referral region.

relatively high seismic risks. In all regressions, the standard errors are clustered at the HRR level.

3.4 Results

3.4.1 Technology Adoption

The literature documents that financial leverage can cause lower capital expenditures. This paper tries to provide direct evidence of the impact of leverage on technology adoption. Examination of the hospital markets provides a unique opportunity because of the availability of rich and detailed information on the adoption of medical technology at the individual hospital level. The main hypothesis is that a hospital with high leverage is more likely to be financially constrained and will have fewer financial resources for technology investments. Meanwhile, there is an alternative hypothesis that financially constrained hospitals may be more likely to adopt such medical technologies. Capital-intensive medical technologies are also often used to perform lucrative services with higher profit margins. The alternative hypothesis can be that hospitals with higher existing leverage level are faster to adopt medical technology so as to generate additional operating cash flows. The probit regression is used in the analysis and the marginal effects (*Ai and Norton*, 2003) are reported in the tables. Table 3.2 shows the results from the basic model. The leverage ratio has a negative relationship with the adoption of shaped beam radiation, 64-slice CT scan, and positron emission tomography. However, surprisingly, the results are not statistically significant. Consistent with previous studies, operating margins and the number of hospital beds are positively correlated with technology adoption. The number of hospital beds is significant at the 1% level for all four types of technology. To ensure that the results are not endogenous and biased, I also run an alternative

model with an exogenous seismic shock. The alterative set of results is reported in Table 3.3. Similarly, leverage has a negative but not statistically significant relationship with adoption. The results on the interaction terms are mixed and insignificant. Table 3.4 also shows similar results. Among the regressions, operating margin and number of hospital beds are significantly positively correlated with adoption. One interesting result is that hospitals affiliated with hospital systems are less likely to adopt all four types of radiology technology. It would be worth investigating the role of system affiliation in technology adoption.

3.4.2 Revenue Growth

For each hospital, I also compute the revenue growth over the seven-year period from 1999 through 2006. The revenue, on average, increases drastically by about 137.6%. The regressions are reported in Table 3.5. In column (1), the leverage ratio and absolute value of seismic risk have negative and insignificant relationships with revenue growth. From columns (2) and (4), coefficients of the interaction of leverage and absolute seismic risk are negative and significant. Thus, seismic risks have a large and negative effect on revenue growth for highly leveraged hospitals. Because the results of technology regressions are not significant, I cannot make too many inferences regarding the pathway of lower revenue growth. Prices and patient mix can be one direction for future research.

3.4.3 Ownership Status: for-profit versus not-for-profit

To examine whether financial leverage has differential effects on technology adoption for for-profits or not-for-profits, I include the interaction term of financial leverage and the indicator variable of for-profit status. The results are presented in Table 3.6. The coefficient of the interaction term is negative across all four regressions.

This suggests that leverage has larger impacts for for-profit hospitals. However, the result is only statistically significant in the positron emission tomography regression and should be interpreted with caution. In fact, the negative sign on the coefficient of the interaction term is the opposite of what the hypothesis will predict. This result is similar to Magnus et al.(2004a), in which they suggest that the association between debt and capital-investment may be weaker because the creditors oversight is less tight in the not-for-profit setting and the tax-exempt debt at times is tied to capital-investment legal requirement. One potential explanation is that not-for-profit hospitals balance between profits and community benefits. When not-for-profits do not face immediate financial pressures, they tradeoff some profits for community benefits, to be better quality or more quantity. Thus, when a highly leveraged not-for-profit is affected by the seismic retrofit mandate, it can provide less community to yield sufficient cash flow internally. In fact, Chang and Jacobson (2010) find that not-for-profits that are more seriously impacted by the retrofit mandate, increase the utilization of imaging services to finance the retrofit costs. Thus, compared to for-profits, not-for-profits are more able to adjust the mix between profitable and less profitable service when they are liquidity constrained.

3.4.4 Overall Discussion

Based on the results from the basic model and the model using the seismic retrofit mandate, I do not find significant relationship between financial leverage and technology adoption. I also repeat the same analysis using other financial measures, including operating cash flow over total asset and interest expense over total debt. The results are presented in Table 3.7 and I do not find consistent relationship with these two financial measures and technology adoption. Because the results are statistically insignificant, I cannot disentangle the two competing hypothesis that financial leverage leads to financial constraints or financial leverage distorts hospitals incentive

to adopt technology. Despite the insignificant results, the provision of health care is similar to providing a public good. Because financial leverage has consistent negative effects on for-profit hospitals, it may be worthy to have policy-makers discuss solutions for already highly leveraged for-profit hospitals or to regulate and prevent the for-profits from being over-leveraged.

3.5 Limitations and Future Work

3.5.1 Empirical Analysis

There are two major limitations of this paper: the small sample size and compliance with the seismic retrofit mandate. Because this study only uses California data and the unit of analysis focuses on the hospital level, the analysis sample at most consists of 250 hospitals. Furthermore, because the variations in the financial leverage are small between years, the dataset is not ideal for constructing panel data for a hospital fixed-effect analysis. Such a small sample limits the possibility of using different econometric techniques and running different robust analyses. Second, although the California Seismic Retrofit Mandate seems to be an exogenous financial shock, there are concerns that the hospitals are not bound by the mandate. In particular, the initial mandate requires enormous financial resources that are beyond many hospitals' financial capablities. The mandate's compliance deadline has been extended several times and there have also been several special arrangements between the government of California and hospitals to finance the construction projects. This concern may explain the insignificant results of the model that uses the seismic retrofit mandate. In future studies, one might want to consider using a national sample that comprises more hospitals or changing the unit of analysis from the California hospital level to the patient level.

3.5.2 Welfare Implications

This paper has not discussed the potential impacts of financial leverage on quality of care and the provision of uncompensated care (*Magnus et al.*, 2004b), two dimensions with strong welfare implications. Since the HCUP-SID is already used in this study, it will be a natural extension to examine the long-term impacts of financial leverage on the quality of care at the individual patient level.

3.6 Conclusion

This paper explores the effects of financial leverage on technology adoption. Although I am not able to establish a solid causal relationship between financial leverage and the probability of adopting radiology technology, I do find the adoption is significantly correlated with the hospital size and operating margin. More interestingly, I also find a consistent and negative relationship between system affiliations and technology adoption. This inverse relationship may provide evidence of the centralization of capital-intensive technology within health systems. It will be worth to pursue a further study of evaluating the efficiency gains through the centralization of medical technology.

Another interesting finding is that financial leverage has more significant impacts on for-profit hospitals than not-for-profits. While not-for-profits rely more on debt-financing (*Reiter et al.*, 2008), they also have the flexibility to adjust the service mix between highly profitable and less profitable service during the financial hardship. Thus, financial leverage may not have significant impacts on technology adoption of not-for-profits, but it can still lead to undesired consequences in quality and quantity. Because of the small sample size of this study, it is difficult to conclude that financial leverage does not have impacts on technology adoption, or the lack of statistical power leads to the insignificant results. In the sample, about 23.4% of the

hospitals have negative equity, which means that the book value of debts exceeds the book value of total assets. It will be interesting to examine whether hospitals with negative equity are also prevalent in other states. To sum up, this paper calls for more attention to reviewing the role of financial leverage in the hospital industry.

Figure 3.1: CAPEX per Licensed Bed 2000-2011 (pegged to 2011 dollars)

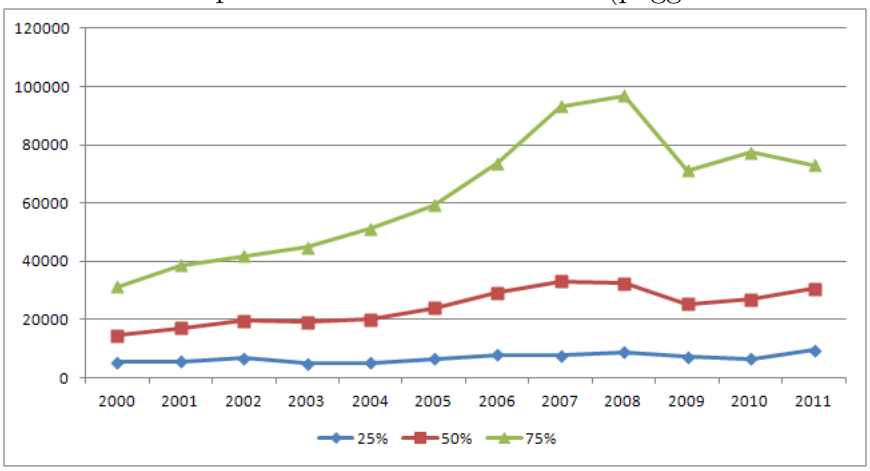


Table 3.1: Summary Statistics

	Mean	Std	Min	Max	Obs
Technology Adoption					
Shaped beam Radiation System	0.223	0.417	0	1	229
Stereotactic Radiosurgery	0.21	0.408	0	1	229
64 Slice CT Scan	0.197	0.398	0	1	229
Poistron Emission Tomography	0.179	0.384	0	1	229
Others					
Δ Market Share	0.006	0.03	-0.207	0.153	276
Revenue Growth	1.376	0.819	-0.128	4.721	276
Financial Measures					
Leverage Ratio	0.629	0.384	0.043	2.399	314
Operating Margin	-0.014	0.11	-0.379	0.262	315
Operating Cashflow/Asset	0.059	0.132	-0.468	0.587	315
Interest Expense/Debt	0.033	0.028	0	0.234	281
Hospital Characteristics					
Absolute Value of Seismic Risk	0.405	0.193	0	0.95	324
Relative Value of Seismic Risk	0.456	0.499	0	1	340
Hospital Beds (in 100)	1.992	1.389	0.1	8.49	340
Public Hospital	0.05	0.218	0	1	340
For-Profit Hospital	0.244	0.43	0	1	340
System Affiliation	0.671	0.471	0	1	340
Teaching Hospital	0.059	0.236	0	1	340
Rural Hospital	0.182	0.387	0	1	340
Market Characteristics					
HHI Index	0.35	0.246	0	1.248	340
ln(County Income)	10.527	0.273	10.025	11.363	335
Patient Characteristics					
Avg. Age	48.149	10.979	11.942	76.077	288
Perct. of Female	0.599	0.058	0.272	0.785	288
Perct. of White	0.514	0.232	0.001	0.944	288

Table 3.2: Leverage on Technology Adoption - Marginal Effects of Probit Model

	Beam Radiation	**Stereotactic Radiosurgery**	**64-Slice CT Scan**	**Poistron Emission Tomography**
Leverage Ratio	-0.086	0.037	-0.018	-0.003
	[0.097]	[0.051]	[0.090]	[0.079]
Operating Margin	0.676**	0.304	-0.24	0.206
	[0.290]	[0.396]	[0.260]	[0.243]
# of Hospital Beds (100)	0.106***	0.103***	0.043***	0.069***
	[0.019]	[0.018]	[0.017]	[0.022]
For-Profit Hospital	-0.107*	-0.01	-0.138*	-0.154
	[0.064]	[0.077]	[0.072]	[0.103]
Public Hospital	N.A.	-0.294*	-0.115	-0.147
		[0.152]	[0.120]	[0.104]
System Affiliation	-0.102**	-0.131**	-0.094*	-0.008
	[0.050]	[0.064]	[0.051]	[0.050]
Teaching Hospital	-0.043	-0.027	0.026	-0.102
	[0.111]	[0.103]	[0.111]	[0.127]
Rural Hospital	-0.159	-0.01	-0.151**	0.046
	[0.126]	[0.078]	[0.075]	[0.091]
HHI Index	-0.002	0.034	0.103	0.09
	[0.104]	[0.109]	[0.085]	[0.128]
ln(County Income)	0.032	-0.096	0.099	0.072
	[0.117]	[0.123]	[0.091]	[0.095]
Avg. Age	-0.002	-0.006	-0.011***	-0.002
	[0.004]	[0.004]	[0.003]	[0.002]
Perct. of Female	0.009	-0.65	-0.966*	-0.12
	[0.508]	[0.775]	[0.514]	[0.427]
Perct. of White	0.196*	0.245**	0.435***	-0.044
	[0.108]	[0.109]	[0.126]	[0.082]
N	193	203	203	203

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) all standard errors are clustered at the health referral region level to account for the within market heterogeneity.
Note (3) HHI is adjusted for chain-affiliation.

Table 3.3: Marginal Effects of Financial Leverage and Seismic Risk on Technology Adoption

	Shaped Beam Radiation System		**Stereotactic Radiosurgery**		**64-Slice CT Scan**		**Poistron Emission Tomography**	
Leverage Ratio	**-0.144**	**-0.151**	**0.041**	**0.086**	**-0.274**	**-0.239**	**-0.105**	**-0.133**
	[0.364]	**[0.351]**	**[0.091]**	**[0.084]**	**[0.247]**	**[0.252]**	**[0.149]**	**[0.145]**
Absolute Seismic Risk	**-0.019**	**0.024**	**-0.075**	**-0.099**	**-0.524**	**-0.638***	**-0.092**	**-0.216**
	[0.423]	**[0.406]**	**[0.308]**	**[0.319]**	**[0.333]**	**[0.342]**	**[0.320]**	**[0.311]**
Relative Seismic Risk	**0.013**	**-0.043**	**0.058**	**0.136**	**0.067**	**0.227****	**-0.097***	**0.109**
	[0.064]	**[0.090]**	**[0.045]**	**[0.091]**	**[0.064]**	**[0.107]**	**[0.055]**	**[0.113]**
Absolute Seismic Risk	**0.126**	**0.018**	**-0.001**	**0.054**	**0.686**	**0.914***	**0.266**	**0.573**
X Leverage Ratio	**[0.733]**	**[0.706]**	**[0.223]**	**[0.241]**	**[0.455]**	**[0.512]**	**[0.353]**	**[0.381]**
Relative Seismic Risk		**0.117**		**-0.142**		**-0.281***		**-0.403****
X Leverage Ratio		**[0.178]**		**[0.106]**		**[0.162]**		**[0.203]**
Operating Margin	0.680**	0.704**	0.313	0.292	-0.256	-0.329	0.159	0.063
	[0.281]	[0.283]	[0.395]	[0.405]	[0.248]	[0.234]	[0.241]	[0.220]
Hospital Beds (in 100)	0.103***	0.103***	0.103***	0.103***	0.038***	0.037***	0.070***	0.071***
	[0.019]	[0.019]	[0.018]	[0.018]	[0.015]	[0.013]	[0.024]	[0.024]
For-Profit Hospital	-0.11	-0.107	-0.007	-0.011	-0.147**	-0.175***	-0.161	-0.194*
	[0.070]	[0.070]	[0.076]	[0.079]	[0.074]	[0.064]	[0.101]	[0.107]
Public Hospital	N.A.	N.A.	-0.289*	-0.309**	-0.139	-0.143	-0.166	-0.180*
			[0.152]	[0.152]	[0.122]	[0.126]	[0.104]	[0.102]
System Affiliation	-0.097	-0.100*	-0.133**	-0.131**	-0.103*	-0.089*	-0.011	0.004
	[0.059]	[0.058]	[0.064]	[0.062]	[0.055]	[0.052]	[0.054]	[0.052]
Teaching Hospital	-0.037	-0.034	-0.013	-0.02	0.042	0.045	-0.122	-0.128
	[0.105]	[0.105]	[0.099]	[0.100]	[0.107]	[0.103]	[0.135]	[0.136]
Rural Hospital	-0.159	-0.163	-0.009	-0.006	-0.161**	-0.163**	0.039	0.037
	[0.126]	[0.129]	[0.077]	[0.077]	[0.079]	[0.080]	[0.089]	[0.092]
HHI Index	0.013	0.01	0.005	0.005	0.096	0.1	0.126	0.126
	[0.118]	[0.119]	[0.137]	[0.133]	[0.104]	[0.098]	[0.143]	[0.143]
ln(County Income)	0.022	0.023	-0.072	-0.072	0.146*	0.152*	0.033	0.031
	[0.121]	[0.121]	[0.123]	[0.122]	[0.083]	[0.083]	[0.110]	[0.106]
N	193	193	203	203	203	203	203	203

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) all standard errors are clustered at the health referral region level to account for the within market heterogeneity.
Note (3) HHI is adjusted for chain-affiliation. Patient-level variables are included but not shown to save space.

Table 3.4: Marginal Effects of Financial Leverage and Seismic Risk - Results from Fully Interacted Model

	Shaped Beam Radiation		**Stereotactic Radiosurgery**		**64-Slice CT Scan**		**Poistron Emission Tomography**	
	HR	LR	HR	LR	HR	LR	HR	LR
Leverage Ratio	-0.4	-0.905	-0.269	0.384	-0.542	0.791	-1.866*	0.337
	[0.687]	[0.730]	[0.561]	[0.351]	[0.500]	[0.714]	[1.099]	[0.430]
Absolute Seismic Risk	1.092	-1.278*	0.659	-2.684*	-0.95	0.369	0.816	-0.276
	[1.469]	[0.735]	[1.115]	[1.564]	[1.017]	[1.049]	[1.181]	[1.486]
Operating Margin	6.431**	2.386	0.771	1.922	-1.134	-0.768	-0.547	2.151
	[2.527]	[2.010]	[3.415]	[3.077]	[1.668]	[1.802]	[3.687]	[1.429]
Hospital Beds (in 100)	0.700***	0.429**	0.552***	0.551***	0.303**	0.254	0.35	0.454***
	[0.176]	[0.168]	[0.184]	[0.153]	[0.132]	[0.202]	[0.335]	[0.116]
For-Profit Hospital	-1.754***	-0.002	-0.987	0.496	-0.820**	-1.057*	N.A.	-0.716
	[0.589]	[0.285]	[0.898]	[0.594]	[0.338]	[0.607]		[0.592]
Public Hospital	N.A	N.A	N.A	-1.358	0.198	-1.189	N.A.	-0.959
				[0.857]	[0.814]	[0.998]		[0.597]
System Affiliation	-1.012**	-0.07	-0.759*	-0.643	-0.319	-0.494	0.056	-0.063
	[0.448]	[0.604]	[0.426]	[0.516]	[0.390]	[0.582]	[0.533]	[0.287]
Teaching Hospital	0.045	-0.088	-0.619	0.388	0.414	-0.046	-0.603	-1.099
	[0.687]	[0.752]	[0.401]	[0.935]	[0.890]	[0.870]	[1.023]	[0.823]
Rural Hospital	N.A.	-0.502	-0.794	0.422	-0.156	N.A.	N.A.	0.763
		[0.633]	[0.841]	[0.499]	[0.518]			[0.539]
HHI Index	0.495	0.297	0.509	-1.218	0.608	0.15	0.8	0.575
	[1.087]	[0.971]	[0.827]	[1.279]	[0.827]	[0.925]	[1.341]	[0.912]
ln(County Income)	0.924	-0.122	-0.039	0.127	0.332	1.077**	-1.181	1.055
	[0.931]	[0.941]	[0.787]	[0.786]	[0.824]	[0.469]	[1.062]	[0.848]
Avg. Age	0.006	-0.019	-0.092***	-0.006	-0.054**	-0.039*	-0.028	-0.008
	[0.025]	[0.017]	[0.033]	[0.020]	[0.024]	[0.023]	[0.034]	[0.012]
Perct. of Female	-0.472	0.977	-13.104***	-0.404	-7.833***	-0.991	-5.191	0.486
	[4.032]	[2.663]	[4.527]	[4.480]	[2.758]	[4.671]	[7.327]	[2.769]
Perct. of White	1.358	0.746	3.318***	-0.198	2.512***	1.482	0.288	-0.779*
	[0.984]	[0.819]	[0.983]	[0.791]	[0.897]	[1.078]	[1.065]	[0.465]
N	71	106	87	113	90	91	57	113

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) all standard errors are clustered at the health referral region level to account for the within market heterogeneity.
Note (3) HHI is adjusted for chain-affiliation.

Table 3.5: Financial Leverage and Seismic Risk on Market Share and Revenue Growth

	Revenue Growth			
	(1)	(2)	(3)	(4)
Leverage Ratio	-0.046	0.256	-0.04	0.228
	[0.144]	[0.171]	[0.145]	[0.167]
Absolute Value of Seismic Risk	-0.024	0.575	-0.202	0.447
	[0.216]	[0.378]	[0.235]	[0.368]
Relative Value of Seismic Risk			0.121*	0.03
			[0.071]	[0.109]
Leverage Ratio		-0.901**		-0.974**
X Absolute Seismic Risk		[0.436]		[0.440]
Leverage Ratio				0.146
X Relative Seismic Risk				[0.167]
Operating Margin	-1.678**	-1.653**	-1.637**	-1.602**
	[0.674]	[0.668]	[0.664]	[0.664]
# of Hospital Bed (in 100)	-0.056	-0.055	-0.052	-0.05
	[0.035]	[0.036]	[0.034]	[0.036]
Public Hospital	-0.228	-0.209	-0.219	-0.187
	[0.160]	[0.170]	[0.160]	[0.175]
For-Profit Hospital	-0.241***	-0.248***	-0.237***	-0.237**
	[0.088]	[0.092]	[0.089]	[0.093]
System Affiliation	0.348**	0.349**	0.340**	0.338**
	[0.138]	[0.140]	[0.141]	[0.145]
Teaching Hospital	-0.045	-0.031	-0.043	-0.025
	[0.145]	[0.153]	[0.142]	[0.149]
Rural Hospital	-0.415***	-0.411***	-0.410***	-0.403***
	[0.135]	[0.126]	[0.133]	[0.123]
HHI Index	-0.042	-0.046	-0.088	-0.088
	[0.262]	[0.266]	[0.255]	[0.259]
ln(County Income)	-0.250*	-0.247*	-0.205	-0.203
	[0.148]	[0.148]	[0.146]	[0.148]
Avg. Age	-0.011**	-0.011**	-0.010**	-0.010*
	[0.005]	[0.005]	[0.005]	[0.005]
Perct. of Female	-0.504	-0.442	-0.411	-0.271
	[0.989]	[1.005]	[1.012]	[1.056]
Perct. of White	0.226	0.245	0.202	0.241
N	256	256	256	256

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) all standard errors are clustered at the health referral region level to account for the within market heterogeneity.
Note (3) HHI is adjusted for chain-affiliation.

Table 3.6: Marginal Effects of Financial Leverage and Ownership Types on Technology Adoption

	Beam Radiation	**Stereotactic Radiosurgery**	**64-Slice CT Scan**	**Poistron Emission Tomography**
Leverage Ratio	**-0.119**	**-0.024**	**-0.07**	**-0.152***
	[0.122]	**[0.083]**	**[0.108]**	**[0.081]**
For-Profit Hospital	**0.103**	**0.151**	**0.009**	**0.601*****
	[0.174]	**[0.168]**	**[0.156]**	**[0.170]**
Leverage Ratio	**-0.157**	**-0.089**	**-0.14**	**-0.611*****
X For-Profit	**[0.109]**	**[0.118]**	**[0.094]**	**[0.202]**
Operating Margin	0.701**	0.259	-0.425	0.229
	[0.306]	[0.439]	[0.295]	[0.299]
Hospital Beds (in 100)	0.106***	0.106***	0.048***	0.072***
	[0.018]	[0.016]	[0.017]	[0.023]
System Affiliation	-0.097*	-0.124**	-0.082	0.012
	[0.050]	[0.061]	[0.052]	[0.049]
Teaching Hospital	-0.044	-0.051	-0.049	-0.15
	[0.110]	[0.108]	[0.116]	[0.129]
Rural Hospital	-0.162	0.002	-0.128*	0.068
	[0.126]	[0.076]	[0.077]	[0.092]
HHI Index	-0.001	0.046	0.138*	0.095
	[0.103]	[0.106]	[0.081]	[0.139]
ln(County Income)	0.025	-0.121	0.117	0.001
	[0.113]	[0.127]	[0.097]	[0.086]
Avg. Age	-0.001	-0.006	-0.012***	-0.001
	[0.003]	[0.004]	[0.003]	[0.002]
Perct. of Female	0.043	-0.889	-1.296***	-0.385
	[0.500]	[0.809]	[0.459]	[0.589]
Perct. of White	0.192*	0.232**	0.411***	-0.098
	[0.105]	[0.115]	[0.134]	[0.083]
N	193	193	193	193

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) all standard errors are clustered at the health referral region level to account for the within market heterogeneity.
Note (3) HHI is adjusted for chain-affiliation.

Table 3.7: Marginal Effects of Financial Measures on Technology Adoption

	Shaped Beam Radiation System			Stereotactic Radiosurgery		
	(1)	(2)	(3)	(1)	(2)	(3)
Leverage Ratio	-0.086			0.037		
	[0.097]			[0.051]		
Operating Cashflow/Asset		-0.108			0.039	
		[0.181]			[0.166]	
Interest Expense/Debt			-0.148			-1.52
			[1.029]			[1.515]
N	193	194	173	203	204	183

	Multi-Slice CT Scan (64+)			Poistron Emission Tomography		
	(1)	(2)	(3)	(1)	(2)	(3)
Leverage Ratio	-0.018			-0.003		
	[0.090]			[0.079]		
Operating Cashflow/Asset		0.245			-0.103	
		[0.271]			[0.230]	
Interest Expense/Debt			0.668			-1.106
			[1.090]			[1.522]
N	203	204	183	203	204	183

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) all standard errors are clustered at the health referral region level to account for the within market heterogeneity.
Note (3) All regressions include the same independent variables as in other Probit regressions.

CHAPTER IV

Managers' Compensation in a Mixed Ownership Industry

4.1 Introduction

Not-for-profit organizations, such as schools, associations, and health care organizations, have become increasingly important in our economy. The total number of not-for-profit organizations has increased by 24% during the past decade. In 2010, about 2.3 million not-for-profits were operating in the U.S., and their economic activities make up 5.5% of the U.S. GDP (*Blackwood et al.*, 2012). Despite their significant influence, not-for-profit organizations are a challenging subject for traditional economic analysis, particularly because the non-distribution constraint prohibits not-for-profits from distributing the profits back to the individuals who have control over the organizations (*Hansmann*, 1980). This constraint contradicts the fundamental profit-maximizing assumption and the motives of not-for-profit organizations remain a puzzle. This paper investigates nursing home managers' compensation and its relationship with performance measures in order to provide new empirical evidence of the difference between for-profits and not-for-profits.

Because not-for-profits have a prominent presence in the health care sector, the performance objectives of not-for-profits has been a central research topic. About

60% of hospitals (*AHA* 2013) and 27% of nursing homes (*CMS*, 2010) are not-for-profits. Within the theoretical literature, it is common to assume that not-for-profits' objective functions include dimensions beyond financial performance. For example, not-for-profit hospitals maximize quality and quantity, subject to budget constraints (*Newhouse*, 1970; *Fledstein*, 1971). Hirth (1999) assumes that not-for-profit nursing homes maximize quality subject to non-distribution constraints. To test the theoretical predictions, most empirical work has examined the product market outcomes, such as quality of care, charity care, and utilization. However, the empirical results are rather mixed. For example, Sloan et al. (2001) find that for-profit hospitals have higher costs than not-for-profits, but there is no difference in the quality provided. Shen (2002) finds that fewer adverse outcomes occur among acute myocardial infarction patients at not-for-profit hospitals. A recent work by Chang and Jacobson (2010) examines the provision of for-profit and not-for-profit services and rejects the hypothesis that not-for-profits are either purely profit maximizing or social welfare maximizing. However, the use of product market performance to estimate the motives of not-for-profits has its limitations. As noted by Norton and Staiger (1994), ownership choices often interact with unobservable market-level characteristics. They find that for-profit hospitals self-select into well-insured areas. Without controlling for such self-selection problems, the estimate from a direct comparison between for-profits and not-for-profits can be endogenous.

Alternatively, I directly test whether for-profits and not-for-profits place different weights on financial and altruistic motives in deciding managers' compensation. Managers are contracted by the board of directors/trustees to act as the representative agents for the security owners (in for-profits) or the donors and communities (in not-for-profits). Therefore, the managers should receive incentives that reflect the motives of their organizations. The idea is that if not-for-profits truly pursue objectives beyond financial performance, other altruistic objectives should also be important in

determining managers' compensation. Similar strategies have been used in previous studies to explore this topic. For example, Roomkin and Weisbrod (1999) find that compensation for top executives in for-profits is higher. They also examine the compensation composition between base salaries and bonuses and find that bonuses are absolutely and relatively greater in for-profits; Ballou and Weisbrod (2003) examine the CEOs' compensation structure and find that religious nonprofits pay significantly higher base salaries, and secular nonprofits are more likely to provide bonuses and incentive plans. Preyra and Pink (2001) find that, compared to the CEOs of publicly traded companies, CEOs of non-profit hospitals earn significantly lower but much more stable compensation.

Studying of managers' incentives also helps to understand agency problems across different organizational forms. As pointed out by Fama and Jensen (*Fama*, 1980; *Fama and Jensen*, 1983a; *Fama and Jensen*, 1983b), the separation of ownership and management improves operating efficiency but also creates agency problems because managers' incentives may not be in line with residual claimants' best interests. Thus, performance-based compensation can be used to correct managers' incentives and alleviate agency problems. Among for-profits, some of the managers have significant ownership stakes (owner-managers), and others do not. When managers also have significant ownership, the agency problems are not as severe, because owner-managers can share part of the organizations' net worth, and their incentives are more in line with other residual claimants. Also, owner-managers may earn higher compensation because of their influence on corporate policies. In terms of not-for-profits, having no residual claimants does not exempt not-for-profits from agency problems. Agency problems still exist between donors/communities and managers, because managers may not use resources optimally to achieve donors' or communities' objectives. If not-for-profits truly pursue objectives beyond profit-maximization, agency problems can be more pronounced in not-for-profits because it is more diffi-

cult for the board to monitor and evaluate among multiple performance criteria. This paper studies managers' incentives to understand agency problems among for-profits with owner-managers, for-profits with non-owner managers, and not-for-profits.

I also link the managers' compensation to the product market structure to test the hypothesis that product market competition can affect managers' compensation. There are different schools of thought that provide different predictions about the effect of competition on managers' compensation. For example, product market competition can serve as an alternative mechanism to motivate managers to make optimal use of resources and mitigate agency problems (*Giroud and Mueller*, 2011); meanwhile, more product market competition makes managerial talents more valuable resources and can increase managers' compensation (*Gabaix and Landier*, 2008; *Bereskin and Cicero*, 2013). This paper attempts to investigate the relationship between the level and incentives of compensation and nursing home market competition. As noted by Grabowski and Hirth (2003) and Horwitz and Nichols (2009), for-profit market share can increase the intensity of the competition. I thus use both the for-profit market share and conventional HHI index to define the intensity of competition.

The empirical analysis relies on a unique eight year dataset. I obtain audited cost reports for nursing homes from the Ohio Department of Job and Family Service. These reports provide detailed data and audited financial information related to managers' compensation and their ownership. All registered nursing homes in Ohio are required to submit their cost reports annually. Therefore, I have compensation and ownership information of all for-profit nursing homes at the establishment level. This dataset presents a valuable opportunity which has not been available in most prior research. Previous work has mostly accessed only data on compensation for not-for-profits, not that of for-profits, or they rely on a single-year cross-sectional survey. Furthermore, the Ohio data also provides information describing managers' experience and educational background that can be used as proxies for ability.

Overall, I find that owner-managers earn 22% higher compensation than not-for-profit managers and for-profit/non-owner managers. There is no consistent relationship between compensation and either financial or altruistic performance. Rather, managers' compensation is positively correlated with directly observable characteristics, including work experience, number of beds, occupancy rate, and payer mix. However, the results should be interpreted with caution. The absence of a significant relationships between compensation and performance does not necessarily indicate that not-for-profits are not different from for-profits. Because managers' turnover is not included in the analysis, it is possible that the board replaces managers who have poor performance rather than reduces their compensation. Also, the evaluation and monitoring of financial and altruistic performance at the establishment level can be too costly to the board, preventing managers' compensation from reflecting short-term performance.

4.2 Conceptual Framework and Hypotheses

The development of the conceptual framework focuses on the level of compensation and the relationship between compensation and performance among three types of managers: for-profit/owner-managers, for-profit/non-owner managers, and not-for-profit managers. I start with the difference between for-profit and not-for-profit managers, and then discuss the distinguishing factors between the managers who have ownership and those who do not. I then link the level and the pay-for-performance relationship of managers' compensation to product market competition. Finally, I discuss system-affiliation and its impacts on agency problems and performance-based compensation.

4.2.1 For-profits and Not-for-profits

Agency problems arise when ownership and management are separated. Starting with the standard principal-agent model by Holmstrom (1979), the board is the principal who writes a contract with the agent (the manager) to make optimal use of resources, and to maximize the residual claimants' welfare. However, because managers' effort is not perfectly observable and monitoring managers' behavior is often costly, managers may actually maximize their own benefits instead of residual claimants' welfare. Because it is not feasible to contract managers' every effort, the board has to seek a second-best alternative: pay for performance. Performance-based compensation ties at least part of the managers' compensation to observable outcomes: for example, financial performance. In a profit-maximizing private firm, one often assumes that managers' compensation is tied to financial performance. This can take the form of performance-based cash bonuses or stock options that supplement base salaries. In a mixed ownership industry, the contract between the principal and the agent becomes more complicated, because not-for-profits can have motives other than profit-maximization. In addition, without residual claimants, it is unclear who should determine not-for-profits' objectives, and who should evaluate whether these objectives are achieved.

Because this paper uses nursing home data in the empirical analysis, I discuss the hypotheses in the context of the nursing home industry. For-profits and not-for-profits are the two major organizational forms in the nursing home industry. For the for-profit nursing homes, I assume that managers' primary task is to maximize profits. Thus, if the firms connect managers' compensation to performance, managers' compensation should be at least partially tied to nursing homes' financial performance. On the other hand, the relationship between compensation and quality measures is more ambiguous. Theoretically, quality performance only matters to for-profit nursing homes through its impact on financial performance. For example, good quality

may attract consumers who are willing to pay higher prices, and good reputation is an intangible asset that allows nursing homes to attract consumers in the long term. Overall, it is possible that for-profit managers are indirectly rewarded for quality which improves profitability. However, managers in for-profits should be less likely rewarded for quality that is driven by altruistic motives.

On the other hand, the objective functions of the not-for-profit organizations often include some altruistic dimensions such as quality, quantity, and community services. Under these circumstances, it is more difficult to tie optimal manager time and effort to each organizational objective. In the context of the nursing home industry, not-for-profit nursing homes are usually assumed to maximize some functions of profits and quality. Although there are no residual claimants in not-for-profits, earning profits is still an important goal, because profits supply financial resources needed in order to provide services and quality of care. However, what sets not-for-profits apart from for-profits is that better quality itself can be a direct objective, even when quality already exceeds a profit-maximizing level. In not-for-profits, both profit-maximizing and altruistic motives make quality an important objective.

H 1: Financial performance should have stronger influence on for-profit managers' compensation than that of the not-for-profit managers'. On the other hand, quality performance should have stronger influence on not-for-profit managers' compensation than that of the for-profit managers.

4.2.2 Owner-managers

Managers of for-profits can be further separated according to two different types: those who have significant ownership (owner-managers) and those who do not (non-owner managers). Owner-managers are considered to be inside block sharehold-

ers who have significant equity stakes in the firms. Their incentives are different than managers who do not have significant ownership (*Holerness*, 2003). To develop the empirical hypotheses, I borrow the concepts from two different schools of thought: the optimal contracting approach and the managerial power approach. The optimal contracting model (*Murphy*, 1999; *Core et al.*, 2003) suggests that, because owner-managers can directly share a portion of the residual profits, the principal-agent problem may be milder. Using a dataset of small corporations, Ang et al. (2000) find that agency costs are inversely related to managers' ownership share. Since there is less need to use pay-for-performance to mitigate the agency problem, one may expect that owner-managers' compensation would be tied less to their performance (*Mehran*, 1995). A different perspective, the managerial power approach (*Bebchuk and Fried*, 2003; *Bebchuk and Fried*, 2004), provides another hypothesis about owner-managers' compensation. Because owner-managers have more influence on corporate policies, they may be more likely to exercise their managerial power to collective private benefits, including their own compensation (*Holerness and Sheehan*, 1988; *Barclay and Holderness*, 1989; *Mikkelson and Regassa*, 1991; *Chang and Mayers*, 1995; *Nicodano and Sembenelli*, 2000).

In addition, compared to non-owner managers, owner-managers face higher risks from their equity stake. Owner-managers can also exercise their managerial power to raise compensation to reflect the investment uncertainty. The hypothesis about owner-managers can be synthesized as follows:

H 2: Owner-managers earn higher compensation than non-owner managers; owner-managers' compensation is tied less to their performance.

4.2.3 Link to Product Market Competition

It is ambiguous what are the net effects of product market competition on the level and incentives of managers' compensation. Product market competition can affect the level and incentives of managers' compensation in several ways. First, managers' skills and talents can be viewed as essential inputs in the production process. Like other inputs, such as labor, capital, and raw materials, owners contract managers for their managerial skills. When the product market becomes more competitive, the returns to managerial skills increase and, thus, the firms are willing to pay higher prices for managerial talents (*Guadalupe*, 2007; *Gabaix and Landier*, 2008). On the other hand, product market competition reduces excess profits which might be shared partially with the managers. The later hypothesis suggests that managers' compensation is inversely related with the intensity of product market competition. The hypothesis related to competition and the level of compensation is as follows.

H 3a: Compensation can increase or decrease when the market is more competitive

When firms evaluate whether to adopt performance-based compensation, product market competition can be an important factor. Competition has two opposing effects on the incentives of managers' compensation. It has long been known to economists that competition can be an effective discipline mechanism to reduce managerial slack (*Giroud and Mueller*, 2010; *Giroud and Mueller*, 2011). That is, in a perfectly competitive market, firms with incompetent managers will be forced to exit the market, or firms face greater pressures to replace incompetent managers. On the other hand, managers in monopolistic firms may not work as diligently as those in competitive firms do (*Bertrand and Mullainathan*, 2003). Monopolistic managers may not make optimal use of corporate resources as they will be less likely to be

penalized by their competitors. One may also expect that agency problems are more serious in the imperfectly competitive markets. Hence, firms in less competitive markets are more likely to adopt performance-based incentives to motivate managers and to mitigate agency problems.

However, competition can also increases the value of managers' efforts. Assuming in a highly competitive market, a slightly difference in managers' productivity can results in significant differences in market share or cost reduction. Thus, in highly competitive product markets, the firms may more likely to provide performance-based incentives to motivate managers(*Cunat and Guadalupe*, 2005; *Cunat and Guadalupe*, 2009a; *Cunat and Guadalupe*, 2009b).

H 3b: Product market competition can be either negatively (lower agency costs) or positively (higher value of managers' efforts) correlated with the relationship between compensation and performance. The net effect is theoretically ambiguous.

Furthermore, in nursing home markets, for-profit market shares represent more intense market competition on financial but not on quality dimensions (*Hirth*, 1999). The competitive spillover effects of for-market share force nursing homes to trade-off quality for financial gains. This leads to an interesting scenario that for-profit market share has nonuniform effects on compensation incentives. Therefore, in a market that is domnated by for-profit nurisng homes, managers' compensation are more likely to tied to financial performance but less to quality performance.

H 3c i: For-profit market share can increase or decrease managers' compensation.
H 3c ii: In a market with higher for-profit market share, managers' compensation is more tied to the financial performance and less tied to quality measures.

4.2.4 System-affiliation

Because about 59% of the nursing homes in the sample belong to multi-facility systems, it is important to examine whether managers in system-affiliated nursing homes face different incentives than those who work in independent nursing homes. Several reasons suggest that managers' compensation in system-affiliated nursing homes is more likely to be tied to performance. First, nursing home systems are more complex organizations than independent facilities and may operate facilities across different geographic markets and product segments. As pointed out by Fama and Jensen (1983), agency problems become more pronounced when the organizations become more complex. Second, managers in system-affiliated nursing homes are like division managers within big enterprises. Because division managers are contracted by top executives in headquarters and not directly by the principals, agency problems are likely to be more severe between managers in system-affiliated nursing homes and the residual claimants (*Scharfstein and Stein*, 2000). Third, the geographical distance between headquarters and system-affiliated nursing facilities can increase monitoring costs (*Giroud*, 2013) and again, leads to more agency problems. Thus, compared to independent nursing facilities, system-affiliated nursing homes should be more likely to adopt performance-based compensation in contracting their managers.

H 4: System-affiliated nursing homes are more likely to adopt performance-based compensation to alleviate agency problems.

4.3 Data and Empirical Strategy

Data availability presents the biggest challenge in a study of managers' compensation in mixed ownership industries. Particularly in the health care sector,

most for-profit providers are not publicly traded companies, and therefore, complete establishment-level compensation information is unavailable to researchers. Previous studies use either a rare single-year survey (*Ballou and Weisbrod*, 2003; *Roomkin and Weisbrod*, 1999) or IRS form I-990 (*Bricklye et al.*, 2010) and confine the scope to only not-for-profit organizations. Two studies by Preyra and Pink (2001) and Reiter et al. (2009) use a small sample of non-profit hospitals in Ontario. Overall, the main limitation of previous studies is that they are not able to compare directly the managers' compensation of for-profits to those of not-for-profits. To overcome these data limitations, I obtain a unique eight year (2003-2010) dataset that provides detailed manager characteristics and compensation for all for-profit and not-for-profit nursing homes in Ohio. The Ohio Department of Job and Family Services collects an annual cost report from every nursing home that receives state Medicaid reimbursement. Because this dataset contains information for both for-profit and not-for-profit nursing homes, I am able to compare directly the compensation and incentive structures between for-profits and not-for-profits.

4.3.1 Manager Characteristics and Compensation

To exclude interim managers, I only include managers who worked at least 200 days during the fiscal year under examination. To account for the potential reporting errors, I also exclude the observations with the top 5% and bottom 5% values of compensation, assets, profit margins, and ROA. The compensation number is adjusted to year 2000 dollars using the consumer price index. Because nursing homes convert their ownership status (for-profit or not-for-profit) for reasons that may not be observable, I also exclude nursing homes that have converted their ownership status during the study period (2003-2010). [1] Table 4.1 shows the basic descriptive

[1] The conversion between for-profit and not-for-profit status implies a potential selection problem. If the conversions mostly happen to financially destressed not-for-profits, I may under-estimate the association between compensation and financial performance at not-for-profits.

statistics. The mean manager compensation is $94,043, and on average, these managers work 36.96 hours per week. To account for the concerns that managers may not be employed full-time, I include a binary variable that indicates whether the managers work at least 40 hours per week. About 27.87% of the managers work fewer than 40 hours per week. In the regression analysis, I also exclude the nursing homes that are located within hospitals or those owned by the government, because those nursing homes can be very different from most for-profit and not-for-profit nursing homes. Among the managers, 91% earned a bachelor degree and have 8.79 years of work experience in a health care-related field. In addition, 14.5% of them are also the owners of the nursing homes. Table 4.2 provides more detailed information about several sub-groups. Among the for-profits, on average, managers who are non-owners earn $93,534, and owner-managers earn $105,615 annually. On the other hand, not-for-profit managers only earn $87,546 each year, which is $18,609 or 20.63% lower than owner-managers do. System affiliation has very limited effects on managers' compensation. The nursing homes that have a higher percentage of revenue from Medicaid residents pay their managers 4.4% less than those that focus on Medicare and private residents. I also reported managers' work hours. On average, managers at not-for-profits work 35.55 hours per week, and non-owner managers work 37.43 hours each week. Managers of system-affiliated nursing homes work 37.32 hours per week, 0.9 more hours than those at independent nursing homes.

Although it is interesting to compare the work hours of managers in different organizational forms, there are several concerns about proceeding with the empirical analysis. First, more than half of the managers report that they work 40 hours a week. It is not clear whether this total is reported at 40 for convenience, the data is top censored at 40, or managers actually work for 40 hours. Second, it might be possible that the managers provide administration at several small nursing homes and split their time among all of the facilities. Third, work hours are endogenous to com-

pensation. Therefore, because of the concerns about data quality and endogeneity, I only report work hours as the supportive information.

Two other important manager characteristics are educational background and years of work experience. Owner-managers are less likely to have a bachelor degree – only 79% compared to the sample mean of 91%. Years of work experience are reported in continuous numbers and capped at 10 years. Owner-managers and not-for-profit managers are more experienced, with 9.33 and 9.29 years of related experience, compared to 8.55 years of non-owner managers. Compared to independent nursing homes, managers who work at system-affiliated homes are more likely to have bachelor's degrees but are slightly less experienced.

4.3.2 Performance Measures

I use two financial and four quality measures to empirically test whether managers' compensation is tied to financial and altruistic motives. These measures are aggregated at the facility level.

4.3.2.1 Financial Measure

Among many financial measures, I use both the profit margin and ratio of return on assets (ROA) as the primary proxies for financial performance. The profit margin is defined as net income divided by total revenues and it measures the profitability of the firm. The average profit margin is 3.26%. The second financial measure, ROA, has been widely used in prior research that studies managers' compensation (*Parrino*, 1997; *Bertrand and Schoar*, 2003). Return on assets is defined as the net profits over total assets; this term captures profitability and then scales the profits by the book value of the firm. The mean and median of ROA are 9.7% and 6.64%.

4.3.2.2 Quality Measures

I use four common quality measures as proxies for managers' performance on quality of care. These measures are the health deficiencies identified by inspectors, prevalence of restraint, prevalence of pressure sores, and nurse hours per patient day. Quality measures are extracted from the CMS' Nursing Home Compare (NHC) website. The website comprises comprehensive quality measures for all Medicare-certified nursing homes. These quality measures are widely applied in literature that examines nursing home quality. Data about inspection deficiency measures are available since year 2001, and other quality measures are available from 2003 to 2010. Every 12-15 months, state health personnel inspect all nursing homes and report any deficiencies and their severity. To account for the severity of each health deficiency, I weight each deficiency according to its severity (from 1 to 12) and create a *Deficiency Score* variable that aggregates all severity-weighted deficiencies; the higher the deficiency score, the lower the quality. Other quality measures are reported quarterly, and I use the fourth-quarter figures to proxy the latest quality level in each year. High prevalence of restraint use and pressure sores in general represents low quality. On average, 5.38% of the residents are physically restrained, and 9.52% of the residents have pressure sores. I also create dummy variables that indicate the observations with the missing value of each quality measure. In calculating the nurse hours per patient day, there are four different staffing hours, which include Registered Nurses (RN) hours per patient day, Licensed Vocational Nurses hours per patient day (LVN), Certificated Nurse Aides (CNA) hours per patient day, and total nurse hours per patient day. The total nurse hours per patient day are 3.69. I use the Medicare provider number to merge managers' compensation and the corresponding quality measures.

4.3.3 Other Important Independent Variables

Online Survey and Certification and Reporting (OSCAR), Ohio nursing home cost report, and NHC dataset also provide several important nursing home-level and market-level control variables. Nursing home ownership types, number of beds, payer mix, and system affiliation are the key variables that are important enough to spark their own discussions. For-profit nursing homes represent 82.3% of those in the sample, and about 15.1% are not-for-profit. The median nursing home has 103.2 beds, and 59.8% of the nursing homes are affiliated with multi-facility systems. For the payer mix, an average nursing home receives 65.6% of its revenue from Medicaid, 22.3% from private payers, and the rest from Medicare. The average number of activities of daily living (ADLs) provides a facility-level proxy to account for different patient case mixes. It measures whether residents can be independent in the activities including bathing, dressing, transferring, toilet use, and eating. The higher the average number of ADLs, the more assistance for daily care the patients/residents in the nursing facilities require. The average number of ADLs is 5.34.

Market-level covariates include for-profit market shares, HHI index, median household income, and the population (in thousands) above 65 years old per square mile. In an earlier work, Nyman (1994) points out that 80% of Wisconsin nursing home residents enter the nursing homes located in the counties where they reside. Thus, I use county as the primary definition of the nursing home market. The market share is calculated as the ratio of the number of nursing home beds over the sum of nursing home beds in each county. Within an average market, for-profit nursing homes account for 81% of the market share, with a standard deviation of 28.3%. To control for the intensity of market competition, I construct a Herfindahl-Hirschman index (HHI) by summarizing the squares of nursing home market shares in each county. The calculation of HHI is not adjusted for system-level market share because the unique system identifier is not available in the dataset. I also include the county

adjustment variable that is included in the compensation report form.

4.3.4 Empirical Specification

4.3.4.1 Baseline Model

I use both the ordinary least squares (OLS) and nursing home fixed-effect models to analyze the level and the change of managers' compensation. Because the current year's compensation likely reflects last year's performance, all performance and nursing home level variables are lagged by one year. Both OLS and fixed-effect models have their own advantages. The results from the OLS regressions provide important information of nursing home-level variables that do not change frequently. On the other hand, nursing home fixed effects can account for time-invariant variables that are not observable or are not available in the dataset, such as corporate governance and corporate culture. The baseline OLS specification is described as:

$$Y_{i,t} = \beta NFP_i + \mu Owner_{i,t} + \delta Performance_{i,t-1} + \gamma Manager_{i,t} + \lambda NH_{i,t-1} + \theta M_{m,t} + T + \epsilon_{i,t} \tag{4.1}$$

Where $Y_{i,t}$ represents two outcomes of interest, the level and the change of managers' annualized compensation. NFP_i is the indicator variable for whether the nursing home is not-for-profit and $Owner$ is one if the managers are also the owners. Thus, the regression compares three types of managers: not-for-profit managers, owner-managers, and the omitted (reference) group of non-owner managers. Government-owned nursing homes are excluded from the analysis, because managers at these nursing homes may earn different compensation and benefits and have distinct career paths and risks. I also lag the performance and nursing home-level variables by one year, because managers' compensation may be based on previous performance. $Performance$ includes the measures of the nursing home financial and quality performance. I also analyze correlations to examine whether the quality measures are highly

correlated. As it is shown in Table 4.3, quality measures are not highly correlated, so I include all measures in the regressions. *Manager* represents the manager-level characteristics including an indicator variable indicating whether the manager has a bachelor degree and a continuous variable of the managers' years of work experience in a related field. NH is a vector of nursing home characteristics including size (number of beds), system affiliation, occupancy rate, and the payer mix among Medicaid, Medicare, and private payers. M represents the market level characteristics, such as for-profit market shares, HHI concentration level, and demographic variables (median household income) for market m in year t. I use county as the definition of the local market. T represents the year dummy variables that control for year-fixed effects.

4.4 Results and Discussions

Among not-for-profit managers, owner-managers, and non-owner managers, I find that owner-managers earn significantly higher compensation than managers in the other two groups. The magnitude is as large as 22%. However, I do not find the significant difference in compensation between not-for-profit managers and non-owner managers. Surprisingly, I find that compensation is not tied to either financial or quality performance in most model specifications. Rather, compensation is statistically significantly correlated with several observable manager and nursing home characteristics, including work experience, occupancy rate, and payer mix.

4.4.1 Compensation

Table 4.4 shows the relationship between compensation and key variables. For the performance variables, I find that both the profit margin and ROA are positively correlated with compensation in three of four specifications. However, the coefficients are not statistically significant. More surprisingly, there is no consistent and significant relationship between managers' compensation and quality measures.

Among quality measures, the number of nurse hours per patient day could be viewed as either a quality or an efficiency measure. From a societal view, having more nurse hours can be considered a positive sign of high quality of care. However, from the organizations' perspective, higher nurse hours can be viewed as operating inefficiency. These opposing interpretations of nurse hours might explain the insignificance findings of nurse hours and compensation. Two manager characteristics, the managers' ownership and experience, are both positively and significantly correlated with their compensation. Owner-managers earn about 22% more compensation than not-for-profit managers and non-owner managers. One standard deviation lower of work experience (2.3 years) is associated with about 4.9% lower compensation.

Among the firm-level variables, occupancy rate, number of beds, and payer mix are the most influential variables. Consistent with prior studies (*Ballou and Weisbrod*, 2003), firm size is an important factor in determining the compensation level. Surprisingly, there is no difference in compensation between not-for-profit and non-owner managers. This evidence suggests that the difference in compensation between for-profit and not-for-profit managers may result from the presence of owner-managers. I will discuss owner-managers more in a later section. The OLS results suggest that larger nursing homes pay their managers' higher compensation, but the fixed-effect model suggests that the change of the number of nursing home beds is negatively related to compensation. In terms of payer mix, the different payer mix among Medicaid, Medicare, or private payers imply that the nursing homes target different product market segments and therefore require managers to have different skills and abilities. Particularly, Medicare covers post-acute for 90 days, and residents engaging in this care often require more complicated services and special rehabilitations. Also, Medicare patients are more profitable than Medicaid residents, and hence, the nursing homes may be more willing to hire more expensive and capable managers. The results suggest that managers of nursing homes with higher Medicare revenue share

receive significantly higher compensation than those with higher private-pay revenue share and Medicaid revenue share.

4.4.2 Pay-for-Performance

Among all specifications, I find no consistent relationship between compensation and either financial or quality performance. Table 4.4 shows the results from the baseline models. To further test the hypothesis that for-profits place more emphasis on financial performance and not-for-profits may emphasize quality more, I include the interaction term of not-for-profit and performance measures. The results are reported in Table 4.5. Again, I find that compensation of managers in not-for-profits is not consistently tied to either financial or quality performance. Overall, I find that in the nursing home industry, managers' compensation does not reflect common financial and quality measures. The results are consistent with the literature (*Holmstrom and Milgrom*, 1991;*Preyra and Pink*, 2001) that firms are more reluctant to use performance-based incentives when the managers are contracted over several tasks, especially when some of them are difficult to measure. In fact, both profitability and quality performance include factors that are out of managers' control. For example, labor costs may increase or decrease across business cycles, and Medicare and Medicaid may adjust their reimbursement rates time by time. In terms of quality, only technical quality measures are included in the analysis. It is possible that resident satisfaction and other dimensions of quality are also the important variables that are not included in the analysis. On the other hand, I find that managers' compensation is positively correlated with the occupancy rate in both OLS and fixed-effect models. The occupancy rate is likely to be an widely used measure in evaluating a manager's performance.

4.4.3 Owner-Managers

In the owner-manager analysis, I include the interaction terms between *owner* and all performance measures. The results are presented in Table 4.6. First, owner-managers earn 22% higher compensation. This result supports the private benefits hypothesis that owner-managers have stronger influence than non-owner managers in determining their own compensation. However, consistent with the discussion of the main analysis, I do not find a distinct relationship between compensation and performance.

There is also an alternative hypothesis that owner-managers have better abilities and thus, earn higher compensation. Because I only include *bachelor degree* and *years of experience* to proxy for managers' abilities, there might be other unobservable abilities (*Kaplan et al.*, 2012) that bias the results. For example, if owner-managers systematically have better abilities, the observed compensation differential actually reflects the different abilities between good and poor managers. However, I am not able to examine this alternative hypothesis because there is no exogenous shock that alters managers' ownership status.

4.4.4 Product Market Competition

The results of product market competition and managers' compensation are presented in Table 4.7 and Table 4.8. I use two measures to define the intensity of product market competition. For-profit market share is the first measure. In the health services research literature (*Hirth*, 1999; *Horwitz and Nichols*, 2009), for-profit market share is viewed as a proxy of the intensity of competition on financial dimension. A dummy variable, low competition, is 1 if the for-profit market share is below 100 % and otherwise is 0. Table 4.7 shows that the for-profit market does not have significant effects on the level and the incentives of managers' compensation. Because more than half of the nursing homes reside in the markets with only for-profit nurs-

ing homes, it is of concern that there are not enough variations to provide sufficient statistical power. Future work to include states with more not-for-profit presence will be an interesting extension.

For the second measure, I use the conventional HHI index. I classify the markets as low competition if their HHI is larger than the median (0.25). The results are presented in Table 4.8. In terms of the level of compensation, there is a consistent and positive connection between competition and compensation. The result favors the competition for managerial skills hypothesis that compensation increases when the market becomes more competitive. However, because the coefficients are not statistically significant, the results are only suggestive. One limitation is that the calculation of HHI is not adjusted for the system affiliation. Given that more than half of nursing homes belong to multi-facility chains, an analysis that uses system-affiliation-adjusted HHI might provide more robust results.

In addition, an alternative explanation of the insignificant relationship between competition and managers' incentives is that the effect of product market competition is non-monotonic. As pointed out by Schmidt (1997), competition can reduce managerial slack but the relation is not necessary to be monotonic. The marginal reduction of managerial slack can increases when the incumbents faces new entrants and decreases when the market becomes perfectly competitive. Thus, performance-based incentives can be more likely to be adopted in both the least and most competitive markets, and less likely to be adopted in the intermediated competitive market. In the future research, it will be interesting to have more formal discussions and examinations of the non-monotonic competition effect on managerial incentives.

4.4.5 System-Affiliation

In the sample, about 59.8% of the nursing homes belong to multi-facility systems. To examine whether managers in system-affiliated nursing homes are more likely to have performance-based compensation (Hypothesis 4), I include the interaction term of system-affiliation and performance measures in the regression. The results are reported in Table 4.9. I find that managers in system-affiliated nursing facilities do not earn statistically significantly different compensation than those who work in independent nursing homes. I also find that system-affiliated managers are not more likely to receive performance-based compensation. Overall, I find that system affiliation does not have a significant effect on managers' compensation.

4.4.6 Limitations and Extensions

There are two major limitations of this study. First, I do not include the managers' tenure and turnover in the analysis, and these two variables can potentially cause omitted variable biases. It is likely that performance is reflected in managers' turnover but not in their compensation. Also, compensation might be positively correlated with tenure in the same firm. If not-for-profit managers tend to stay in the same organization for a longer period, the compensation for not-for-profit managers may be over-estimated. However, in the Ohio dataset, the computation of tenure and turnover is feasible but very time-consuming because there are no unique manager identifiers. I plan to code these manager identifiers and incorporate them in the future study. Second, the compensation information does not separate the composition between base salaries and stock bonus. For the privately held nursing homes, without the market value of the stock bonus, the actual compensation that includes stock bonus can be potentially higher than it is reflected in the data. Furthermore, the convex payoff of stock options can incentivize managers focus more about profitability than other objectives. It is also possible that performance is tied to the composition

of compensation and not the overall level of the compensation. Although Cole and Mehran (2008) points out that only very few privately held small firms issue stock options, there are nursing homes belonging to national chains which operate more than 200 nursing homes nationally (for example, Genesis HealthCare and Golden Living). Compensation of managers in nursing homes that belong to large systems is more likely to include stock bonuses. Unfortunately, such data are not available for the nursing home cost reports from the major state agencies.

Future research should also expand the scope of studies from Ohio to other states, including California, Florida, Illinois, Massachusetts, Michigan, and New York. Because of the strictness of Certificate-of-Need (CON) laws and the differing for-profit penetration rates by state, the incorporation of multiple major states can provide more market-level variations to examine the interaction between the product market structure and managers' compensation.

4.5 Conclusion

The primary goal of this paper is to use a novel dataset of managers' compensation to provide empirical evidence that for-profit and not-for-profit organizations place different emphasis on financial and altruistic motives. This paper also examines the difference between owner-managers and non-owner managers. Surprisingly, I find that compensation is not consistently related to either financial or quality measures. Therefore, no evidence supports the hypothesis that not-for-profits place more weight on altruistic performance in determining managers' compensation. However, the results should be interpreted with caution. The insignificant findings do not necessarily imply that not-for-profits do not have altruistic motives. It is possible that the measures used in this paper are too noisy to reflect the managers' contribution and thus are not adopted as the evaluation benchmarks. As shown in the results, compensation is tied to some other measures, such as occupancy rate and managers' experience.

On the other hand, I find that owner-managers earn significantly higher compensation than not-for-profit and for-profit/non-owner managers do. The difference is as large as 22% of the average annual compensation. These results are consistent with the hypothesis that owner-managers can exercise their influence to collect private benefits. It raises a corporate governance issue for smaller health services providers. About 14.9% of observations in the sample are owner-managers. It is possible that owner-managers also have significant presence in other health services industries in which small-medium firms are the dominant organizational forms. Because owner-managers have more substantial financial interests and also have stronger influence on firms' policies, it is of great interest to examine whether owner-managers are more likely to trade-off public welfare for personal benefit, when they face adverse events. This issue is left for future research to explore.

Figure 4.1: The Distribution of Annualized Compensation by For-Profit Status

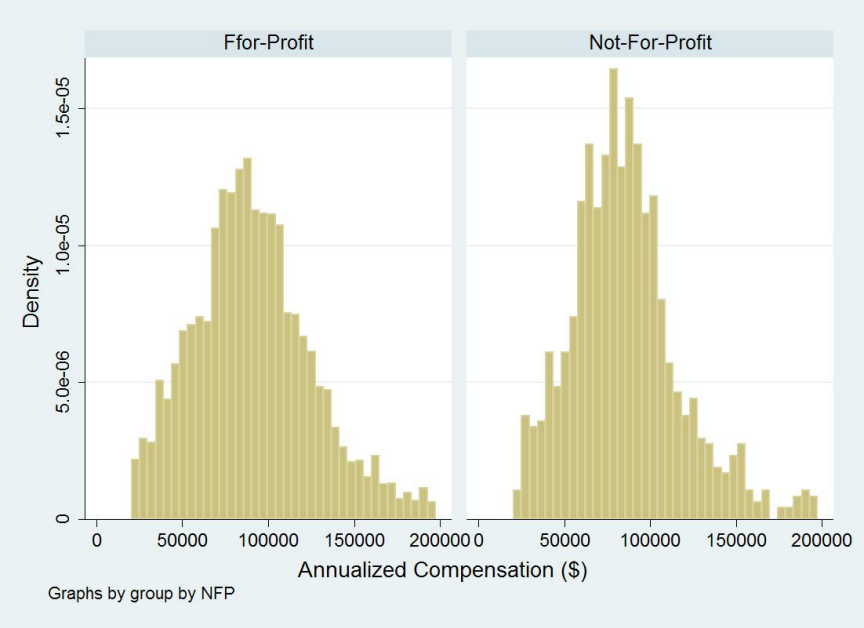


Table 4.1: Summary Statistics

	Mean	Min	Median	Max	Std	N
Manager-Level						
Annual Compensation	94,043	20,549	90,662	197,464	31,611	4767
Weekly Work Hours	36.964	16.060	40	40	6.030	4767
Bachelor Degree	0.909	0	1	1	0.288	4767
Years of Work Experience	8.794	0	10	10	2.348	4767
Owner	0.145	0	0	1	0.352	4767
Performance Measures						
Profit Margin (%)	3.256	-16.859	3.542	17.681	6.465	4767
Return on Assets (%)	9.698	-59.968	6.638	81.224	22.131	4767
Deficiency Score	21.876	0.000	17	210	20.428	4767
Restraint (%)	5.382	0	4	45	6.025	4767
Restraint_NA	0.038	0	0	1	0.190	4767
Pressure Sores (%)	9.518	0	9	42	7.554	4767
Pressure Sores _NA	0.202	0	0	1	0.402	4767
Nurse Hrs per Day	3.692	0	3.66	18.7	0.917	4767
Nurse Hrs_NA	0.023	0	0	1	0.150	4767
Nursing Home-Level						
For-Profit	0.823	0	1	1	0.382	4767
Private-Pay Shr	0.223	0.000	0.212	1.000	0.128	4681
Medicaid-Pay Shr	0.656	0.000	0.661	1.000	0.154	4681
Avg. ADL	5.335	1.862	5.331	8.957	0.774	4681
Government Owned	0.026	0	0	1	0.160	4767
Hospital Based	0.003	0	0	1	0.050	4767
System Affiliated	0.598	0	1	1	0.490	4767
Occupancy Rate	87.522	1	90	100	11.788	4676
Number of Beds	103.203	18	100	351	43.615	4681
Market-Level						
For-Profit Mkt Shr	0.810	0.000	1.000	1	0.283	4767
000' 65+/ square mile	0.121	0.004	0.054	0.454	0.130	4767
HHI	0.411	0.060	0.301	1.000	0.299	4767
Median Income	44,651	27,849	44,093	88,645	7,406	4767

Note: Private-pay share, Medicaid-pay share, avg. ADL, occupancy rate, and number of beds are 1 year lagged values and thus have fewer observations.

Table 4.2: Compensation and Manager Characteristics by Sub-groups

	Mean	Std	Min	Median	Max	N
Compensation ($)						
Overall	94,406	31,841	20,549	91,199	197,464	4644
Not-For-Profit	87,546	27,279	23,113	85,249	196,943	718
For-Profit: Owner	105,615	40,180	22,858	101,549	196,485	691
For-Profit: Non-Owner	93,534	30,134	20,549	91,550	197,464	3235
System-Affiliated	94,116	30,113	21,896	91,890	197,464	2852
Not-System-Affiliated	94,866	34,416	20,549	90,366	196,943	1792
More Medicaid Shr	92,515	32,004	20,549	89,031	196,222	2477
Fewer Medicaid Shr	96,566	31,523	22,213	93,155	197,464	2167
Weekly Work Hrs						
Overall	36.97	6.04	16.06	40.00	40.00	4644
Not-For-Profit	35.55	6.02	16.06	40.00	40.00	718
For-Profit: Owner	36.32	6.67	16.59	40.00	40.00	691
For-Profit: Non-Owner	37.43	5.85	16.31	40.00	40.00	3235
System-Affiliated	37.32	5.85	16.06	40.00	40.00	2852
Not-System-Affiliated	36.42	6.30	16.59	40.00	40.00	1792
More Medicaid Shr	37.07	6.14	16.31	40.00	40.00	2477
Fewer Medicaid Shr	36.87	5.93	16.06	40.00	40.00	2167
Bachelor Degree						
Overall	0.91	0.29	0.00	1.00	1.00	4644
Not-For-Profit	0.91	0.28	0.00	1.00	1.00	718
For-Profit: Owner	0.79	0.41	0.00	1.00	1.00	691
For-Profit: Non-Owner	0.93	0.25	0.00	1.00	1.00	3235
System-Affiliated	0.93	0.25	0.00	1.00	1.00	2852
Not-System-Affiliated	0.87	0.33	0.00	1.00	1.00	1792
More Medicaid Shr	0.91	0.29	0.00	1.00	1.00	2477
Fewer Medicaid Shr	0.91	0.28	0.00	1.00	1.00	2167
Experience (Years)						
Overall	8.78	2.36	0.00	10.00	10.00	4644
Not-For-Profit	9.33	1.73	0.00	10.00	10.00	718
For-Profit: Owner	9.29	1.88	0.00	10.00	10.00	691
For-Profit: Non-Owner	8.55	2.53	0.00	10.00	10.00	3235
System-Affiliated	8.57	2.49	0.00	10.00	10.00	2852
Not-System-Affiliated	9.12	2.09	0.00	10.00	10.00	1792
More Medicaid Shr	8.59	2.55	0.00	10.00	10.00	2477
Fewer Medicaid Shr	9.00	2.09	0.00	10.00	10.00	2167

Note: The reported statistics do not include managers in government-owned nursing homes.

Table 4.3: Correlation Between Quality Measures

	Restraint	Pressure Sores	Deficiencies	Nurse Hours
Restraint	1.000			
Pressure Sores	0.045	1.000		
Deficiencies	0.066	0.110	1.000	
Nurse Hours	-0.028	-0.017	-0.078	1.000

Table 4.4: Determinants of Managers' Compensation

	OLS		Nursing Home FE	
	$	**Δ $**	**$**	**Δ $**
Performance				
Profit Margin $_{t-1}$	45.8	176.90**	-26.67	6.52
	[60.18]	[73.88]	[49.80]	[90.16]
ROA $_{t-1}$	0.28	1.26	2.87***	-0.74
	[2.48]	[1.73]	[0.84]	[1.42]
Restraint $_{t-1}$	-116.35	-79.29	167.68*	-14.08
	[98.61]	[142.10]	[89.35]	[333.99]
Pressure Sores $_{t-1}$	-52.05	-12.55	30.18	136.440
	[84.72]	[122.81]	[70.82]	[127.89]
Deficiencies $_{t-1}$	-14.66	-40.59	4.75	-13.38
	[22.45]	[39.78]	[19.37]	[44.84]
Nurse Hours/Day $_{t-1}$	-1788.85**	778.78	227.49	-278.29
	[858.51]	[686.91]	[434.68]	[863.50]
Manager Characteristics				
Owner	20533.85***	807.7	24114.18***	17630.81**
	[3415.41]	[1984.62]	[5058.29]	[6980.07]
Bachelor Degree	-1911.98	-2344.04	-3457.12	-3670.73
	[3109.77]	[2376.44]	[3162.85]	[4866.42]
Experience (Years)	2150.45***	1225.94***	2088.60***	1784.37***
	[202.00]	[368.58]	[301.73]	[628.18]
Firm Characteristics				
Not-For-Profit	-1845.98	771.47		
	[2241.98]	[1931.66]		
System-Affiliation $_{t-1}$	964.56	-1695.69	1362.86	2669.62
	[1735.81]	[1370.68]	[1714.36]	[3304.79]
Occupancy Rate $_{t-1}$	110.15**	3.18	156.88***	43.41
	[53.12]	[68.60]	[52.26]	[78.64]
Number of Beds $_{t-1}$	245.30***	-3.95	100.37*	-131.53*
	[23.54]	[23.20]	[57.85]	[70.85]
Private-Pay Share $_{t-1}$	-25533.14***	12580.25	-6212.34	-22647.19*
	[9153.88]	[10958.40]	[7048.13]	[11744.74]
Medicaid-Pay Share $_{t-1}$	-37129.32***	17908.66*	-4377.01	-3443.17
	[8131.56]	[10164.90]	[6636.55]	[10828.45]
Avg. # of ADLs $_{t-1}$	-893.4	-144.14	-1765.19**	-193.98
	[906.73]	[751.74]	[694.93]	[1266.37]
R-Squared	0.42	0.02	0.33	0.02
N	4543	4541	4543	4541

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) For OLS, standard errors are clustered at the county level; I use robust standard error for nursing home fixed-effect models.
Note (3) All regresions control for the year-fixed effects, managers' functions, for-profit market share, HHI, county level income, percentage of population above 65 years old, county adjustment, and indicators of missing quality measures, full-time managers, and solo managers.

Table 4.5: Effects of Not-For-Profit Status on Compensation Incentives

	OLS		**Nursing Home FE**	
	$	**Δ $**	**$**	**Δ $**
	(1)	(2)	(3)	(4)
Not-For-Profit	-3421	2233.03		
	[6334.117]	[6691.450]		
Profit Margin $_{t-1}$	37.57	222.33***	-80.29	-24.39
	[57.934]	[83.175]	[65.223]	[127.327]
Not-For-Profit X Profit Margin $_{t-1}$	-42.7	-314.45**	-67.64	-359.11
	[226.347]	[127.728]	[175.681]	[255.118]
ROA $_{t-1}$	0.04	-0.57	3.43***	-0.95
	[1.827]	[0.864]	[0.949]	[1.676]
Not-For-Profit X ROA $_{t-1}$	6.73	198.00***	93.12	287.07**
	[92.238]	[70.160]	[67.216]	[132.691]
Restraint $_{t-1}$	-161.26	-155.66	151.24*	-121.07
	[98.338]	[184.222]	[91.774]	[440.780]
Not-For-Profit X Restraint $_{t-1}$	170.95	300.73	-123.13	387.8
	[208.015]	[225.411]	[213.623]	[446.762]
Pressure Sores $_{t-1}$	-119.06	-64.56	-25.59	108.69
	[100.684]	[159.540]	[78.578]	[154.679]
Not-For-Profit X Pressure Sores $_{t-1}$	80.57	-15.8	50.58	-83.61
	[182.383]	[228.915]	[128.792]	[265.226]
Deficiencies $_{t-1}$	-25.31	-56.59	-16.45	-40.59
	[21.049]	[52.504]	[22.187]	[55.160]
Not-For-Profit X Deficiencies $_{t-1}$	-64.94	17.04	-7.69	22.84
	[69.227]	[93.622]	[56.523]	[90.286]
Nurse Hrs $_{t-1}$	-1100.05	1182.92	438.58	-717.07
	[1040.419]	[889.028]	[560.783]	[1222.960]
Not-For-Profit X Nurse Hrs $_{t-1}$	-139.89	-684.45	476.7	1317.7
	[1332.585]	[980.739]	[693.432]	[1256.420]
R-squared	0.42	0.02	0.33	0.02
Observations	4543	4541	4543	4541

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) For OLS, standard errors are clustered at the county level; I use robust standard error for nursing home fixed-effect models.
Note (3) All regresions include all independent variables in the Table 4.
Note (4) The reference group is the for-profit/non-owner manager

Table 4.6: Effects of Owner-Managers on Compensation Incentives

	OLS		**Nursing Home FE**	
	$	**Δ $**	**$**	**Δ $**
	(1)	(2)	(3)	(4)
Owner	31096.65**	3322.77	25859.05**	10396.77
	[13796.264]	[8730.351]	[11941.509]	[17054.298]
Profit Margin $_{t-1}$	37.57	222.33***	-80.29	-24.39
	[57.934]	[83.175]	[65.223]	[127.327]
Owner X Profit Margin $_{t-1}$	23.25	-168.92*	138.83	111.77
	[132.066]	[99.646]	[147.954]	[177.937]
ROA $_{t-1}$	0.04	-0.57	3.43***	-0.95
	[1.827]	[0.864]	[0.949]	[1.676]
Owner X ROA $_{t-1}$	41.98	46.88	-9.3	12.46
	[49.752]	[32.597]	[38.354]	[55.275]
Restraint $_{t-1}$	-161.26	-155.66	151.24*	-121.07
	[98.338]	[184.222]	[91.774]	[440.780]
Owner X Restraint $_{t-1}$	104.06	228.37	270	281.33
	[479.873]	[245.328]	[404.159]	[516.703]
Pressure Sores $_{t-1}$	-119.06	-64.56	-25.59	108.69
	[100.684]	[159.540]	[78.578]	[154.679]
Owner X Pressure Sores $_{t-1}$	349.11	395.95	292.15	304.47
	[284.898]	[240.960]	[278.224]	[347.591]
Deficiencies $_{t-1}$	-25.31	-56.59	-16.45	-40.59
	[21.049]	[52.504]	[22.187]	[55.160]
Owner X Deficiencies $_{t-1}$	129.64	104.11	137.45**	166.81
	[97.806]	[90.357]	[57.847]	[103.376]
Nurse Hrs $_{t-1}$	-1100.05	1182.92	438.58	-717.07
	[1040.419]	[889.028]	[560.783]	[1222.960]
Owner X Nurse Hrs $_{t-1}$	-5279.12*	-2354.28	-2937.27	418.82
	[2891.530]	[1614.222]	[2660.039]	[3557.031]
R-squared	0.42	0.02	0.33	0.02
Observations	4543	4541	4543	4541

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) For OLS, standard errors are clustered at the county level; I use robust standard error for nursing home fixed-effect models.
Note (3) All regresions include all independent variables in the Table 4.
Note (4) The reference group are the for-profit/non-owner managers.

Table 4.7: Market Competition (For-profit Market Share) and Managers' Compensation

	OLS		**Nursing Home FE**	
	$	**Δ $**	**$**	**Δ $**
	(1)	(2)	(3)	(4)
LC(Low Competition)	-4984.51	7134.98	-6615.58	10620.87
	[5913.956]	[5713.918]	[4154.405]	[8920.482]
Profit Margin $_{t-1}$	54.24	229.46**	-28.15	68.54
	[85.383]	[97.304]	[81.071]	[146.261]
LC X Profit Margin $_{t-1}$	-12.85	-74.25	2.17	-77.72
	[93.877]	[104.501]	[97.285]	[169.364]
ROA $_{t-1}$	0.13	0.34	2.58***	-0.9
	[2.446]	[1.160]	[0.762]	[1.448]
LC X ROA $_{t-1}$	0.97	4.45	4.41	-9.22
	[11.778]	[13.759]	[8.228]	[20.943]
Restraint $_{t-1}$	-77.86	55.47	170.4	82.02
	[122.236]	[107.296]	[111.686]	[244.403]
LC X Restraint $_{t-1}$	-107.92	-349.76	28.28	-170.52
	[167.709]	[292.723]	[150.743]	[506.522]
Pressure Sores $_{t-1}$	-202.89*	-39.37	-32.59	130.38
	[119.064]	[102.562]	[93.727]	[140.341]
LC X Pressure Sores $_{t-1}$	341.22**	60.25	141.93	37.1
	[156.479]	[178.117]	[133.335]	[229.886]
Deficiencies $_{t-1}$	-0.13	4.79	-13.61	39.1
	[34.780]	[39.616]	[26.519]	[50.969]
LC X Deficiencies $_{t-1}$	-29.98	-91.11	39.17	-121.03
	[55.747]	[70.171]	[37.810]	[87.803]
Nurse Hrs $_{t-1}$	-2188.08*	1616.42**	-57.04	817.11
	[1239.571]	[707.391]	[563.591]	[948.719]
LC X Nurse Hrs $_{t-1}$	955.77	-1745.93	664.66	-2142.33
	[1443.432]	[1161.335]	[742.271]	[1751.668]
R-squared	0.42	0.02	0.33	0.02
Observations	4543	4541	4543	4541

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) For OLS, standard errors are clustered at the county level; I use robust standard error for nursing home fixed-effect models.
Note (3) All regresions include all independent variables in the Table 4.
Note (4) The reference group are nursing homes that locates in high competition markets. High/low competition is defined as if for-market share is above or below median.

Table 4.8: Market Competition (HHI Index) and Managers' Compensation

	OLS		**Nursing Home FE**	
	$	**Δ $**	**$**	**Δ $**
	(1)	(2)	(3)	(4)
LC(Low Competition)	-7711.28	-7669.05	-1365.37	-9575.52
	[5634.737]	[6684.483]	[4113.476]	[9549.632]
Profit Margin $_{t-1}$	67.13	123.51*	-114.99*	-52.25
	[76.595]	[73.116]	[68.615]	[112.873]
LC X Profit Margin $_{t-1}$	-36.18	105.15	166.56*	106.22
	[112.245]	[81.052]	[87.369]	[144.299]
ROA $_{t-1}$	-10.13	0.49	0.34	-9.06
	[7.791]	[10.312]	[6.134]	[13.756]
LC X ROA $_{t-1}$	11.5	-0.08	2.02	8.45
	[8.025]	[10.579]	[6.215]	[13.929]
Restraint $_{t-1}$	-243.04*	-353.74	218.63*	-161.15
	[123.830]	[307.935]	[116.850]	[608.091]
LC X Restraint $_{t-1}$	206.3	454.09	-63.7	230.04
	[152.451]	[296.203]	[119.302]	[465.593]
Pressure Sores $_{t-1}$	-108.29	-141.1	-49.37	-83.63
	[129.398]	[236.752]	[112.672]	[221.962]
LC X Pressure Sores $_{t-1}$	94.8	204.4	132.57	354.44
	[144.005]	[225.684]	[128.281]	[237.943]
Deficiencies $_{t-1}$	-2.79	-71.21	27.19	-72.03
	[46.518]	[72.559]	[27.761]	[85.988]
LC X Deficiencies $_{t-1}$	-20.5	56.92	-39.38	103.05
	[58.950]	[78.440]	[32.902]	[119.511]
Nurse Hrs $_{t-1}$	-2627.72**	280.34	294.96	-1295.52
	[1174.265]	[1393.422]	[825.777]	[1979.645]
LC X Nurse Hrs $_{t-1}$	1297.39	888.32	-11.79	1647.9
	[1302.035]	[1378.836]	[923.472]	[2019.863]
R-squared	0.42	0.02	0.33	0.02
Observations	4543	4541	4543	4541

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) For OLS, standard errors are clustered at the county level; I use robust standard error for nursing home fixed-effect models.
Note (3) All regresions include all independent variables in the Table 4.
Note (4) The reference group are nursing homes that locates in high competition markets. High/low competition is defined as HHI index above or below median.

Table 4.9: Effect of System Affiliation on Compensation Incentives

	OLS		**Nursing Home FE**	
	$	**Δ $**	**$**	**Δ $**
	(1)	(2)	(3)	(4)
System $_{t-1}$	-1579.43	4756.99	-371.3	13629.79
	[7099.136]	[7636.708]	[4290.322]	[8317.552]
Profit Margin $_{t-1}$	122.07*	87.3	35.34	19.13
	[70.349]	[80.110]	[66.792]	[90.912]
System $_{t-1}$ X Profit Margin $_{t-1}$	-180.54**	155.57	-123.87	17.33
	[86.709]	[126.454]	[87.032]	[150.818]
ROA $_{t-1}$	50.66**	9.91	14.35	-51.98
	[24.388]	[37.811]	[18.179]	[32.352]
System $_{t-1}$ X ROA $_{t-1}$	-50.76**	-9.95	-11.2	51.93
	[24.655]	[38.211]	[18.205]	[32.395]
Restraint $_{t-1}$	-317.78	-158.11	111.67	-171.57
	[217.708]	[146.866]	[146.466]	[246.758]
System $_{t-1}$ X Restraint $_{t-1}$	307.39	110.67	94.79	230.13
	[238.011]	[224.040]	[165.508]	[552.186]
Pressure Sores $_{t-1}$	-78.14	155.96	53.86	290.38
	[153.289]	[160.398]	[121.454]	[222.382]
System $_{t-1}$ X Pressure Sores $_{t-1}$	50.47	-282.22	-44.93	-230.81
	[174.682]	[197.215]	[150.309]	[288.678]
Deficiencies $_{t-1}$	-13.95	2.04	5.92	22.8
	[39.779]	[41.953]	[31.149]	[46.573]
System $_{t-1}$ X Deficiencies $_{t-1}$	-3.18	-63.74	-1.79	-56.08
	[44.747]	[73.992]	[39.360]	[73.628]
Nurse Hrs $_{t-1}$	-2059.64	1256.13*	-24.59	1073.29
	[1361.443]	[722.175]	[612.062]	[844.551]
System $_{t-1}$ X Nurse Hrs $_{t-1}$	452.53	-875.18	425.68	-2434.18
	[1585.892]	[1321.311]	[847.148]	[1651.699]
R-squared	0.42	0.02	0.33	0.02
Observations	4543	4541	4543	4541

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) For OLS, standard errors are clustered at the county level; I use robust standard error for nursing home fixed-effect models.
Note (3) All regresions include all independent variables in the Table 4.
Note (4) The reference group are the nursing homes that do not affiliate to systems.

Table 4.10: Effect of System Affiliation on Compensation -Full Interaction Model

	OLS				Nursing Home Fixed Effect			
	$	$	Δ $	Δ $	$	$	Δ $	Δ $
	System	Not System	System	Not System	System	Not System	System	Not System
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Profit Margin $_{t-1}$	-40.85	125.39	303.52***	2.87	-80.22	-9.08	120.58	-50.75
	[75.869]	[76.218]	[93.734]	[66.863]	[56.364]	[68.649]	[119.953]	[95.704]
ROA $_{t-1}$	0.69	32.15	-0.31	6.12	6.06***	-5.18	-0.51	-70.79**
	[2.028]	[23.917]	[1.312]	[33.577]	[0.892]	[19.614]	[1.945]	[28.495]
Restraint $_{t-1}$	-8.27	-324.6	-75.07	-99.13	268.37**	36.62	-253.28	103.2
	[89.130]	[215.748]	[204.600]	[138.477]	[110.275]	[160.720]	[546.520]	[180.991]
Pressure Sores $_{t-1}$	-57.12	-84.2	-158.56	138.01	-46.32	44.32	-50.87	80.29
	[84.010]	[162.501]	[164.894]	[168.001]	[91.617]	[125.768]	[177.589]	[172.732]
Deficiencies $_{t-1}$	-10.4	18.34	-60.53	4.03	0.96	13.73	-31.33	10.93
	[24.326]	[43.771]	[56.804]	[42.154]	[24.810]	[33.658]	[65.205]	[46.606]
Nurse Hrs $_{t-1}$	-1224.35	-1348.14	634	937.81	310.14	640.55	-1100.55	912.19
	[893.786]	[1310.600]	[970.381]	[693.161]	[546.356]	[623.786]	[1335.150]	[779.565]
R-squared	0.27	0.194	0.275	0.181	0.306	0.192	0.333	0.211
Observations	3985	2453	3238	1912	3682	2329	4128	2611

Note (1) ***, **, and * represent significance at 1 %, 5 %, and 10 % levels
Note (2) For OLS, standard errors are clustered at the county level; I use robust standard error for nursing home fixed-effect models.
Note (3) All regressions include all independent variables in the Table 4.

CHAPTER V

Conclusion

This dissertation examines three topics related to the interaction of financial arrangements and production decisions in health care organizations; specifically, the dynamics of nursing home quality across business cycles, financial leverage and hospital technology adoption, and managers compensation in mixed ownership industries. The universal theme among these three essays aim to investigate the link between financial and operational decisions and provide empirical evidence on welfare gains or losses resulting from finance decisions.

The results detailed in the second chapter provide consistent evidence that nursing home quality is counter-cyclical; quality improves during recessions and deteriorates during booms. I theorize that the fluctuation of labor market and the relatively rigid public reimbursement are two important mechanisms that result in counter-cyclical quality. Furthermore, I investigate whether nursing homes financial leverage can amplify the counter-cyclical fluctuation of quality. While financial leverage is consistently and significantly associated with quality, the interaction term of leverage and business cycles is not always significant. This chapter provides theoretical arguments and empirical evidence that nursing home quality is counter-cyclical; however, it requires further study to clarify the causality between financial leverage and quality.

The third chapter attempts to provide empirical evidence of the impacts of financial leverage on technology adoption. The research design uses the California Seismic Retrofit Mandate as an exogenous financial shock that crowds out hospitals financial resources. Surprisingly, I find no significant relationship between financial leverage and the adoption of radiology technology. However, it is difficult to interpret the nonsignificant results because of the small sample size. Thus, I recommend incorporating more hospitals in multiple states for future study.

The fourth chapter examines whether nursing home managers are compensated differentially among three different identities, not-for-profit, for-profit and non-owner, and for-profit and owner. The results show that managers compensation is not tied to their performance. Rather, their compensation is associated more so with concrete measures including the size of nursing home, payer-mix, and managers experience. Among three types of managers, owner-managers earn significantly higher compensation than do non-owner managers and not-for-profit managers. Compensation of non-owner managers is not significantly different from that of not-for-profit managers. Particularly, the separation of owner-managers from the non-owners provides an alternative angle to study the difference between for-profits and not-for-profits. Perhaps, the for-profit managers equity stakes in the organization are more influential than is the legal definition of for-profit or not-for-profit status. Additional research is encouraged to explore the roles and influences of owner-managers in health care industries.

APPENDICES

APPENDIX A

Theoretical Proof

A.1 Appendix A: Theoretical Proofs

A.1.1 Demand

Consumers of nursing home care are assumed to only partially observe nursing home quality. β represents the severity of asymmetric quality information. The consumers are distributed uniformly between [0,1] with transportation cost t. The market share in the first period σ_1 can be defined as:

$$\sigma^A_{1_{(Q^A,Q^B)}} = \frac{1}{2} + \frac{\beta(Q^A - Q^B)}{2T} = 1 - \sigma^B_{1(Q^A,Q^B)} \tag{A.1}$$

Overtime, consumers gradually learn the true quality of the nursing homes and reduce the level of information asymmetry between nursing homes and consumers. Because it requires significant time to adjust quality and also alter quality reputation, the model assumes quality stay the same in both the first and second periods. In the second period, the true nursing home quality is fully revealed to the consumers so β

is normalized to one - the assumption of perfect information. The market share in the second period can be defined as:

$$\sigma^{A}_{2_{(Q^A,Q^B)}} = \frac{1}{2} + \frac{(Q^A - Q^B)}{2T} = 1 - \sigma^{B}_{2(Q^A,Q^B)} \tag{A.2}$$

A.1.2 Nursing Home with 100 % Internal Financing

In this simple model, I assume both nursing homes A and B are profit maximizing and their initial start-up investments are 100 % equity financed. The firms have sufficient internal cash-flows for operation needs and have no borrowings and debts. The nursing home A's maximization problem can be characterized as:

$$Max_{[Q^A]}\Pi_{(Q^A,Q^B)} \;:\; (\overline{P} - C^{A}_{(\theta_j Q^A)})\sigma^{A}_{1_{(Q^A,Q^B)}} + \delta(\overline{P} - C^{A}_{(\theta_j Q^A)})\sigma^{A}_{2_{(Q^A,Q^B)}} \tag{A.3}$$

Cost is a monotonic increasing function of quality. For simplicity, it can be defined as:

$$C^A = \theta_j Q^A \tag{A.4}$$

Taking derivative w.r.t. to Q^A resulting in the following First Order Condition:

$$\begin{aligned}\frac{\partial \Pi_{(Q^A,Q^B)}}{\partial Q^A} = & -\theta_j(\frac{1}{2} + \frac{\beta}{2T}Q^A - \frac{\beta}{2T}Q^B) + \frac{\beta}{2T}(\overline{P} - \theta_j Q^A) \\ & -\delta\theta_j(\frac{1}{2} + \frac{1}{2T}Q^A - \frac{1}{2T}Q^B) + \delta\frac{1}{2T}(\overline{P} - \theta_j Q^A)\end{aligned} \tag{A.5}$$

Set $\frac{\partial \Pi_{(Q^A,Q^B)}}{\partial Q^A} = 0$, solve for Q^A

$$Q^A = \frac{1}{2}[Q^B + \frac{\overline{P}}{\overline{\theta}} - \frac{(1+\delta)}{(\beta+\delta)}T] \tag{A.6}$$

Assume symmetric Nash equilibrium, solve the maximization problem for nursing home B:

$$Q^B = \frac{1}{2}[Q^A + \frac{\overline{P}}{\overline{\theta}} - \frac{(1+\delta)}{(\beta+\delta)}T] \tag{A.7}$$

Substitute Q^A into Q^B, the equilibrium Q^{A^*} and Q^{B^*} can be solved as

$$Q^{A^*} = Q^{B^*} = [\frac{\overline{P}}{\overline{\theta}} - \frac{(1+\delta)}{(\beta+\delta)}T] \tag{A.8}$$

APPENDIX B

Technical Note on Quality Measures

B.1 Appendix B: Technical Note on Quality Measures

This section provides definitions and explanations of the nursing home quality measures that are used in the empirical analysis.

B.1.1 Deficiencies and Severity Weight

Nursing home inspections provide detailed deficiency information by categories and severity. There are two broader types of deficiencies: (1) health deficiencies and (2) life and fire deficiencies. Each inspected deficiency is assigned a letter tag from A to L, in which A represents the mildest and L represents the most severe deficiencies. I assign a numerical value of each letter tag and summarize the total deficiencies scores for each nursing home. The higher the deficiencies score, the lower the quality.

B.1.2 Health Deficiencies

Health deficiencies include eight deficiency categories:(1) Mistreatment, (2) Quality Care, (3) Resident Assessment, (4) Resident Rights, (5) Nutrition and Diet, (6)

Pharmacy Service, (7) Environment, and (8) Administration.

Examples of health deficiencies include violations of the following guidelines: *hiring only people with no legal history of abusing, neglecting, or mistreating residents*; *completely assessing each resident's assessment at least every 12 months*; and *making sure each resident receives an accurate assessment by a qualified health professional.*

B.1.3 Fire and Safety Deficiencies

Fire and Safety deficiencies include 19 deficiency categories:(1) Building Construction, (2) Interior Finish, (3) Corridor Walls and Doors, (4) Vertical Openings, (5) Smoke Compartmentation and Control, (6) Hazardous Areas, (7) Exit and Exit Access, (8) Exits and Egress, (9) Illumination and Emergency Power, (10) Emergency Plans and Fire Drills, (11) Fire Alarm Systems, (12) Automatic Sprinkler Systems, (13) Smoking Regulations, (14) Building Service Equipment,, (15) Furnishings and Decorations, (16) Laboratories, (17) Medical Gases and Anesthetizing Areas, (18) Electrical Deficiencies, and (19) Miscellaneous.

B.1.4 Severity Weighting

Each deficiency depending on its severity is assigned an alphabetic code from A to L. The severity is the combination of the scope and the level of harm. For example, severity is coded as A for *Isolated/Potential for minimal harm*, H for *Pattern/Actual harm*, or L for *Widespread/ Immediate jeopardy to resident health or safety.* I further scale each deficiency by its severity from 1 (A) to 12 (L) and aggregate the scores at the facility level.

BIBLIOGRAPHY

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AHA (2013), Fast fact on us hospitals, *AHA Hospital Statistics*.

Ai, C., and E. Norton (2003), Interaction terms in logit and probit models, *Economics Letters*, *80*(1), 123–129.

Akerlof, G. A. (1970), The market for "lemons": Quality uncertainty and market mechanism, *The Quarterly Journal of Economics*, *84*(3), 488–500.

Ang, J. S., R. A. Cole, and J. W. Lin (2000), Agency costs and ownership structure, *The Journal of Finance*, (1), 81–106.

Arrow, K. (1963), Uncertainty and the welfare economics of medical care, *The American Economic Review*, (5), 941–973.

Ballou, J. P., and B. A. Weisbrod (2003), Managerial rewards and the behavior of for-profit, governmental, and nonprofit organizations: Evidence from the hospital industry, *Journal of Public Economics*, *87*, 1895–1920.

Barclay, M. J., and C. G. Holderness (1989), Private benefits from control of public corporations, *Journal of Financial Economics*, *25*, 371–95.

Bazzoli, G. J., H.-F. Chen, M. Zho, and R. C. Lindrooth (2008), Hospital financial condition and the quality of patient care, *Health Economics*, *17*(8), 977–995.

Bebchuk, L. A., and J. M. Fried (2003), Executive compensation as an agency problem, *The Journal of Economic Perspectives*, *17*(3), 71–92.

Bebchuk, L. A., and J. M. Fried (2004), Pay without performance.

Bereskin, F. L., and D. C. Cicero (2013), Ceo compensation contagion: Evidence from an exogenous shock, *Journal of Financial Economics*, *107*(2), 477–493.

Bernanke, B., and M. Gertler (1989), Agency costs,net worth, and business fluctuations, *American Economic Review*, *79*, 87–114.

Bernanke, B., M. Gertler, and S. Gilchrist (1996), The financial accelerator and the flight to quality, *The Review of Economics and Statistics*, *78*(1), 1–15.

Bertrand, M., and S. Mullainathan (2003), Enjoying the quiet life? corporate governance and managerial preferences, *Journal of Political Economy*, pp. 1043–1075.

Bertrand, M., and A. Schoar (2003), Managing with style: The effect of managers on firm policies, *The Quarterly Journal of Economics*, pp. 1169–1208.

Blackwood, A. S., K. L. Roeger, and S. L. Pettijohn (2012), the nonprofit sector in brief - public charities, giving, and volunteering, *Urban Institute*.

Blanchard, O. J., and F. Lopez-de Silane (1994), What do firm do with cash windfalls, *The Journal of Financial Economics*, *36*, 337–360.

Bricklye, J., R. L. Van Horn, and G. J. Wedig (2010), Board composition and nonprofit conduct: Evidence from hospital, *Journal of Economic Behavior and Organization*, *76*, 196–208.

Busse, M. (2002), Firm financial condition and airline price wars, *RAND Journal of Economics*, *33*(2), 298–318.

Calomiris, C., and R. G. Hubbard (1990), Imperfect information, multiple loan markets, and credit rationing, *The Economic Journal*, *100*(399), 90–104.

Campello, M. (2003), Capital structure and product market interactions: Evidence from business cycles, *Journal of Financial Economics*, *68*, 353–378.

Campello, M. (2006), Debt financing: Does it boost or hurt firm performance in product markets?, *Journal of Financial Economics*, *82*, 135–172.

Campello, M., J. R. Graham, and C. R. Harvey (2010), The real effects of financial constraints: Evidence from a financial crisis, *Journal of Financial Economics*, *97*, 470–487.

Cawley, J., D. Grabowski, and R. Hirth (2006), Factor substitution in nursing homes, *Journal of Health Economics*, *25*(2), 234–247.

Chang, S., and D. Mayers (1995), Who benefits in a negotiated block trade, *Unpublished Paper, University of California at Riverside*.

Chang, T., and M. Jacobson (2010), What is the mission of a not-for-profit hospital? evidence from california's seismic retrofit mandate, *under revision*.

Chevalier, J. A. (1995), Capital structure and product-market competition: Empirical evidence from the supermarket industry, *The American Economic Review*, *85*(3), 415–435.

Chevalier, J. A., and D. S. Scharfstein (1996), Capital market imperfections and countercyclical markups:theory and evidence, *The American Economic Review*, *86*(4), 703–725.

Clement, J. P., G. J. Bazzoli, and M. Zhao (2011), Nursing home price and quality responses to publicly reported quality information, *Health Services Research*, pp. 1–20.

CMS (2010), Nursing home data compendium.

Cole, R. A., and H. Mehran (2008), What can we learn from privately held firms about executive compensation?, *Federal Reserve Bank of New York Staff Reports*, (314).

Core, J. E., W. R. Guay, and D. F. Larcker (2003), Executive equity compensation and incentives: A survey, *Economic Policy Review*, *9*(1), 27–50.

Cronqvist, H., A. K. Makhija, and S. E. Yonker (2009), What does ceo's personal leverage tell us about corporate leverage, *Working Paper*.

Cunat, V., and M. Guadalupe (2005), How does product market competition shape incentive contracts?, *Journal of the European Economic Association*, *3*(5), 1058–1082.

Cunat, V., and M. Guadalupe (2009a), Executive compensation and competition in the banking and financial sectors, *Journal of Banking and Finance*, *33*(3), 495–504.

Cunat, V., and M. Guadalupe (2009b), Globalization and the provision of incentives inside the firm: The effect of foreign competition, *Journal of Labor Economics*, *27*(2), 179–212.

Dranove, G. C., David, and C. Ody (2013), How does hospital respond to negative financial shocks? the impact of the 2008 stock market crash, *Working Paper*.

Eisenberg, D., E. Golberstein, J. Whitlock, and M. Downs (2012), Social contagion of mental health: Evidence from college roommates, *Health Economics*, *forthcoming*.

Fama, E. F. (1980), Agency problems and the theory of the firm, *Journal of Political Economy*, *88*(2), 288–307.

Fama, E. F., and M. C. Jensen (1983a), Separation of ownership and control, *Journal of Law and Economics*, *26*(2), 301–325.

Fama, E. F., and M. C. Jensen (1983b), Agency problems and residual claims, *Journal of Law and Economics*, *26*(2), 327–349.

Fazzari, S. M., G. R. Hubbard, and B. C. Petersen (1988), Financial constraints and corporate investment, *Brookings Papers on Economic Activity*, *n*(1), 141–195.

Fledstein, M. (1971), The not-for-profit hospital as a physicians' cooperative, *The American Economic Review*, *63*(1), 87–99.

Friedman, M. (1957), The permanent income hypothesis, *A Theory of the Consumption Function*, *2*, 20–37.

Gabaix, X., and A. Landier (2008), Why has ceo pay increased so much?, *Quarterly Journal of Economics*, *123*, 49–100.

GAO (2010), Nursing homes: Complexity of private investment purchases demonstrates need for cms to improve the usability and completeness of ownership data, *September*.

Giroud, X. (2013), Proximity and investment: Evidence from plant-level data, *The Quarterly Journal of Economics*, pp. 861–915.

Giroud, X., and H. M. Mueller (2010), Does corporate governance matter in competitive industries?, *Journal of Financial Economics*, *95*, 312–331.

Giroud, X., and H. M. Mueller (2011), Corporate governance, product market competition, and equity prices, *The Journal of Finance*, (2), 563–600.

Goodman, W. C. (2006), Employment in hospitals:uncnventional patterns over time, *Monthly Labor Review*, *June*, 3–12.

Grabowski, D. C., and R. A. Hirth (2003), Competitive spillovers across non-profit and for-profit nursing homes, *Journal of Health Economics*, *22*(1), 1–22.

Greenwald, B. C., and J. E. Stiglitz (1993), Financial market imperfections and business cycles, *The Quarterly Journal of Economics*, *108*(1), 77–114.

Guadalupe, M. (2007), Product market competition, returns to skill, and wage inequality, *Journal of Labor Economics*, *25*(3), 439–474.

Hadlock, C. J., and J. R. Pierce (2010), New evidence on measuring financial constraints: Moving beyond the kz index, *The Review of Financial Studies*, *23*(5), 1909–1940.

Hansmann, H. (1980), The role of nonprofit enterprise, *The Yale Law Journal*, *89*(5), 835–901.

Hirth, R. A. (1999), Consumer information and competition between nonprofit and for-profit nursing homes, *Journal of Health Economics*, *18*, 219–240.

Hirth, R. A., and S. S. Huang (2012), Private-pay prices for skilled nursing facility care, *Working Paper*.

Hirth, R. A., J. C. Banaszak-Holl, and J. McCarthy (2000), Nursing home to nursing home transfers: prevalence, time pattern and resident correlates, *Medical Care*, *38*(6), 660–669.

Holerness, C. G. (2003), A aurvey of blockholders and corporate control, *FRBNY Economic Policy Review*.

Holerness, C. G., and D. P. Sheehan (1988), The role of majority shareholders in publicy held corporations: An exploratory analysisl, *Journal of Financial Economics*, *20*, 317–346.

Holmstrom, B. (1979), Moral hazard and observability, *The Bell Journal of Economics*, *10*(1), 74–91.

Holmstrom, B., and P. Milgrom (1991), Multitask principla-agent analysis: Incentive contracts, asset ownership, and job design, *Journal of Law, Economics, Organization*, *7*, 24–52.

Horwitz, J., and A. Nichols (2009), Hospital ownership and medical services: Market mix, spillover effects, and nonprofit objectives, *Journal of Health Economics*, *28*, 924–937.

Hoshi, K. A., Takeo, and D. Scharfstein (1991), Corporate structure, liquidity, and investment: Evidence from japanese industrial groups, *The Quarterly Journal of Economics*, *106*(1), 33–60.

Hotelling, H. (1929), Stability in competition, *The Economic Journal*, *39*(153), 41–57.

Jaffee, T., Dwight M.and Russell (1976), Imperfect information, uncertainty, and credit rationing, *The Quarterly Journal of Economics*, *90*(4), 651–666.

Kaplan, S. N., and L. Zingales (1997), Do investment-cash flow senstivities provide useful measures of financing constraints?, *The Quarterly Journal of Economics*, *112*(1), 169–215.

Kaplan, S. N., M. M. Klebanov, and M. Soresen (2012), Which ceo characteristics and abilities matter?, *The Journal of Finance*, (30), 973–1007.

Keeton, W. R. (1979), Equilibrium credit rationing.

Khanna, N., and S. Tice (2004), Pricing, exit, and location decisions of firms: Evidence on the role of debt and operating efficiency, *Journal of Financial Economics*.

Klemperer, P. (1995), Competition when consumers have switching costs: An overview with applicaiton to industrial organization, macroeconomics, and international trade., *Review of Economic Studies*, *62*(4), 515–539.

Lamont, O. (1995), Corporate-debt overhang and macroeconomic expectations, *The American Economic Review*, *85*(5), 1106–1117.

Lamont, O. (1997), Cash flow and investment: Evidence from internal capital markets, *Journal of Finance*, (1), 83–109.

Magnus, S., and D. Smith (2000), Better medicare cost report data are needed to help hospitals benchmark costs and performance, *Health Care Management Review*, *25*(4), 65–76.

Magnus, S., D. Smith, and J. Wheeler (2004a), The association of debt-financing with not-for-profit hospital's operational and capital-investment efficiency, *Journal of Health Care Finance*, *30*(4), 33–45.

Magnus, S., D. Smith, and J. Wheeler (2004b), The association of debt-financing with not-for-profit hospital's provision of uncompensated care, *Journal of Health Care Finance*, *30*(4), 46–58.

Maksimovic, V., and S. Titman (1991), Financial policy and reputation for product quality, *The Review of Financial Studies*, *4*(1), 175–200.

Matsa, D. A. (2011), Running on empty? financial leverage and product quality in the supermarket industry, *American Economic Journal:Microeconomics*, *3*(1), 137–173.

Meade, C., J. Kulick, and R. Hillestad (2002), Estimating the compliance cost of california sb 1953, *Report prepared for California HealthCare Foundation*.

Mehran, H. (1995), Executive compensation structure, ownership, and firm performance, *Journal of Financial Economics*, *38*, 163–184.

Mikkelson, W., and H. Regassa (1991), Premiums paid in block transactions, *Managerial and Decision Economics*, *12*, 511–7.

Modigliani, F., and M. H. Miller (1958), The cost of capital, corporation finance and the theory of investment, *American Economic Review*, *48*, 261–297.

Murphy, K. J. (1999), Executive compensation, *Handbook of Labor Economics*, *Orley Ashenfelter and David Card, eds. Amsterdam*, 2458–563.

Myers, S. C., and N. S. Majluf (1984), Corporate financing and investment decisions when firms have information that investors do not have, *Journal of Financial Economics*, *13*, 197–221.

Newhouse, J. (1970), Toward a theory of nonprofit institutions: An economic model of a hospital, *The American Economic Review*, (60), 64–73.

Nicodano, G., and A. Sembenelli (2000), Private benefits, block transaction premia, and ownership structure., *Unpublished Paper, University of Turin*.

Norton, E. C., and D. O. Staiger (1994), How hospital ownership affects access to care for the uninsured, *The Rand Journal of Economics*, *25*(1), 171–185.

Nyman, J. A. (1994), Market concnetration, excess demand and price, *The Journal of Industrial Economics*, *42*(2), 193–204.

Parrino, R. (1997), Ceo turnover and outside succession: A cross-sectional analysis, *Journal of Financial Economics*, *46*, 165–197.

Preyra, C., and G. Pink (2001), Balancing incentives in the compensation contracts of nonprofit hospital ceos, *Journal of Health Economics*, *20*, 783–801.

Reiter, K., J. Wheeler, and S. DG (2008), Liquidity constraints on hospital investments when credit markets are tight, *Journal of Health Care Finance*, *35*(1), 24–33.

Reiter, K. L., G. A. Sandoval, A. D. Brown, and G. H. Pink (2009), Ceo compensation and hospital performance, *Medical Care Research and Review*, pp. 725–736.

Roomkin, M., and B. Weisbrod (1999), Managerial compensation and incentives in for-profit and nonprofit hospitals, *Journal of Law, Economics, and Organization*, *15*(3), 750–781.

Ruhm, C. J. (2000), Are recession good for your health, *Quarterly Journal of Economics*, *115*(2), 617–650.

Scharfstein, D. S., and J. C. Stein (2000), The dark side of internal capital markets: Divisional rent-seeking and inefficient investment, *The Journal of Finance*, *55*(6), 2537–2564.

Schmidt, K. M. (1997), Managerial incentives and product market competition, *Reviw of Economic Studies*, *64*, 191–213.

Sharpe, S. A. (1994), Financial market imperfections, firm leverage, and the cyclicality of employment, *The American Economic Review*, *84*(4), 1060–1074.

Shen, Y.-C. (2002), The effect of financial pressure on quality of care in hospitals, *Journal of Health Economics*, *22*, 243–269.

Sloan, F. A., G. A. Picone, D. H. Taylor Jr., and S.-Y. Chou (2001), Hospital ownership and cost and quality of care: Is there a dime's worth of difference?, *Journal of Health Economics*, *20*(1), 1–21.

Stevens, M. D. L. P. M. E., Ann Huff, and M. Filipski (2011), The best of times, the worst of times, understanding pro-cyclical mortality, *NBER Wroking Paper*, *2011*.

Stevensons, D. G., and D. C. Grabowski (2008), Private equity investment and nursing home care: Is it a big deal, *Health Affair*, *2008*.

Stiglitz, J. E., and A. Weiss (1987), Credit rationing: Reply, *The American Economic Review*, *77*(1), 228–231.

Tirole, J. (2006), The theory of corporate finance.

Werner, R. M., E. C. Norton, R. T. Konetzka, and D. Polsky (2012), Do consumers respond to publicly reported quality information? evidence from nursing homes, *Journal of Health Economics*, *31*, 50–61.

Whited, T. M. (1992), Debt, liquidity constraint, and corporate investment: Evidence from panel data, *Journal of Finance*, *47*(4), 1425–1460.

Whited, T. M., and G. Wu (2006), Financial constraint risk, *Review of Financial Studies*, *19*(2), 531–559.

Yamada, Y. (2002), Profile of home care aides, nursing home adies, and hospital aides: Historical changes and data recommendations, *The Gerontologist*, *42*(2), 199–206.

Zhu, M. R. (2011), Corporate hedging, financial distress, and product market competition, *Working Paper*.

Zingales, L. (1998), Survival of the fittest or the fattest? exit and financing in the trucking industry, *Journal of Finance*, (3), 905–938.