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ABSTRACT

Information Disclosure, Competition and the Behavior of Firms:
Evidence of Nursing Homes

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This dissertation investigates how public disclosure of quality information affects the behavior of firms. The first chapter uses a quality disclosure policy, the Nursing Home Quality Initiative (NHQI), to examine how quality "report cards" affect firms' choices of multidimensional product quality. I show that after the introduction of NHQI: (1) most newly reported quality measures improve slightly; (2) the citation composition shifts in favor of problems not included in reported NHQI measures; (3) nursing homes do not increase quality-related nursing inputs. These findings are consistent with the multitasking hypothesis that, rather than increasing resources for quality improvement, firms may respond to information disclosure about some dimensions of quality by shifting resources away from other dimensions.

The second chapter also uses the quality disclosure policy, the Nursing Home Quality Initiative, to test two competing streams of theories about the behavior of non-profits whose profits are not allowed to be legally distributed among shareholders. I find that (1) secular non-profits are as responsive as for-profits to information disclosure in "teaching-to-the-test" while religious non-profits are less responsive than for-profits; (2) concerns about losing potential contributors motivate secular non-profits to shift resources away from unreported dimensions, but this does not occur in the case of religious non-profits; (3) there is no evidence that both types of non-profits mimic the behavior of for-profits when competing with them. All these findings suggest that secular non-profits may use the multitasking strategy in response to

information disclosure due to the potential threat of losing contributors, while religious non-profits may have few incentives to do so because of their strong sense of ideals.

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Chapter Two

Ideals versus Dollars: How Do Non-profits Respond to Quality Incentives?

CHAPTER ONE

Multitasking, Information Disclosure and Product Quality: Evidence from Nursing Homes

I. Introduction

Many industries have mandatory disclosure policies. These policies are implemented in a variety of ways ranging from food labeling, restaurant hygiene grade cards and gas mileage figures to healthcare report cards. The justification for increasing the amount of information about quality available to consumers is supported by the conventional wisdom that more information is better. The logic is as follows. Information disclosure mitigates information asymmetry, facilitates the identification of good quality by consumers, reduces consumers' search costs and increases firms' demand elasticity to quality[1].

Nevertheless, it need not be true that information disclosure motivates firms to improve quality. Under some circumstances, the effects of information disclosure on firms' choices of quality are unclear. The existing empirical work provides mixed evidence. Jin and Leslie (2003) show that hygiene grade cards cause an increase in restaurants' hygiene quality, but Chipty and Witte (1998) show that the quality of day care is insensitive to the new information provided by a referral agency. Dranove et al. (2003) show that the introduction of health care report cards may lead to a loss of social welfare as physicians may shun the sickest patients in order to increase the scores on their report cards.

[1] See Arrow (1963), Akerlof (1970), Shapiro (1982), Dranove and Satterthwaite (1992) and Fishman and Hagerty (2003). I discuss the main differences among those models in the analytical framework section.

In this paper, I examine another potential reason why the conventional wisdom may not hold -- multitasking. When quality is multidimensional, information disclosure may give firms an incentive to reallocate resources across different dimensions of quality without necessarily increasing overall quality. Multitasking theory (Holmstrom and Milgrom, 1991) tells us that changes in returns across tasks alter the effort levels that are supplied. Information disclosure increases consumers' sensitivity to reported dimensions of quality and changes the relative returns across tasks by rewarding those reported dimensions and/or by reducing their opportunity costs. As a result, rather than increasing overall quality-related resources, firms may respond to the disclosure of some dimensions of quality information by shifting resources away from other dimensions of quality.

I use nursing homes as the study setting to examine how an increase in information about some dimensions of product quality affects firms' choices of multiple quality dimensions. There are two main challenges in verifying the multitasking hypothesis.

First, although multitasking behavior has received attention from theorists, it is hard to test empirically due to the lack of an exogenous source of variation in incentive changes across tasks. In 2002, the Center for Medicare and Medicaid Services (CMS) launched the Nursing Home Quality Initiative (NHQI), which publicly reported selected quality measures of nursing homes. I exploit this policy to test how homes' quality decisions change with such an information shock.

Second, the main challenge for verifying multitasking comes from the fact that both overall effort and effort being allocated across tasks are unobservable to researchers. The empirical literature on multitasking mainly focuses on the behavior of individuals whose effort is hard to observe and measure. Due to data limitations, researchers often infer that multitasking must be taking place by merely showing that individuals improve performance on some dimensions and

reduce performance on others[2]. This paper documents more detailed evidence for the multitasking behavior of firms. The data in nursing homes allows me to distinguish substitutes and complements among tasks, to test the shift of effort across tasks and to detect changes in overall effort.

I investigate the effects of the release of nursing home report cards on all the homes that are certified by Medicare and/or Medicaid from 1999 to 2005 in the United States. I show that, after the introduction of NHQI: (1) most of the newly reported scores on the quality measures improve slightly; (2) the citation composition shifts in that the share of deficiency citations for problems that are unreported and substitutes to tasks reported by the NHQI increases; and (3) there is no evidence that nursing homes increase quality-related inputs. In addition to these key findings, I also show that consumer demand becomes sensitive to reported NHQI measures and the increase in citations is not fully explained by changed inspector behavior. These results suggest that publicly releasing quality information may not necessarily motivate firms to make changes in quality improvement. Instead, it leads them to reallocate resources across dimensions of quality.

This paper stands at the intersection of the literature on information economics, the economics of organization and health economics, and makes three main contributions. First, and most significantly, I show that information disclosure may give firms an incentive to reallocate resources across different dimensions of quality. This study is one of the few empirical studies documenting evidence to confirm the widely suspected "practicing-to-report-card" phenomenon. Second, an advantage of this paper's micro-level data structure allows me to tackle the challenge in the multitasking empirical literature that multitasking is not a necessary condition for the pattern whereby firms (individuals) improve performance on some dimensions but reduce

[2] See Brickley and Zimmerman (2001), Jacob (2005) and Mullen et al (2007).

performance on others. Third, focusing on health care, this study provides strong evidence for the resource-shifting effects of report cards. This evidence is crucial to ongoing report card policy decisions, given that consumers are deeply concerned about health care quality.

The rest of this paper is organized as follows. Section II introduces the analytical framework of information disclosure and multitasking. Section III introduces the relevant institutional knowledge of the nursing home industry and the general identification strategy used in this paper. Section IV describes the data. Section V presents the basic response pattern of nursing homes. Section VI documents the evidence of multitasking. Section VII identifies the changes in inspector behavior. Section VIII concludes.

II. The Analytical Framework of Information Disclosure and Multitasking

This section investigates how firms choose multidimensional product quality when consumers are better informed. On the basis of what I learned from a series of site visits and interviews, I adopt the multitasking framework to analyze the potential impact of an increase in information about some dimensions of quality on the behavior of firms. In particular, I consider the possibility that mandatory disclosure could mitigate information asymmetry and may also have some implications for the nature of information, managerial behavior and competition among nursing homes when quality is a strategic choice with multiple dimensions.

A. Information Asymmetry and the Roles of Players

There are many goods and services for which some dimensions of quality are difficult for consumers to identify *ex ante* and verify *ex post*. For instance, in nursing homes, frequent careful turning of the elderly from side to side helps prevent pressure ulcers and skin breakdown.

However, it is difficult to measure how well nurses perform this task. Absent reliable and comprehensive quality measures, consumers have to resort to other mechanisms, such as word-of-mouth, list prices and market shares[3], to form their beliefs about quality. When these mechanisms are also inadequate, firms may be discouraged from investing in quality improvement. Instead, firms may pool with other firms by setting similar prices but providing lower quality[4]. As Akerlof (1970) shows, an extreme outcome in this situation is that firms with good quality may be driven out of the market.

One way to alleviate the information asymmetry is to find an independent third party with the authority to disclose quality information of products to consumers. As the regulators of the nursing home industry, the CMS and state health departments take the responsibility of releasing quality information to the public. In 2002, the CMS introduced the NHQI nationwide, a mandatory disclosure policy that publicly reported some but not all dimensions of quality information in a comparable format.

B. Information Disclosure and Unidimensional Quality

Information disclosure may mitigate information asymmetry, help consumers identify high quality and reward firms that improve quality by an increase in demand. This is the primary rationale for regulators to adopt mandatory disclosure in many industries. Many models of

[3] Shapiro (1982) notes that seller reputation helps consumers to identify product quality. Rogerson (1983) shows the connection between unobserved quality and word-of-mouth. The mechanism that price signals quality has gotten broad attention in the literature (Wolinsky, 1983; Milgrom and Roberts, 1986; Bagwell and Riordan, 1991). Moreover, Caminal and Vives (1996) show that consumers rationally believe that high market shares are associated with high product quality.

[4] Schwartz and Wilde (1985) analyzed several scenarios about product prices and quality levels offered by firms when consumers are imperfectly informed. The most likely scenario is that almost all consumers are not sophisticated and the market for high quality disappears. The result from this scenario is that consumers see only low quality goods sold at supracompetitive prices.

consumer search assume that such disclosure reduces consumers' cost of acquiring information and thereby increases consumer welfare (e.g. Shapiro, 1982; Chan and Leland, 1982, 1986).

These models consider the interactions between firms and consumers but neglect the interactions among competing firms. Dranove and Satterthwaite (1992) facilitate the consideration of quality as a strategic choice in the context of competition. They set up a search model by treating quality disclosure as an increase in the precision of quality information available to consumers. With this increased precision, consumers become more sensitive to new quality information. Consequently, the firm-level elasticity of demand with respect to quality and the equilibrium quality increase.

Although Dranove and Satterthwaite's model confirms the traditional finding that disclosure should lead to improved quality, even after accounting for competitive reactions, this result may not hold when certain assumptions of these models are relaxed. For example, if quality information is accessible but not processable[5] or simply confirms consumers' prior beliefs, then its disclosure may have no effect (Hibbard and Jewett, 1997; Dafny and Dranove, 2008). To take another example, if firms are vertically differentiated, quality disclosure could cause each firm to make a divergent quality choice (Tirole, 1988).

Empirical work provides mixed evidence for the impact of information disclosure on quality[6]. For example, Jin and Leslie (2003) show that hygiene cards cause an increase in restaurants' hygiene quality, but Chipty and Witte (1998) show that the quality of day care is insensitive to the new information provided by a referral agency. In addition, in those industries

[5] Day (1976) doubts the information can be comprehended if the form does not permit direct comparison.
[6] See Blumenthal and Kilo (1998), Rainwater et al (1998), Epstein (1998), Mathios (2000), Ferris et al (2001), Mukamel & Spector (2003), Werner and Asch (2005) and so on.

such as hospitals and schools, where consumers are also the inputs, disclosure may cause firms to cherry-pick consumers (Dranove et al., 2003).

In this study, I investigate another reason why disclosure could have ambiguous effects -- multitasking. To my knowledge, few papers discuss the potential for multitasking to render disclosure ineffective[7]. This paper contributes to the information disclosure literature by adopting a multitasking framework to explain how information disclosure affects firms' choices of multidimensional quality. Further, this paper uses nursing homes as a study setting to provide systematic evidence for the "practicing-to-report-card" phenomenon.

C. Multitasking: Information Disclosure and Multidimensional Quality

The central theme of multitasking is what Steven Kerr (1975) calls "The Folly of Rewarding for A While Hoping for B". Regulators often adopt measures to evaluate quality and hope that firms can improve their product thanks to disclosed quality measures. The fact that firms take more actions than regulators can measure can eventually lead to a distortion of quality measures (Feltham and Xie, 1994; Baker, 1992, 2002). As a result, firms may not necessarily increase their overall quality.

Incentives in multitasking theory must be attached to both the change of the overall effort level and the allocation of effort across tasks. In this study setting, the incentive issue created by multitasking is that firms allocate their resources by focusing more on some tasks than on others. Multitasking theory (Holmstrom and Milgrom, 1991) tells us that an increase in the "return" of a certain dimension of quality results in an increase in the resources that will be supplied to that

[7] Dranove and Satterthwaite (1992)'s paper suggests but does not fully develop the idea that quality improvement is not guaranteed when products have multiple dimensions.

dimension and that the changes in the relative "returns" across dimensions of quality affect the allocation of resources across dimensions.

Information disclosure may change the relative "returns" across different dimensions of quality. Before the disclosure of quality information, the inability of consumers to fully observe all quality dimensions may cause the differences between the "returns" across dimensions to be relatively small. After disclosing information on some dimensions of quality to the public, consumers may be more sensitive to the newly disclosed quality measures, which may result in changes in the relative "returns" in that those reported dimensions of quality become relatively more valuable. Such changes reward activities for improving those reported dimensions and/or reduce their opportunity costs (reduce the incentives for the other activities that improve quality in unreported dimensions). As a result, firms may reallocate their inputs by diverting resources away from unreported dimensions when the reported and the unreported dimensions of quality are not complementary. And such incentives for resource shifting are distinct from the strategic issues in different market structure scenarios.

Empirically, Mullen, Frank and Rosenthal (2007) test multitasking prediction by studying the impact of direct reward, pay-for-performance, on the quality of healthcare providers. They show that some of the clinical measures rewarded by the pay-for-performance scheme get better while a number of measures that are not rewarded or weakly rewarded fall significantly when the rewards program is introduced. In this study, I explore the potential linkage between multitasking and information disclosure, in that quality in different dimensions is motivated by observability instead of direct reward. In addition, I consider the different relationships (substitutes or complements) across tasks and the changes in the overall effort level.

In summary, the impact of information disclosure on multidimensional product quality is more complicated than the unidimensional case. We need to consider the incentive for resource reallocation stemming from the multidimensional quality assumption. Overall, this paper tests for three hypotheses. The null hypothesis is

H0: An increase in quality information to consumers may give firms no incentives to change quality and quality-related resources.

This may hold when either disclosed quality information is useless to consumers or demand is inelastic to quality. There are two alternative hypotheses. One alternative hypothesis, supported by the conventional wisdom that "more information is better", is

H1: An increase in quality information to consumers may motivate firms to increase quality-related resources and make changes that improve overall quality (the conventional hypothesis).

The other alternative hypothesis derived from the multitasking framework is

H2: An increase in quality information to consumers may motivate firms to reallocate resources instead of increasing quality-related resources. Quality may improve along reported dimensions but may deteriorate along unreported ones (the multitasking hypothesis).

III. Institutional Knowledge and General Identification Strategy

A. Nursing Home Quality Initiative

In November 2002, the CMS launched the NHQI policy. This initiative publicly reports selected measures of quality for Medicare and Medicaid-certified nursing homes[8]. To help raise

[8] In April 2002, the Centers for Medicare & Medicaid Services (CMS) launched a six-state pilot in Colorado, Florida, Maryland, Ohio, Rhode Island and Washington.

awareness of the NHQI throughout the country, the CMS ran an informational advertisement (in English and Spanish) in 71 major daily newspapers on November 13, 2002. Around this time there were no local or nationwide adverse reports about nursing home quality[9].

Since it is impossible for the CMS to release information on all dimensions of quality to the public, they reported selected NHQI quality measures (QMs) that are directly related to changed resident health status. For example, one measure reported is the "percent of residents who need help with daily activities (*ADL*)". As we know, quality in nursing homes is mainly based on what nurses do on a day-to-day basis. It may take more staff time to allow residents to do daily activities by themselves, rather than to assist them in these activities. However, the elderly benefit from doing their daily activities by themselves, since this increases their confidence and level of fitness. For the details of the NHQI QMs, see Table A1 and Table A2.

B. Annual Inspection and Deficiency Citations

The CMS contracts with each state to randomly conduct onsite inspections to determine if its nursing homes meet the minimum Medicare and Medicaid quality standards. These standards are broadly outlined in the Social Security Act.

On average, inspections are conducted once a year. During an inspection, the state looks at three categories of quality: Quality of Care, Quality of Life and Administration. These three categories comprise over 190 regulatory standards that cover a wide range of quality components (see Table A3). When an inspection team finds that a home does not meet a specific regulation, a deficiency citation will be issued to that specific quality dimension. The home receives a list of

[9] I searched some news banks (Proquest, the New York Times, CNN and Fox News) and did not find adverse news during the period when the NHQI was introduced.

citations after inspection and is required to provide a plan of correction. Homes have the right to disclaim/degrade those deficiency citations within a short period.

Depending on the nature of the problem, the CMS can take action against the nursing home. For instance, it may fine the nursing home, deny it payment, or install a State Monitor. If the nursing home does not correct its problems, the CMS will terminate its agreement.

C. Timing of Quality Information Disclosure

The general identification strategy relies heavily on the timing of information disclosure. I divide the timing of the policy change events into pre- and post- introduction of the NHQI (See Figure 1). The *Pre-NHQI* period is from 1998 to 2001. In this period, there are two important events about information disclosure. First, the *number of deficiency citations* has been released to the public starting in 1998. Second, during this period some states began disclosing comparable nursing home quality information. The *Post-NHQI* period starts in 2002 when the national NHQI is launched.

I use the annual "State-by-State Guide to Nursing Home Performance Data" in the American Association of Retired Persons (AARP) Bulletin and government policy reports to classify states into two groups (see Table 1). The treated group (*Newly Disclosed*) includes those states that never disclosed any quality information before the introduction of NHQI. The control group (*Previously Disclosed*) includes those states that adopted report cards in the *Pre-NHQI* period. Castle and Lowe (2005) investigate these state report cards and conclude that the information presented in these report cards uses the same data source that the CMS uses to construct the NHQI QMs, but differs in the ways measures are presented.

The rationale behind the classification in this study is that consumers, inspectors and nursing homes may respond actively to completely new quality information. In other words, the NHQI QMs must overlap with information that has already been presented in the state report cards. When consumers know what they have already known, the effect of disclosure will be mitigated (Dafny and Dranove, 2008). The identifying assumption therefore is that any differences in the pre-period would have followed the same course without the introduction of the NHQI.

The estimation based on this control group might not be without a shadow of a doubt. Nevertheless, using this control group, I can explore the different responsiveness between groups with different information coverage[10]. To make the results more convincing, I also investigate the pure effect of disclosure using the *Newly Disclosed* group only in the estimation sections.

D. Validity of Identifying Assumption

This NHQI policy provides the time variation and can be regarded as an information shock in the sense that both consumers and nursing homes can neither anticipate the policy nor predict which quality dimensions to report. Figure 1 shows the yearly trends of total deficiency citations for each group. These trends are almost the same before 2001, but between 2002 and 2003 the trend for the *Newly Disclosed* group goes up, and down for the *Previously Disclosed* group. After 2004, the trends again coincide. Table 2a presents the changes in *the number of deficiency citations* between one year before and one year after the introduction of NHQI for both groups, which is consistent with what Figure 1 shows. In the estimation sections, I also provide empirical evidence for the assumption that the policy in 2002 is econometrically exogenous.

[10] This may be particularly important for testing the multitasking hypothesis: a move from *zero* to ten disclosed measures is likely to have a different effect on behavior than a move from *some* to ten.

A selection issue may arise within the control group. Figure 1 shows that both groups have similar trends in *the number of deficiency citations* right before the disclosure policy takes effect. Nevertheless, the adoption of quality information disclosure in different states prior to NHQI might not be randomly assigned -- it could be influenced by some socio-economic characteristics. Some unobserved factors correlated with the adoption of quality information disclosure might also affect quality.

I follow a procedure to rule out the possible violation of the identifying assumption. Contrary to the conventional wisdom that bad quality motivates states to introduce quality information disclosure, states with better quality of care seem more likely to adopt quality information disclosure earlier (See Table 1). I conduct a probit analysis to see what makes a state adopt quality information disclosure. The results of Table A4 show that the adoption of quality information disclosure is uncorrelated with scores for measures of different aspects of quality.

IV. Data Setting

A. Sample Description

The CMS randomly inspects all CMS-certified nursing homes in the United States every year to guarantee that the quality of each nursing home meets the minimum requirements. My data contains every annual inspection[11] from 1999 to 2005 for every certified nursing home.

I use two data sources to construct measures of interest. The main data source is the Online Survey, Certification and Reporting (OSCAR) data compiled by the CMS. It records comprehensive information ranging from facility characteristics and aggregated resident

[11] On average inspections are conducted once per year (See the website of Nursing Home Compare). Some nursing homes undergo several surveys a year due to their poor quality. I counted the first inspection as the annual inspection because whether a facility needs to be visited a second time in a given year is determined by the results of the first inspection.

characteristics to inspection outcomes in every annual inspection; and includes approximately 15,500 CMS-certified facilities every year, which account for almost all nursing homes in the USA (Strahan, 1997). Moreover, it provides detailed information on each deficiency citation in its deficiency files. The complementary data source is the SNF Cost Report in which skilled nursing facilities report annual cost information such as nurse salaries to get reimbursements from the CMS. I use it to get some evidence for the impact of NHQI on nursing inputs.

B. Measures of Nursing Performance and Nursing Inputs

Quality in the nursing home industry is mainly determined by what nurses do on a day-to-day basis. Nurses' daily tasks vary widely, ranging from helping the elderly to walk, to preventing the breakdown of their skin. Their performance of these tasks is the main indicator of nursing home quality. Therefore, I construct three sets of measures describing nursing performance and nursing inputs that help to assess different aspects of quality in a nursing home.

The measures in the first set evaluate nursing performance based on the results of inspection outcomes. Every year, an inspection team conducts an inspection in every nursing home. Inspectors examine different dimensions of quality, such as, if nurses wash their hands properly between caring for residents, if an activity program is available for the elderly and so on. After their investigation, they decide whether or not to issue a citation on a given dimension of quality and what severity level to assign for the issued citation. By the end of the inspection, the nursing home knows how many deficiency citations it has received. The representative measures in this set are the *number of deficiency citations* (which only includes citations from health inspections) and the total *number of citations* (which includes citations from both health and fire inspections). These are directly available in the OSCAR data.

The measures for assessing nursing performance in the second set are from the list of NHQI QMs (See Table A2). Notice that most of these measures are imperfect because if a resident is in declining health, even the best nurse could not help to reverse it.

The representative measure I use is the "percent of residents who lose their control of bowel and bladder (*Bowel*)". I choose this for two reasons. First, this loss of functional ability is not an inevitable part of aging and can often be successfully treated by, and is highly sensitive to, good nursing care[12]. Second, evidence suggests that this measure from the Minimum Data Set (MDS) is valid and related to resident characteristics as expected (Gambassi et al, 1999).

The MDS is collected at regular intervals for every resident in a Medicare or Medicaid certified nursing home. Information is collected on the resident's health, physical functioning, mental status, and general well-being. However, the NHQI QMs constructed by using the MDS data are only available since 2002. I circumvent this problem by using the coding correspondences between MDS and OSCAR, which allow me to figure out some of the NHQI QMs from 1999 to 2005 by using the aggregated resident characteristics in the OSCAR data[13]. The measures I construct are highly correlated with NHQI QMs from the MDS (the correlation coefficients are between 0.9 and 1 for the selected measures).

The third set includes measures related to nursing inputs. I construct two indicators, *nursing hours per resident day*[14] and *nursing salaries per resident day*[15], which are widely used in health economics research. Many studies agree that increased staffing is associated with better quality

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[12] See the Nursing Home Quality Manual, 2004, provided by the Quality Improvement Organization (QIO).

13 The variables of aggregated resident characteristics in OSCAR are constructed by using the MDS data. You can see this relationship on the webpage of "Coding Crosswalks between the MDS version 2.0 and HCFA 672 and 802 Forms" through the following link:
http://www.cms.hhs.gov/MinimumDataSets20/10_CodingCrosswalks.asp#TopOfPage

[14] Nursing hours per resident day equal total full time equivalences (FTEs) times 5 divided by the number of residents. Here, FTEs reported in the OSCAR are based on a 35-hour work week with 7 days.

[15] Nursing salaries per resident day equal the total salaries divided by the number of residents and 365 days, adjusted by 2005 medical CPI. Here, *total salaries* are available in the direct cost section in the SNF Cost Report.

of care (Braun, 1991; Harrington et al, 2000; Schnelle et al 2004).The linkage between wages and nursing outcomes can be explained by the human capital literature which indicates that wages reflect nursing skills. Low salaries have been associated with poor quality of care and high nurse turnover rate (Munroe, 1990; Spector and Takada, 1991). Thus, both indicators clearly reflect the differences in nursing inputs across firms. These variables are obtained from the OSCAR data and the SNF Cost Report.

It is important to clarify the relationships between measures of nursing performance in the first two sets. The key feature of the relationships is that the dimensions of quality quantified by NHQI QMs are a subset of what an annual inspection covers. During a nursing home inspection, an inspection team will look at three categories of quality: Quality of Care, Quality of Life and Administration. These three categories contain all the regulatory standards that nursing homes must meet at all times. After inspection, the home receives a list of citations, which generates the measure *number of deficiency citations*. The CMS released this measure to the public in 1998[16] without much publicity. This went largely unnoticed because consumers do not find this type of information very useful in making comparisons (Stevenson, 2007). According to an investigation on "what information consumers need in the nursing home industry," conducted by Kane and Kane (2001), the elderly want greater empowerment to play a more active role in decision making, "but it is impossible to get comparable information on nursing homes". This deficiency triggered the introduction of the NHQI. In 2002, the CMS quantified some dimensions of quality,

[16] "A recent report by the U.S. House of Representatives (2002) concluded that the CMS website was misleading consumers because it did not report findings from complaint investigations. In response, the CMS added the complaint information to the website in the spring of 2002" Harrington et al. (2003). I considered this argument.

defined comparable quality measures[17] and released them nationwide at the website of Nursing Home Compare (NHC).

To summarize, the relationships of measures of nursing performance between the first two sets can be described as follows. First, and most critical to this analysis, some of the quality dimensions in the citation dataset overlap with the newly reported NHQI QMs. Second, the NHQI QMs, intensively advertised by the CMS, are more comparable and easier for consumers to understand than other measures. Third, the NHQI QMs are newly disclosed information, which is precisely what "an increase in information to consumers" refers to in this study.

C. Preliminary Analysis: Changes in Response to Information Disclosure

I first examine the means of the representative measures of nursing performance and nursing inputs, and compare changes in these measures for the *Newly Disclosed* and *Previously Disclosed* groups before running any regressions. Table 2a shows the changes in differentials between both groups in three representative measures between one year before and one year after the introduction of NHQI.

Comparisons of these means, reported in Table 2a, provide no evidence of a change in a between-group difference in the NHQI QMs and nursing inputs. But, changes of inspection outcomes did differ between groups. The representative measure for inspection outcomes is the *number of deficiency citations*. Its between-group difference is trivial in 2001 and becomes large in 2003. The rough differences-in-differences value is 0.99 at the one percent significance level,

[17] The first version of NHQI QMs includes ten measures. The CMS revised them based on the feedback from nursing homes and consumers since Nov, 2002 and decided the final version with fifteen measures in Jan, 2004 (See Table A1). These measures are all about the changes of resident health status. In this study, I regard the first releasing time as the reference year because the public can not anticipate the policy and what kind of quality information would be disclosed at that time.

accounting for 16% of its mean. *Bowel* refers to the percent of residents who lose control of their bowel and bladder, which, as previously mentioned, is the representative measure of the NHQI QMs. The rough differences-in-differences value is 0.01, which is insignificant and trivial. So is the differences-in-differences value of the representative measure for nursing inputs.

My main concern with regard to Table 2a arose from the possibility that the introduction of the NHQI may have had no effect on the *number of deficiency citations* within the treated group. In other words, the positive and significant differences-in-differences value may simply be a result of the decrease in deficiency citations in the control group. To rule out this possibility, I regress the *number of deficiency citations* with year dummies and nursing home dummies for a subsample including all the homes in the treated group. The year that the NHQI was implemented, 2002, is the reference year. Table 2b shows that the coefficients of 2003, 2004 and 2005 are positive and significant. Their magnitudes are bigger than those of 1999, 2000, and 2001, which are not significantly positive. The results suggest that the introduction of NHQI is associated with more deficiency citations in the nursing homes in the treated group.

V. The Basic Response Pattern

In this section, I examine how an increase in information about some dimensions of quality affects both inspection outcomes and resident health status. I aim to determine if the results are consistent with the conventional wisdom that quality information disclosure motivates firms to improve quality. If quality has improved, then the number of deficiency citations will have declined and the NHQI QMs will have improved.

I use a differences-in-differences approach to examine the impact of NHQI on those performance measures derived from inspection outcomes and changed resident health status. The estimation equation of primary interest is

$$Y_{jt} = \alpha_j + \alpha_t + \beta * D_j * D2002_{jt} + \varepsilon_{jt} \quad (1)$$

where Y_{jt} denotes the two representative measures the *number of deficiency citations* and *Bowel* in nursing home *j* at time *t*. *D* is a binary dummy variable that equals one for states where quality information was not publicly available before the passage of NHQI. *D2002* is a dummy variable that equals one after and zero before the NHQI takes effective. Hence, the differences-in-differences coefficient β represents the differential effect of NHQI on the *number of deficiency citations* and *Bowel*. If β<0, this implies that the adoption of NHQI is associated with fewer deficiency citations or fewer residents who lose control of their functional abilities in the treated group relative to the control. I also control for home specific effects (α_j) and year effects (α_t). The unit of observation is an annual facility inspection. I adopt a correction of standard deviations based on the asymptotic approximation of an arbitrary variance–covariance matrix.

Table 3 reports the differential effect of NHQI on the *number of deficiency citations* and *Bowel*. The results in Row 1 are based on the estimation of specification (1), which show that, after the introduction of NHQI, the number of deficiency citations in the *Newly Disclosed* group on average increased by 0.8 citations per inspection and the percent of residents who lost bowel control decreased by 0.4 percentage points relative to their control group (*Previously Disclosed*). Given that the means of *number of deficiency citations* and *Bowel* are 6.2 and 5.6 respectively, the magnitudes of these two coefficients account for 13% and 7% of their means.

I investigate the robustness of the results under a number of alternative specifications. In doing robustness checks, I mainly consider the following three issues. First, my assumption

about the timing of the adoption of quality information disclosure in different states is randomly assigned. My concern is that some socio-economic characteristics that affect the adoption of information disclosure might also be correlated with the measures that help in assessing different aspects of quality. Second, the baseline specification treats all facilities of different size equally. However, facilities with varying size may respond to NHQI differently. Third, estimation at the facility level may not capture the impact of NHQI on nursing home entry and exit.

Overall, the results were quite robust under all these specifications (see Table 3). The specification in Row 2 replaces home specific effects with time varying home characteristics; Row 3 takes into account the possible bias in estimation due to some socio-economic characteristics in different states. It shows that the results are robust enough to include additional time-varying covariates for real per capita state income, state population and the state unemployment rate in equation (1). Row 4 depicts the different behavior of facilities with varying size by weighting equation (1) by the number of residents in each facility. In Row 5, I re-estimate specification (1) by using a restricted sample that excludes those facilities that either had not been inspected since 2002 or had just begun to be inspected after 2002. The classification of both the treated group and the control group used in Row 1-5 is based on the ARRP nursing home annual report. Rows 6 and 7 use new treated/control groups suggested by Castle and Lowe (2005) to estimate the same specifications. I also use some other measures of nursing performance to support the response pattern.

Taken together, the results in Table 2a, Table 2b and Table 3 verify the response pattern: i.e. after the introduction of NHQI, although scores of the NHQI-defined QMs improve slightly, the number of deficiency citations increases significantly. These findings are not consistent with either the null hypothesis or the conventional hypothesis.

VI. Evidence of Multitasking

A possible explanation of this response pattern is the multitasking hypothesis. The hypothesis is that nursing homes may divert resources from the NHQI-unreported dimensions toward the NHQI-reported dimensions. As a result, scores of the newly released NHQI QMs improve slightly, but the number of deficiency citations that include both NHQI-reported and NHQI-unreported dimensions also increases significantly.

In this section, I provide a strategy for identifying the shift of resources in nursing homes. I use a deficiency citation dataset to examine whether the citation composition shifts, i.e. whether the share of deficiency citations for problems that are unreported and substitutes to tasks reported by the NHQI measures increases. I then investigate the incentives for nursing homes to engage in multitasking behavior by asking two questions: on the supply side, do nursing homes increase nursing inputs, and, on the demand side, are consumers sensitive to the new information? The results of my analysis are consistent with the multitasking hypothesis.

A. Identifying the Shift of Resources: Citation Composition

The "resident-centered, outcome-based" annual inspection looks at three categories of quality: *Quality of Care*, *Quality of Life* and *Administration*. Most critical to this analysis, the dimensions of quality quantified by the NHQI QMs are a subset of those covered by an annual inspection. This allows me to classify all the dimensions covered by an annual inspection into two groups: one group includes all NHQI-reported dimensions and the other includes those dimensions unrelated to reported NHQI measures. Dimensions of quality betweenthese two groups are not complementary. With this classification, I can verify whether nursing homes

engage in multitasking behavior by testing whether the share of the NHQI-unreported citations increases after the introduction of NHQI.

Table 4 presents the classification of all dimensions of quality covered by an annual inspection. Group A includes all the dimensions overlapping with the NHQI QMs. A representative example for Group A is the regulatory standards for ADL that set the minimum standards for how to take care of the activities of daily living for the elderly. It overlaps with the percent of residents who need help in daily living activities (*ADL)*, one of the NHQI QMs.

As I mentioned, the underlying assumption for this multitasking hypothesis is that the tasks for improving different dimensions of quality in two groups are substitutes. Otherwise, improving dimensions of quality in one group would help to improve dimensions of quality in the other group as well. Therefore, in Group B, I include those dimensions of quality that may be complementary to those in Group A. For example, the regulation for Vision and Hearing (F313) is complementary to the regulation for ADL. If the elderly are encouraged to carry out their activities of daily living by themselves, they may remain more confident and stay more active, which may help to slow down the loss of vision and hearing ability. The NHQI QMs quantify some dimensions of quality in the category of *Quality of Care* and most of the remaining dimensions in this category are complementary to those in Group A. I include all the remaining dimensions in this category into Group B to avoid any difficulties in justifying the classification.

Group C includes dimensions that are substitutes to problems reported by NHQI measures. A case in point is the regulation for washing hands between caring for residents (F444). As we know, the working hours per day for each nurse are limited. Washing hands properly between caring for residents is a possible substitute for helping with the activities of daily living for the elderly. These two tasks are indivisible, which means that the two tasks could not be done by

different nurses. They have to compete for the limited time of one nurse. This example also provides evidence that job design may not successfully eliminate multitasking in nursing homes.

To summarize, the relationships among these three groups can be described in terms of sets: (1) the union of the three groups is a universal set; (2) the intersection between the union of Groups A, B and C is empty.

Following this classification, I construct three variables describing the citation composition as dependent variables: *Share of Citations, Level of Citations* and *Less Harm Citations*.

- *Share of Citations* equals the number of the NHQI-unreported citations (Group C) divided by the total number of citations;
- *Level of Citations* is the number of the NHQI-unreported citations (Group C);
- *Less Harm Citations* is the number of the NHQI-unreported citations that do not result in actual harm[18] (a subset of Group C).

I use the facility/inspection year as a unit of observation. Table A5 shows the changes in these three variables between one year before and one year after the introduction of the NHQI. The rough values of the differences-in-differences for the three variables are positive at the one percent significance level. This shows that the adoption of NHQI is associated with a shift in citation composition -- namely a higher percentage of NHQI-unreported citations, more NHQI-unreported citations with less harm and more NHQI-unreported citations overall in the treated group than in the control group.

B. Estimation: Changes in Citation Composition

[18] Inspectors classify the citations into four categories: Minimal Harm, Potential Harm, Actual Harm and Immediate Jeopardy. Citations with less harm refer to the citations in the first two categories.

The identifying assumption for estimating specification (1) is that, without the NHQI, any differences in the pre-period would have followed the same trend in both treated and control groups. If this assumption did not hold, nursing homes, for example, might anticipate the implementation of the NHQI, and then the differences-in-differences coefficients would be biased. To confirm that the changes in dependent variables are not an artifact of differential trends, I estimate another specification suggested by Finkelstein (2007):

$$Y_{jt} = \alpha_j + \alpha_t + \sum_{year=1999}^{2005} \lambda_t * D_j * 1(Year) + \varepsilon_{jt} \qquad (2)$$

Table 5 shows the results of specification (1) and (2), treating the citation composition variables as dependent variables. The differences-in-differences coefficients in column (1), (3) and (5) are positive at the five percent significance level in all three regressions. The introduction of the NHQI is associated with a shift in citation composition, in the sense that, facilities in the *Newly Disclosed* group significantly raise the share of the NHQI-unreported citations by 3.1 percentage points more on average than those in the *Previously Disclosed* group and get 0.68 more deficiency citations for problems not included in reported NHQI measures. More interestingly, the differences-in-differences coefficient for *Less Harm Citations* is 0.67, slightly lower than the effect on the *Level of Citations*, which suggests that most of the increase in deficiency citations along the unreported dimensions come from the increase in citations with less harm.

Column (2), (4) and (6) in Table 5 provide evidence that the introduction of the NHQI policy is statistically exogenous. I use 2001 as the reference year and normalize it as zero. The estimated λs before 2002 are insignificant and small, while the λs after 2002 are positive and

significant. These λs together suggest that the trend of citation composition is flat before 2002 and goes upward in favor of multi-tasking behavior afterward.

I also document the evidence for the changes in complements in column (7) and (8). The differences-in-differences coefficient for the share of citations in Group B is small, negative and insignificant. The estimated λs are insignificant overall and the signs of λs after 2002 are negative. These results are consistent with the response pattern in which the NHQI quality measures get slightly better.

In addition, I conduct a counterfactual experiment by limiting the data to the period between 1999 and 2002 and assigning some year prior to 2002 as the year in which NHQI was implemented. If the assumption holds, I would not expect to find any statistically significant or substantively large effects from these "false" tests using the three different variables. The results verify the validity of this assumption. All the coefficients are small and insignificant. For example, the coefficients (robust standard errors) of *Share of Citations*, using 2000 and 2001 as the mock year, are 0.003 (0.21) and 0.004 (0.30) respectively. These results indicate that the changes in citation composition are not correlated with preexisting trends in *Share of Citations*.

To obtain the pure effect of disclosure on nursing home behavior and further confirm the validity of the multitasking hypothesis, I use a restricted sample that only includes facilities in the newly-disclosed group for robustness check.

Figure 2 shows the trends of the number of citations along reported and unreported dimensions by using this restricted sample. As we can observe, the number of deficiency citations along reported dimensions is flat over the years, while that along unreported ones is flat before 2002 and then goes upward. This figure indicates that the introduction of the NHQI is associated with more citations along unreported dimensions and no changes along reported ones.

Next, I test if there is a shift in citation composition consistent with nursing home multitasking behavior. . The procedures are as follows: First, I define Group A and B as the *Reported* group and Group C as the *Unreported* group, and calculate the number of deficiency citations per inspection in the two groups respectively; Second, I reshape the restricted sample in which the unit of observation is group/facility/year; Then, I look at the changes of citation composition in a five-year window, two years before and two years after the introduction of the NHQI, by running the following specification:

$$CITATIONS_{ijt} = \alpha + \sum_{t=-2}^{+2} \beta_t * REPORTED_i * YEAR_t + REPORTED_i + \alpha_j + \alpha_t + \varepsilon_{ijt} \quad (3)$$

Here, the dependent variable $CITATIONS_{ijt}$ refers to the number of deficiency citations in group *i* in nursing home *j* at time *t*. *REPORTED* is a binary variable that equals 1 for the *Reported* group and 0 for the *Unreported* group. βs capture the differences in citations between the *Reported* and the *Unreported* group in the five-year window. I control group effects, year effects and facility specific effects. ε is the error term. A correction of standard deviations based on asymptotic approximation of an arbitrary variance–covariance matrix is adopted.

Table 6 summarizes the shift of citation composition in the newly-disclosed group. The negative and significant coefficient in column (1) suggests that the introduction of the NHQI is associated with the shift of citations from the *Reported* group to the *Unreported* one. Column (2) shows that the estimated βs are insignificant and small in the years before the introduction of the NHQI and become negative and significant afterward. Column (3) and (4) use the number of citations with less harm as dependent variables and show the similar response pattern. The results suggest that the introduction of the NHQI is econometrically exogenous and causes the

shift of deficiency citations in favor of problems that are unreported and substitutes to tasks reported by the NHQI measures in the newly-disclosed group.

My main concern arose from the possibility that information disclosure may cause nursing homes to cherry-pick the elderly who are relatively healthy. The change of resident composition might bias the estimation. I use three procedures to rule out the possible biases.

First, I look at whether nursing homes select healthier patients. Following the idea proposed in Dranove et al. (2003) that low expenditures imply a healthier cohort, I calculate the inflation-adjusted mean expenditures of each nursing home to measure the distribution of patient health status. In Figure A1, both the "previously disclosed" group and the "newly-disclosed" one show a similar pattern of mean expenditures increasing after 2002. There is no evidence that information disclosure causes nursing homes to cherry-pick healthier residents.

Second, one merit of my citation classification is that citations in Group C are independent of resident health status. For example, one quality dimension in Group C is housekeeping (F253), which is correlated to how often a nursing home has its floors swept, but is not be affected by whether residents admitted to this home are relatively healthy. In other words, the increase in citations in Group C is orthogonal to whether nursing homes select residents.

Third, I include the variable "mean expenditures" in the specifications to control for the potential biases from differential resident selection. Though not shown in the paper, the results are similar to what is shown in Table 5 and 6.

C. The Supply Side: Do Nursing Homes Increase Nursing Inputs?

This subsection investigates the incentives for nursing homes to reallocate resources in response to information disclosure. For a nursing home whose major goal is to maximize profit,

a necessary concern is cost minimization, given its product position. This is the major motive that drives nursing homes to reallocate resources instead of increasing them. It is of interest to ask the following question regarding incentives for cost minimization: do nursing homes increase their overall effort level (nursing inputs) in response to quality information disclosure? The answer to this question will help us further understand why information disclosure results in more deficiency citations and the shift of citation composition.

I use *nursing hours per resident day* and *nursing salaries per resident day* as the measures for nursing inputs. These two indicators predict nursing home strategies easily and accurately, and have been used in many of the studies measuring nursing inputs. In the long-term care industry, the main sources of quality are nurses' day-to-day activities. It is important to know how many nursing hours are used to take care of each resident and how much a nursing home spends directly on caring for its residents.

There is no compelling evidence of an immediate impact of the introduction of NHQI on either *nursing hours per resident day* or *nursing salaries per resident day* provided by the differences-in-differences approach. Table 7a shows that the differences-in-differences coefficients for *nursing hours per resident day* and *nursing salaries per resident day* are 0.11 and -0.39 respectively. These coefficients are insignificant and their magnitudes are very trivial relative to their means. The results indicate that the introduction of the NHQI did not have a significant differential impact on nursing hours or nursing salary in both groups. OSCAR data provides detailed information for different types of nurses such as registered nurses, LPN/LVN and nurse aids. Table 7b shows the results using nursing hours per resident per day, for each type, as the dependent variable. The evidence supports the basic finding that nursing homes do not change their nursing inputs and no factor substitution across nursing types occurs.

D. The Demand Side: Does Demand Become Sensitive to the NHQI-defined QMs?

Ascertaining if consumers are sensitive to the newly released NHQI QMs is important to this study for two reasons. First, as I mentioned in the analytical framework section, the effectiveness of disclosure is an important assumption for studying firm behavior in response to information disclosure. If consumers are not sensitive to the new information, nursing homes have little incentive to make changes. Second, this paper focuses on the multitasking behavior of nursing homes. If consumers are not sensitive to the NHQI QMs, there is no point in nursing homes diverting resources toward reported dimensions. In this subsection, I first document both the official and the anecdotal evidence and then provide the empirical evidence to show that consumer demand is, in fact, sensitive to the NHQI QMs.

According to the CMS documents, visits to the Nursing Home Compare (NHC) website increased tremendously after the introduction of the NHQI. Furthermore, the CMS conducted an online satisfaction survey on whether the CMS provides clear, valuable, easy to understand, easy to search and valuable information. Results suggest a high level of satisfaction with the NHQI QMs. On a scale of 0 to 10, over 40% of web users evaluated the quality of the information as a 10 and approximately 70% gave the information an 8 or higher (CMS, 2002).

During my interviews with the local ombudsmen and the staff of QIOs, I collected some anecdotal evidence that consumers were aware of the NHQI QMs. As the local ombudsmen said, consumers often call them to inquire about quality across nursing homes in a specific area. After the introduction of NHQI, consumers raised some new questions relating to those NHQI QMs.

However, the most convincing evidence of consumer awareness comes from the empirical findings that nursing homes with worse NHQI-defined quality measures have a greater decrease in their occupancy rate than other nursing homes. I estimate the following specification:

$$Y_{jt} = \alpha_j + \alpha_t + \beta * D_j * D2002_{jt} + \gamma * QM_{jt} * D_j * D2002_{jt} + \delta * QM_{jt} + \varepsilon_{jt} \quad (4)$$

This specification is a modified version of the baseline specification (1) and differs in the introduction of the add-in measure of quality (*QM*). *QM* represents the NHQI QMs, such as the percent of residents who lose their control in bowel and bladder (*Bowel*), the percent of residents who need assistance in daily activities (*ADL*) and so on (See Table A2). To make the coefficients more readable, I weight those *QM*s by 100, which means that their magnitudes lie in the interval [0, 1]. Y_{jt} denotes the occupancy rates in a nursing home *j* at time *t*. All the other variables are as defined in specification (1). I also include nursing home specific effects and year effects.

Here, the coefficient of primary interest is γ, which represents how information disclosure via NHQI QMs affects average occupancy rates. Take *Bowel* as an example: if $\gamma<0$, it implies that facilities with a higher percentage of residents who lose bowel control would have a greater reduction in occupancy rate after the introduction of the NHQI. The coefficient β represents the differential effects of NHQI on occupancy rates. If $\beta<0$, it implies that the introduction of NHQI is associated with a lower occupancy rate.

Table 8 shows that the γ coefficients are significantly negative for different NHQI QMs. This indicates that demand at nursing homes with bad scores drops faster than at those with good scores. Take *Bowel* as an example. If the proportion of residents who lose bladder or bowel control is higher in Home A than in Home B by 10 percent, then the occupancy rate in Home A would drop by 0.72% more than that in Home B, due to the introduction of NHQI. This suggests that consumer demand becomes sensitive to newly released NHQI QMs. I also include mean expenditures to control for changes in the distribution of resident health status. The results remain the same.

VII. Are Inspectors More Careful?

Multitasking is a sufficient but not necessary condition for the response pattern in which scores of the NHQI QMs improve slightly while the number of deficiency citations increases significantly. There could be some other force that drives the increase in deficiency citations. Multitasking may cause the shift in the severity distribution of citations, but changed inspector behavior (i.e. inspectors are more careful in detecting deficiencies) may also result in more citations. The main identification challenge is how to separate the two effects: worse quality and more careful inspectors[19]?

In this section, I introduce a strategy that helps to isolate the effect of changed inspector behavior from that of multitasking. The econometrics procedure is as follows. First, I develop a simultaneous equations model so that I can use the correlations in the error terms of both equations to control for the unobserved quality changes. Then I impose a discrete factor structure on the error terms of both equations, which allows me to semiparametrically estimate the equations jointly with the full information maximum likelihood (FIML). This framework was proposed by Mroz and Guilkey (1992), Mroz (1999), Cameron and Taber (2004) and Blau (1994). The results suggest that inspectors are slightly more careful in detecting the deficiencies after the introduction of the NHQI.

A. Inspector Evaluation Equation

[19] One may argue that inspectors might have responded to the NHQI by raising their standards. This would also result in an increase in deficiency citations. At one point, I was convinced by this argument but changed my mind after a series of interviews. From them, I learned that nursing homes have the right to appeal if they don't agree with inspectors. And, inspectors have to conduct another visit in response to the appeal. Some lawyers told me that inspectors actually have few incentives to raise their standards due to the shortage of inspectors. Furthermore, the quality standards are outlined in the Social Security Act, which remains the same after the introduction of the NHQI.

I rely on the shift in the severity distribution of citations to detect changed inspector behavior. Inspectors have a grading system consisting of five categories with four thresholds. The five categories are *No Citations*, *Minor Harm*, *Potential Harm*, *Actual Harm* and *Immediate Jeopardy*. For simplicity, I adopt the label "*a tag*" for dimensions of quality. If the latent evaluation of quality meets the minimum requirements, no citation will be issued under this tag. Otherwise, a citation will be issued and a severity category will be assigned.

I construct a truncated ordered model to formulate the process of issuing a citation.

$$W_{ijt} = \alpha_1 Q_{ijt} + \alpha_2 Z_{jt} + \varphi * D_j * D2000_{jt} + \eta_i + \eta_t + \varepsilon_{ijt} \tag{5}$$

$$R_{ijt} = \begin{cases} 1 & if\ \mathrm{W_{ijt}} < W_0 \\ 0 & otherwise \end{cases} \tag{6}$$

$$H_{ijt} = \begin{cases} I & if\ W_1 \le W_{ijt} < W_0 \\ II & if\ W_2 \le W_{ijt} < W_1 \\ III & if\ W_3 \le W_{ijt} < W_2 \\ IV & if\ W_{ijt} \le W_3 \end{cases} \tag{7}$$

Equation (5) describes how an inspection team evaluates a tag, where W_{ijt} is a latent variable measuring the quality of a tag i in a nursing firm j at time t. Here, high W_{ijt} indicates a high quality evaluation. Q includes a set of observed citation characteristics used for quality evaluation. They include the following: if the same citation has ever been issued in the nursing home's history (*History*), if it had a negative outcome (*Outcome*) and the number of affected residents (*Scope*). Z refers to facility characteristics that can affect inspector evaluation, such as the number of total citations in the previous year ($Defnum_{t-1}$), aggregated resident characteristics and state dummies. *D* is a binary dummy variable that equals one for states where quality information was not publicly available before the passage of NHQI. *D2002* is a dummy variable that equals one after and zero before the NHQI takes effect. Here, the differences-in-differences

coefficient φ captures the changed inspector behavior[20]. If φ<0, it means that as a result of the disclosure policy, inspectors become more careful in detecting evidence of deficiencies that may lower the latent evaluation of quality. I also include tag dummies η_i and year dummies η_t. ε refers to error terms.

The inspector team compares the latent evaluation of quality with the minimum requirements and decides on issuing a citation. Equation (6) shows the rule for issuing a citation and W_0 stands for the minimum requirements. If the latent evaluation of quality is lower than W_0, a citation is issued and *R* equals one. Otherwise, no citation will be issued to that dimension and no citation characteristics of that dimension will be observed. If a citation is issued (R_{ijt}=1), a severity category is assigned to the citation according to the rule described by Equation (7). *H* indicates the severity categories from *Minor Harm* (*I*) to *Immediate Jeopardy* (*IV*). The *W*s stand for the thresholds used for categorizing severity levels, where $W_3 < W_2 < W_1 < W_0$.

Because researchers can not fully observe the quality characteristics of each citation, some unobserved quality components in the error terms (the ε's), which might be correlated with the introduction of the NHQI, may bias φ. In other words, the estimate φ that captures the shift in the severity distribution of deficiency citations may include both the effect of changed firm and inspector behavior. How to control the unobserved quality changes due to changed firm behavior is a big identification challenge for testing if inspectors are more careful after the introduction of NHQI.

B. Correction Time Equation

[20] The effort inspectors spend in detecting evidence of deficiencies may differ across severity levels. Hence, φ can be modeled as φ_m, and m refers to the severity level, m= {1, 2, 3, 4}. For simplicity, I assume $\varphi_m=\varphi$, a constant across different severity levels.

The identification strategy used here relies on a variable, *Correction Time*, the time that a nursing home uses to correct a deficiency citation[21]. *Correction Time* is correlated with quality changes due to changed firm behavior but is independent of changed inspector behavior. This idea can be explained using an analogy to homework grading. Teachers are sometimes very careful and sometimes less careful in detecting errors during grading, which may result in different scores. However, changed teacher behavior does not affect the time that a student uses to correct a wrong answer. The time that the student uses is correlated with his own academic ability but is independent of changed teacher behavior.

Switching back to the scenario of annual inspection, *Correction Time* is simply a function of citation characteristics and some specific firm characteristics.

$$T_{ijt} = \beta_0 + \beta_1 Q_{ijt} + \beta_2 X_{ijt} + \eta_i + \eta_t + \xi_{ijt} \tag{8}$$

Here, T_{ijt} is *Correction Time* used for tag *i* in nursing home *j* at time *t* conditional on the citation issued (R_{ijt}=1). It cannot be used as a control variable for Equation (5) because *Correction Time* is generated after an annual inspection, which does not affect inspectors' evaluation of a dimension of quality. On the right hand side of the equation, the citation characteristics Q and other dummy variables are the same used in Equation (5). X_{ijt} is a set of facility characteristics including ownership, chain affiliation, the number of total beds and so on, which may not affect inspectors' evaluation of quality. The error terms (the ξ's) include unobserved changes in quality which are also included in the error terms (the ε's) of the inspector evaluation equation.

[21] According to the CMS regulation, a facility has to correct its cited deficiency in a given time period if it wants to keep its agreement with CMS in the next year. The correction of the deficiency is monitored and enforced by annual inspection and consumer complaints. If an inspection team finds that a firm did not correct its problems instantly, as it promised it would, CMS may fine it, deny the payments to it or even cancel its Medicare or Medicaid certificate.

I aim to use the correlations across the disturbances in the inspector evaluation equation and the correction time equation (the ε's and the ξ's) to control for the unobserved quality changes. Hence, I impose a discrete factor structure on the error terms in equations (5) and (8):

$$\varepsilon_{ijt} = \varepsilon^{*}_{ijt} + \rho_k \nu \tag{9}$$

$$\xi_{ijt} = \xi^{*}_{ijt} + q_k \nu \tag{10}$$

where ε^{*}_{ijt} and ξ^{*}_{ijt} are mutually independent draws from different normal distributions; υ represents the unobserved quality factors assumed to be independent of regressors in both equations (5) and (8); and ρ and q are factor loadings reflecting the correlations of the ε's and the ξ's in the simultaneous equations. The subscript k distinguishes the citations according to different statuses: whether it is issued before or after the introduction of NHQI, and whether it is issued to a nursing home in the *Newly Disclosed* group. I assume υ to be distributed by a step function (Heckman and Singer, 1984). To reduce the computational burden, I assume fixed factors across all observations, make k equal 1 if a citation is issued to a nursing home in the *Newly Disclosed* group after the introduction of NHQI and 0 otherwise, and normalize one factor loading in equation (9) as unity.

C. Estimation and Results

I estimate the simultaneous equations jointly by full information maximum likelihood (FIML). Since ε and ξ are independent conditional on the υ, I derive the FIML by integrating out the discrete factors in the joint distribution of ε and ξ conditional on the υ as in the standard random effects approach. The FIML is

$$L=\prod_{i=1}^{I}\sum_{n=1}^{N}\pi_n\cdot\left\{\prod_{m=1}^{4}[\Phi(W_{m-1}-\varphi G-\alpha_1 Q-\alpha_2 Z-\eta_i-\eta_t-\rho_k\theta_n)-\Phi(W_m-\varphi G-\alpha_1 Q-\alpha_2 Z-\eta_i-\eta_t-\rho_k\theta_n)]^{(\mathrm{H=m})}\cdot\frac{1}{\sigma_\xi}\phi\left(\frac{T-\beta_1 Q-\beta_2 X-\eta_i-\eta_t-q_k\theta_n}{\sigma_\omega}\right)\cdot\Phi(W_0-\varphi G-\alpha_1 Q-\alpha_2 Z-\eta_i-\eta_t-\rho_k\theta_n)^{-1}\right\}$$

where *G=D*D2002* and m refers to the severity level, m= {1, 2, 3, 4}. The details about estimation and the likelihood function are available in Appendix A. I use bootstraps to get standard errors for the coefficients.

Table 9 shows the results from three different specifications. Column 1 reports the results of the inspector evaluation equation without considering the unobserved quality changes in the error terms. The coefficient φ in Column 1 is negative and insignificant. Column 2 uses *Correction Time* as a control variable for the inspector evaluation equation. φ is still negative and insignificant, but less negative than φ in Column 1, which indicates that the overall quality might be slightly worse due to the new information. Column 3 shows the results of the simultaneous equations model controlling for unobserved quality changes. φ is small, negative and significant at the ten percent significance level. The result suggests that inspectors may be slightly more careful after the introduction of NHQI and that the small number of changes will not undermine the evidence for the multitasking hypothesis.

VIII. Conclusion

This study examines how an increase in information about some dimensions of quality affects firm behavior. I relax the quality dimensionality assumption by considering quality with multiple dimensions in a multitasking framework, and analyze a panel dataset for almost all nursing homes in the USA. The dataset covers the period before and after the enforcement of a

mandatory quality disclosure policy (NHQI). My central finding is that report cards cause nursing homes to reallocate resources, rather than increasing resources for quality improvement. Quality improves slightly along reported dimensions but may deteriorate along unreported ones. To establish this, I show that, after the introduction of the NHQI: (1) scores of NHQI-defined QMs improve slightly while the number of deficiency citations increases; (2) the citation composition shifts in favor of problems not included in and substitutes to tasks that are reported by the NHQI measures; and (3) there is no evidence that nursing homes increase quality-related nursing inputs.

I hesitate to conclude that disclosure fails to motivate nursing homes to improve overall quality because the answer depends on whether the NHQI leads homes to allocate resources more efficiently. The available findings are not enough to draw such conclusion.

Although it would be desirable to conduct a welfare analysis of the disclosure policy, it is beyond the scope of my study. Even if information about the overall prices for nursing homes were available, the lack of marginal returns for different dimensions of quality would make it almost impossible to undertake the welfare analysis within the multitasking framework.

Overall, this paper documents the evidence for "teaching-to-test", which is critical to ongoing report card policy decisions in many industries, especially schools and hospitals. In addition, understanding the relationship between information and resource allocation is also important for understanding the performance of economic organizations. Given that information shapes incentives, managers should not simply release performance measures for which data are readily available. Rather, they should be selective about the measures they release, to reduce workers' incentives to distort performance measures.

A question that remains unanswered in this paper is if there is an optimal design to mitigate the distortion of performance measures[22]. From the perspective of market structure, can competition prevent firms from shifting resources away from unreported dimensions? From the perspective of organizational design, are non-profits less likely than for-profits to divert resources away from "hard-to-measure" dimensions? Can we believe that the chain-affiliated firms cherish their reputation more than the freestanding ones and provide higher quality in unreported dimensions? This is the subject of future work.

[22] One possible solution to the multitasking problem is to simply change the job design such that firms do not give workers some tasks whose quality is newly disclosed and some whose quality is not; instead, firms may give these tasks to different workers. However, whether job design can help to solve the multitasking issue depends on whether those tasks are separable to a large extent. If some tasks are indivisible, the mechanism of job design can not remove the incentives for multitasking.

References

Akerlof, G. A. "Market for Lemons - Quality Uncertainty and Market Mechanism." *Quarterly Journal of Economics* 84, no. 3 (1970): 488-500.

Arrow, K. J. "Uncertainty and the Welfare Economics of Medical-Care." *American Economic Review* 53, no. 5 (1963): 941-73.

Bagwell, K., and M. H. Riordan. "High and Declining Prices Signal Product Quality." *American Economic Review* 81, no. 1 (1991): 224-39.

Baker, G. "Distortion and Risk in Optimal Incentive Contracts." *Journal of Human Resources* 37, no. 4 (2002): 728-51.

Baker, G. P. "Incentive Contracts and Performance-Measurement." *Journal of Political Economy* 100, no. 3 (1992): 598-614.

Blau, D. M. "Labor-Force Dynamics of Older Men" *Econometrica* 62, no. 1 (1994): 117-56.

Blumenthal, D., and C. M. Kilo. "A Report Card on Continuous Quality Improvement" *Milbank Quarterly* 76, no. 4 (1998): 625-29.

Braun, B. I. "The Effect of Nursing-Home Quality on Patient Outcome" *Journal of the American Geriatrics Society* 39, no. 4 (1991): 329-38.

Brickley, J.A and J.Z.Zimmerman. "Change Incentives in a Multitask Environment: Evidence from a Top-tier Business", *Journal of Corporate Finance*, Vol 7, no.4 (2001):367-96.

Cameron, S. V., and C. Taber. "Estimation of Educational Borrowing Constraints Using Returns to Schooling" *Journal of Political Economy* 112, no. 1 (2004): 132-82.

Caminal, R., and X. Vives. "Why Market Shares Matter: An Information-Based Theory" *Rand Journal of Economics* 27, no. 2 (1996): 221-39.

Castle, N. G., and T. J. Lowe. "Report Cards and Nursing Homes" *Gerontologist* 45, no. 1 (2005): 48-67.

Chan , Y.S., and H. Leland. "Prices and Qualities in Markets with Costly Information" *Review of Economic Studies* 49 (1982): 499-516.

———. "Prices and Qualities: A Search Model" *Southern Economic Journal* 52 (1986): 1115-30.

Chipty, T., and A. D. Witte. "Effects of Information Provision in an Vertically Differentiated Market", *NBER Working Paper* (1998).

CMS. "Report on Evaluation Activities for the Nursing Home Quality Initiative Pilot" edited by Centers for Medicare & Medicaid Services, 2002.

Dafny, L., and D. Dranove. "Do Report Cards Tell Consumers Anything They Don't Already Know? The Case of Medicare HMOs", *Rand Journal of Economics (forthcoming 2008*).

Day, G. S. "Assessing Effects of Information Disclosure Requirements" *Journal of Marketing* 40, no. 2 (1976): 42-52.

Dranove, D., D. Kessler, M. McClellan, and M. Satterthwaite. "Is More Information Better? The Effects Of "Report Cards" On Health Care Providers" *Journal of Political Economy* 111, no. 3 (2003): 555-88.

Dranove, D., and M. A. Satterthwaite. "Monopolistic Competition When Price and Quality Are Imperfectly Observable" *Rand Journal of Economics* 23, no. 4 (1992): 518-34.

Epstein, A. M. "Rolling Down the Runway - the Challenges Ahead for Quality Report Cards" *Jama-Journal of the American Medical Association* 279, no. 21 (1998): 1691-96.

Feltham, G. A., and J. Xie. "Performance-Measure Congruity and Diversity in Multitask Principal-Agent Relations" *Accounting Review* 69, no. 3 (1994): 429-53.

Ferris, T. G., D. Dougherty, D. Blumenthal, and J. M. Perrin. "A Report Card on Quality Improvement for Children's Health Care" *Pediatrics* 107, no. 1 (2001): 143-55.

Finkelstein, A. "The Aggregate Effects of Health Insurance: Evidence from the Introduction of Medicare" *Quarterly Journal of Economics* 122, no. 1 (2007): 1-37.

Fishman, M. J., and K. M. Hagerty. "Mandatory Versus Voluntary Disclosure in Markets with Informed and Uninformed Customers" *Journal of Law Economics & Organization* 19, no. 1 (2003): 45-63.

Gambassi, G., F. Landi, K. L. Lapane, A. Sgadari, V. Mor, and R. Bernabei. "Predictors of Mortality in Patients with Alzheimer's Disease Living in Nursing Homes" *Journal of Neurology Neurosurgery and Psychiatry* 67, no. 1 (1999): 59-65.

Harrington, C., J. O'Meara, M. Kitchener, L. P. Simon, and J. F. Schnelle. "Designing a Report Card for Nursing Facilities: What Information Is Needed and Why" *Gerontologist* 43 (2003): 47-57.

Harrington, C., D. Zimmerman, S. L. Karon, J. Robinson, and P. Beutel. "Nursing Home Staffing and Its Relationship to Deficiencies" *Journals of Gerontology Series B-Psychological Sciences and Social Sciences* 55, no. 5 (2000): S278-S87.

Heckman, J and B. Singer. "A Method for Minimizing the Impact of Distributional Assumptions in the Econometric Models for Duration Data", *Econometrica* 52, no.2 (1984): 271-320.

Hibbard, J. H., and J. J. Jewett. "Will Quality Report Cards Help Consumers?" *Health Affairs* 16, no. 3 (1997): 218-28.

Holmstrom, B., and P. Milgrom. "Multitask Principal Agent Analyses - Incentive Contracts, Asset Ownership, and Job Design" *Journal of Law Economics & Organization* 7 (1991): 24-52.

Jacob, B.A. "Accountability, Incentives and Behavior: the Impact of High-stakes in the Chicago Public Schools", *Journal of Public Economics* 89, no.5-6 (2005):761-96

Jin, G. Z., and P. Leslie. "The Effect of Information on Product Quality: Evidence from Restaurant Hygiene Grade Cards" *Quarterly Journal of Economics* 118, no. 2 (2003): 409-51.

Kane, R. L., and R. A. Kane. "What Older People Want from Long-Term Care, and How They Can Get It" *Health Affairs* 20, no. 6 (2001): 114-27.

Kelley, J.I. "State-by-State Guide to Nursing Home Performance Data" AARP, 2001.

Kerr, S. "Folly of Rewarding a, While Hoping for B" *Academy of Management Journal* 18, no. 4 (1975): 769-83.

Mathios, A. D. "The Impact of Mandatory Disclosure Laws on Product Choices: An Analysis of the Salad Dressing Market" *Journal of Law & Economics* 43, no. 2 (2000): 651-77.

Milgrom, P., and J. Roberts. "Price and Advertising Signals of Product Quality" *Journal of Political Economy* 94, no. 4 (1986): 796-821.

Mroz, T. A. "Discrete Factor Approximations in Simultaneous Equation Models: Estimating the Impact of a Dummy Endogenous Variable on a Continuous Outcome" *Journal of Econometrics* 92, no. 2 (1999): 233-74.

Mroz, T. A., and D.K. Guilkey. "Discrete Factor Approximations for Use in Simultaneous Equation Models with both Continuous and Discrete Endogenous Variables" In *Mimeo, Department of Economics, University of North Carolina*, 1992.

Mukamel, D. B., and W. D. Spector. "Quality Report Cards and Nursing Home Quality" *Gerontologist* 43 (2003): 58-66.

Mullen, K.J., R.G. Frank, and M.B. Rosenthal. "Can You Get What You Pay For? Pay-for-Performance and the Quality of Healthcare Providers ", *Working Paper*, 2007.

Munroe, D. J. "The Influence of Registered Nurse Staffing on the Quality of Nursing-Home Care" *Research in Nursing & Health* 13, no. 4 (1990): 263-70.

Nelson, P. "Information and Consumer Behavior" *Journal of Political Economy* 78, no. 2 (1970): 311-29.

Rainwater, J.A., P.S. Romano, and D.M. Antonius. "The California Hospital Outcomes Project: How Useful Is California's Report Card for Quality Improvement?" *The Joint Commission Journal on Quality Improvement* 24, no. 1 (1998): 31-39.

Rogerson, W. P. "Reputation and Product Quality" *Bell Journal of Economics* 14, no. 2 (1983): 508-16.

Schnelle, J. F., S. F. Simmons, C. Harrington, M. Cadogan, E. Garcia, and B. M. Bates-Jensen. "Relationship of Nursing Home Staffing to Quality of Care" *Health Services Research* 39, no. 2 (2004): 225-50.

Schwartz, A., and L. L. Wilde. "Product Quality and Imperfect Information" *Review of Economic Studies* 52, no. 2 (1985): 251-62.

Shapiro, C. "Consumer Information, Product Quality, and Seller Reputation" *Bell Journal of Economics* 13, no. 1 (1982): 20-35.

Spector, W.D., and H.A. Takada. "Characteristics of Nursing Homes That Affect Resident Outcomes" *Journal of Aging and Health* 3, no. 4 (1991): 427-54.

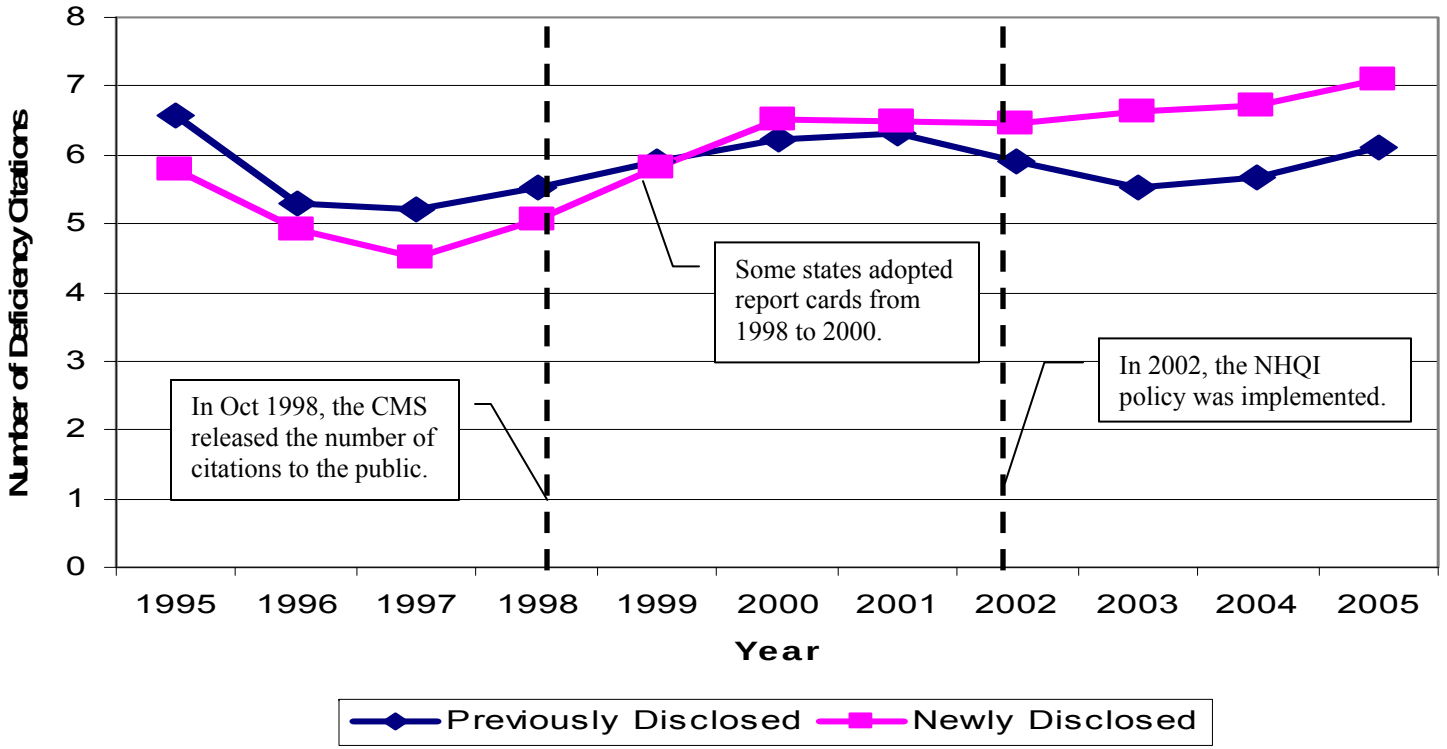
Stevenson, D.G. "Is a Public Reporting Approach Appropriate for Nursing Home Care?" *Journal of Health Politics, Policy and Law* 31, no. 4 (2006): 773-810.

Tirole, J. *The Theory of Industrial Organization*: MIT Press, 1988.

Werner, R. M., and D. A. Asch. "The Unintended Consequences of Publicly Reporting Quality Information" *Jama-Journal of the American Medical Association* 293, no. 10 (2005): 1239-44.

Wolinsky, A. "Prices as Signals of Product Quality" *Review of Economic Studies* 50, no. 4 (1983): 647-58.

Figure 1: Yearly Trend of Total Deficiency Citations in Nursing Homes

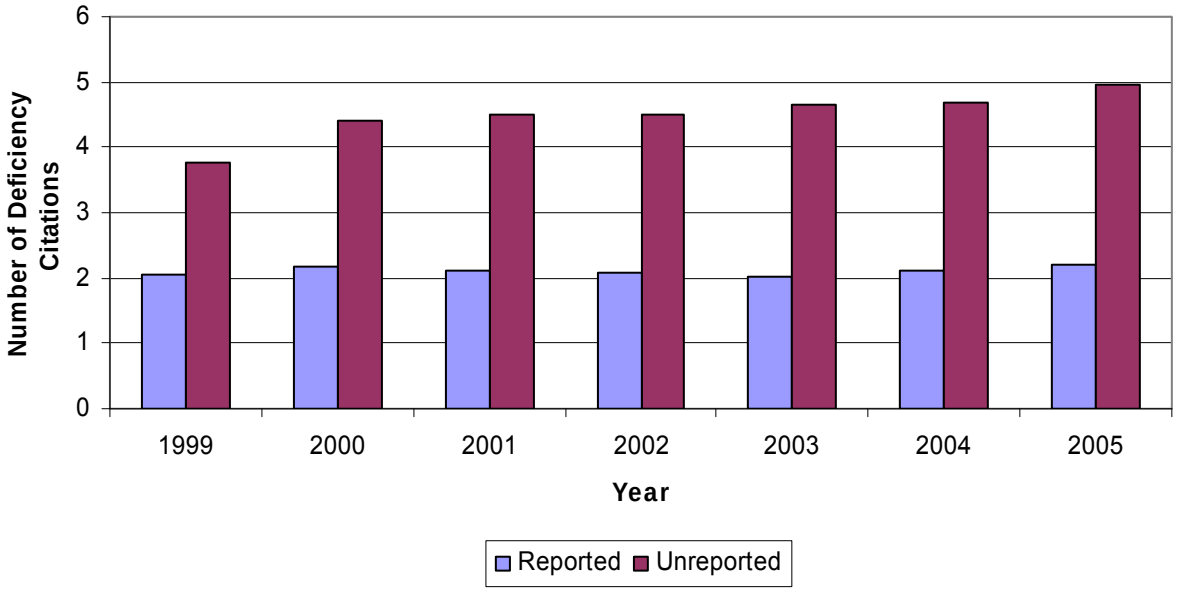


Notes:

a. Figure 1 depicts the yearly trend of the number of total deficiency citations across groups and the timing of some important events regarding information disclosure from 1995 to 2005.

b. It shows that the trends for both groups are almost parallel before 1998 and overlapping between 1999 and 2001; but, between 2002 and 2003, the trend for the *Newly Disclosed* group goes up, and, for the *Previously Disclosed* group, it goes down. After 2004 the trends again coincide.

Figure 2: Yearly Trend of Citation Composition in the Newly-disclosed Group



Notes:

a. Figure 2 depicts the yearly trend of citation composition using a restricted sample that only includes nursing homes in the newly-disclosed group.
b. "Reported" refers to the citations in Group A and Group B, which are overlapping with or complements to the reported NHQI QMs. "Unreported" refers to the citations in Group C, which are substitutes for the tasks reported by the NHQI QMs.
c. The number of citations remains the same over years in the reported group, but rises in the unreported group, especially after 2002.
d. Considering the results in Table 6, I conclude that the shift of citation composition arises from the increase in the deficiency citations for problems that are substitutes for the tasks reported by the NHQI QMs.

Table 1: States with/without Quality Information Disclosure Before 2000

Group		Kelley's List	Castle's List
Treated: States without any quality information disclosure before 2000 ***Newly Disclosed***		AK, AL, AR, ***AZ, CO,*** CT, DC, DE, GA, HI, ID, KS, KY, LA, ME, MI, MN, MO, MT, NC, ND, NE, NH, NM, OK, OR, SC, SD, TN, VA, WA,WV and WY	AK, AL, AR, CT, DC, DE, GA, HI, ID, KS, KY, LA, ME, MI, MN, MO, MT, NC, ND, NE, NH, NM, OK, OR, SC, SD, TN, VA, WA,WV and WY
Control: States with quality information disclosure before 2000 ***Previously Disclosed***	Report Cards	FL, IN, IA, MD, MA, NJ, NY, OH, PA, RI and TX	***AZ, CO,*** FL, IL, IN, IA, MD, MA, MS, NV, NJ, NY, OH, PA, RI, TX, UT, VT and WI
	Other Forms	CA, IL, NV, UT, VT and WI	CA

Notes:

a. Kelley's List comes from the AARP Bulletin: "State-by-State Guide to Nursing Home Performance Data" annually. I use it as the basis for classification because it is annually updated.
b. Castle's List comes from the paper "Report Cards and Nursing Homes" written by Castle and Lowe in 2005. They compile report card information across states before 2003.
c. The major difference between the two lists is the classification of the two states Arizona and Colorado. I alternate between the two classifications when estimating.

Table 2a: Comparisons of Measures of Quality
Between the "Newly Disclosed" and "Previously Disclosed" Groups

	Newly Disclosed	Previously Disclosed	Between-Group Difference	Differences-in-Differences
Inspection Outcomes	***Number of Deficiency Citations***			
2001	6.54	6.40	0.14	0.98
2003	6.65	5.53	1.12	(0.11)
NHQI QMs	***Bowel (%): Percent of Residents Who Lose Controls of Bowel and Bladder***			
2001	5.47	4.65	0.82	0.01
2003	5.01	4.18	0.83	(0.13)
Nursing Inputs	***Nursing Hours per Resident Day***			
2001	2.79	2.71	0.08	0.05
2003	2.72	2.59	0.13	(0.03)

Standard deviations are given in brackets

Table 2b: Yearly Trend of Inspection Outcomes of the *Newly Disclosed* Group

Dependent Variable= Number of Deficiency Citations

		Robust			95% Confidence Interval	
	Coefficient	SE	t Value	P Value	Lower Bound	Upper Bound
Constant	6.497***	0.058	112.520	0.000	6.384	6.611
1999	-0.735***	0.085	-8.640	0.000	-0.902	-0.568
2000	0.010	0.083	0.120	0.902	-0.153	0.174
2001	0.036	0.082	0.440	0.659	-0.125	0.197
2003	0.162**	0.083	1.970	0.049	0.001	0.324
2004	0.252***	0.083	3.020	0.002	0.089	0.416
2005	0.677***	0.087	7.810	0.000	0.507	0.847
Nursing Home Dummy	Y					
R-Square	0.426					
Num of Obs	47762					

* p<0.10, ** p<0.05, *** p<0.01

Notes:

a. Measures in Table 2a are representatives from different sets. "*Number of deficiency citations"* captures the outcomes from annual inspections. Percent of residents who lose control of bowel or bladder (*Bowel*) is among one of the NHQI-defined QMs. *Nursing salary per resident day* assesses quality from the aspect of nursing inputs.

b. Table 2b, using 2002, when NHQI was implemented as the reference year, suggests that the introduction of NHQI is associated with more deficiency citations in the *Newly Disclosed* group.

Table 3: How Do Nursing Homes Respond to Information Disclosure?

	Dependent Variables	Inspection Outcome		Selected NHQI Quality Measures			
		Deficiency Citations	Total Citations	Bowel	ADL [a]	Transfer [a]	Bedfast
1	**Baseline specification**	**0.808****	1.036**	**-0.438***	-0.310	-0.299	-0.078
	(Clustered)	**(0.391)**	(0.502)	**(0.253)**	(0.362)	(0.373)	(0.178)
	Mean	6.218	8.998	5.625	25.644	25.922	5.059
	Magnitude	13.0%	11.5%	-7.1%	-1.2%	-1.2%	-2.0%
2	Time Varying Covariates	0.839**	1.074**	-0.508*	-0.379	-0.357	-0.168
	(Clustered)	(0.393)	(0.502)	(0.277)	(0.359)	(0.384)	(0.193)
3	Socio-economics Covariates	0.748**	0.995**	-0.559**	0.026	0.031	-0.205
	(Clustered)	(0.319)	(0.491)	(0.218)	(0.334)	(0.318)	(0.151)
4	Different Size	0.862*	1.040*	-0.489*	-0.254	-0.210	-0.046
	(WLS, Clustered)	(0.448)	(0.551)	(0.248)	(0.381)	(0.368)	(0.179)
5	Entry and Exit Considered	0.811**	1.036**	-0.445*	-0.305	-0.282	-0.080
	(Clustered)	(0.397)	(0.508)	(0.256)	(0.369)	(0.379)	(0.181)
6	Baseline specification	0.794*	0.920*	-0.490*	-0.524	-0.546	-0.130
	(Castle's List)	(0.407)	(0.532)	(0.253)	(0.354)	(0.362)	(0.184)
7	Pre- and Post- Period	0.835*	0.963*	-0.485*	-0.517	-0.504	-0.131
	(Castle's List)	(0.422)	(0.546)	(0.271)	(0.380)	(0.385)	(0.192)

* p<0.10, ** p<0.05, *** p<0.01

Notes:

a. It shows the basic response pattern of nursing homes, in that the introduction of NHQI is associated with more deficiency citations and a lower percent of residents who lose control of their bowels in the treated group than in the control one.

Table 4: Classification of Citations by Definitions of NHQI-Defined Quality Measures

Group	Tags	Connections to NHQI-defined QMs
A. Overlapping with NHQI QMs	F221 Physical Restraints	Percent of Residents Who Were Physically Restrained
	F310 Activities of Daily Living Maintenance F311 Appropriate ADL Treatment F312 ADL Services	Percent of Residents Whose Need for Help With Daily Activities Has Increased
	F314 Pressure Sores	Percent of Residents Who Have Pressure Sores
	F315 Catheter Prevention F316 Incontinence Care	Percent of Residents Who Lose Control of Their Bowels
		Percent of Residents Who Have a Catheter Inserted and Left in Their Bladder
		Percent of Residents with a Unary Tract Infection
	F317 Range Motion Maintenance F318 Limited Range of Motion Services	Percent of Residents Who Spent Time in Bed/ Chair
		Percent of Residents Whose Ability to Move Got Worse
	F319 Mental and Psychosocial Services F320 Maintenance of Psychosocial Functioning	Percent of Residents Who are Depressed or Anxious
B. Related to NHQI QMs	F353 Sufficient Nursing Staff F354 Registered Nurse Staff And the remaining tags in "Quality of Care"	Complement to tasks quantified by the NHQI QMs
C. Unrelated to NHQI QMs	All the Tags except those Tags in Group A and Group B. Example: F444 Hand Washing	Substitute for tasks quantified by the NHQI QMs

Notes:

$A \cup B \cup C = \Omega$ and $(A \cup B) \cap C = \varnothing$

a. This table classifies the citations into two groups which are substitutes: NHQI-related (Group A & B) and NHQI-unrelated (Group C). They are not complementary and compete for the limited nursing resources.

Table 5: How Does Citation Composition Shift after the Introduction of NHQI?

Dependent Variable	Substitutes						Complements	
	Level of Citations		Less Harm Citations		Share of Citations		Share of Citations	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
NHQI	**0.683****		**0.669****		**0.031****		**-0.010**	
	(0.304)		**(0.303)**		**(0.015)**		**(0.011)**	
NH1999		-0.173		-0.195		0.002		0.002
		(0.309)		(0.286)		(0.018)		(0.009)
NH2000		0.111		0.108		0.004		0.002
		(0.188)		(0.184)		(0.012)		(0.009)
NH2002		0.316		0.297		0.016		0.001
		(0.233)		(0.225)		(0.010)		(0.007)
NH2003		0.869**		0.829**		0.048***		-0.010
		(0.341)		(0.342)		(0.016)		(0.012)
NH2004		0.795**		0.778**		0.035*		-0.007
		(0.334)		(0.331)		(0.018)		(0.013)
NH2005		0.694*		0.684*		0.026		-0.014
		(0.364)		(0.363)		(0.019)		(0.013)
Year Dummy	Included***	Included***	Included***	Included***	Included***	Included***	Included***	Included***
Facility Dummy	Included***	Included***	Included***	Included***	Included***	Included***	Included***	Included***
R-Squared	0.461	0.461	0.466	0.467	0.307	0.307	0.233	0.233
N	108977	108977	108977	108977	108977	108977	108977	108977

* p<0.10, ** p<0.05, *** p<0.01

Notes:

a. This table shows that the introduction of NHQI is associated with a shift in citation composition, namely a higher percentage of NHQI-unreported citations, more NHQI-unreported citations with less harm and more NHQI-unreported citations overall in the newly-disclosed group than in the previously disclosed group.

Table 6: The Impact of NHQI on Citation Composition Within the Newly-Disclosed Group

	All Citations		Less Harm Citations	
	(1)	(2)	(3)	(4)
NHQI*Report	-0.439***		-0.398**	
	(0.150)		(0.156)	
$Year_{-2}$*Report		-0.013		-0.012
		(0.128)		(0.129)
$Year_{-1}$*Report		-0.182		-0.116
		(0.145)		(0.149)
$Year_{0}$*Report		-0.206		-0.134
		(0.168)		(0.171)
$Year_{+1}$*Report		-0.405***		-0.327**
		(0.139)		(0.143)
$Year_{+2}$*Report		-0.347**		-0.273*
		(0.145)		(0.146)
Report	-2.196***	-2.222***	-2.399***	-2.450***
	(0.201)	(0.152)	(0.196)	(0.143)
2000	0.406***	0.413***	0.490***	0.496***
	(0.074)	(0.104)	(0.063)	(0.096)
2001	0.437***	0.528***	0.579***	0.637***
	(0.112)	(0.148)	(0.096)	(0.141)
2002	0.440**	0.522*	0.598***	0.646**
	(0.200)	(0.261)	(0.177)	(0.241)
2003	0.687**	0.669**	0.855***	0.819***
	(0.283)	(0.274)	(0.269)	(0.256)
2004	0.759**	0.713**	0.948***	0.886***
	(0.319)	(0.312)	(0.303)	(0.293)
2005	0.949***	0.730***	1.125***	0.926***
	(0.326)	(0.266)	(0.307)	(0.242)
Facility Dummy	Included***	Included***	Included***	Included***
R-Squared	0.391	0.391	0.400	0.400
N	95524	95524	95524	95524

* p<0.10, ** p<0.05, *** p<0.01

Notes:

a. I use a restricted sample that only includes nursing homes in the newly-disclosed group to obtain the pure effect of disclosure on citation composition.
b. The results show two facts: (1) the introduction of NHQI is associated with the shift of citations from the reported group to the unreported group; (2) in the five year window, the yearly trend for the number of citations is flat before the introduction of NHQI and shifts away from the reported group to the unreported group afterward.

Table 7a: Do Nursing Homes Increase Nursing Inputs?

Dependent Variable	Nursing Hours Per Resident Day		Nursing Salaries Per Resident Day	
	OLS	Fixed Effects	OLS	Fixed Effects
NHQI	**0.098**	**0.106**	**-0.592**	**-0.392**
	(0.091)	**(0.122)**	**(1.805)**	**(1.907)**
Medicare	3.621***		20.156***	
	(0.596)		(4.794)	
Medicaid	-2.657***		-42.274***	
	(0.442)		(3.592)	
Beds	-0.011***		0.073	
	(0.001)		(0.054)	
Non-profit	0.823***		21.994***	
	(0.171)		(3.594)	
Government	0.217***		9.411***	
	(0.067)		(0.831)	
Chain	-0.281***		-0.876	
	(0.055)		(0.611)	
Hospital Based	0.106		1.255	
	(0.475)		(4.430)	
Year Dummy	Included***	Included***	Included***	Included***
Facility Dummy		Included***		Included***
R-Squared	0.193	0.543	0.48	0.868
N	108920	108702	75965	75965

* p<0.10, ** p<0.05, *** p<0.01

Table 7b: The Impact of NHQI on Nursing Hours per Resident Day by Nurse Type

Dependent Variable	All Nurses	Registered Nurses	LPN/LVN	Nurse's Aids
Baseline Specification	0.098	0.015	0.023	0.062
(Clustered)	(0.104)	(0.017)	(0.048)	(0.050)
Time Varying Covariates	0.098	0.015	0.013	0.070
(OLS, Clustered)	(0.09)	(0.02)	(0.04)	(0.05)
Different Size	0.010	-0.003	0.001	0.012
(WLS, Clustered)	(0.022)	(0.007)	(0.011)	(0.014)
Socio-economics Covariates	0.043	0.015	0.002	0.026
(Clustered)	(0.075)	(0.019)	(0.025)	(0.039)
Mean	2.749	0.518	0.824	1.407

Table 8: Does Consumer Demand Become Sensitive to the Newly Released NHQI-Defined QMs?

Dependent Variable=Occupancy Rate

	Bowel		ADL		Transfer		Bedfast	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
QM*NHeffect	**-0.072*** **	**-0.074*** **	**-0.059*** **	**-0.061*** **	**-0.049*** **	**-0.051*** **	**-0.059** **	**-0.061** **
	(0.023)	**(0.023)**	**(0.014)**	**(0.014)**	**(0.012)**	**(0.012)**	**(0.024)**	**(0.024)**
QM	-0.014	-0.013	0.009	0.008	-0.002	-0.003	-0.037**	-0.035**
	(0.010)	(0.009)	(0.011)	(0.010)	(0.009)	(0.008)	(0.017)	(0.017)
NHeffect	-0.018***	-0.013**	-0.006	-0.001	-0.009	-0.003	-0.018***	-0.013***
	(0.005)	(0.005)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)
Per Capita Income		-0.059		-0.036		0.030		0.003
		(1.806)		(1.847)		(1.839)		(1.807)
Population		0.001		0.001		0.001		0.001
		(0.002)		(0.002)		(0.002)		(0.002)
Unemployment		0.012***		0.012***		0.012***		0.012***
		(0.004)		(0.004)		(0.004)		(0.004)
Year Dummy	Included***	Included***	Included***	Included***	Included***	Included***	Included***	Included***
Facility Dummy	Included***	Included***	Included***	Included***	Included***	Included***	Included***	Included***
R-Squared	0.727	0.727	0.727	0.727	0.727	0.727	0.727	0.727
N	108975	108975	108975	108975	108975	108975	108975	108975

* p<0.10, ** p<0.05, *** p<0.01

Notes:

a. *QM* refers to the NHQI-defined Quality Measures. To make the coefficients more readable, I weight those *QM*s by 100, which means that the magnitudes of those QMs are in the interval of [0, 1].

b. The negative coefficients for the interaction between QM and the effects of NHQI (*QM*NHeffect*) indicates that nursing homes with a higher percentage of residents who are in bad health status, such as bowel control loss, would have a greater reduction in occupancy rate after the introduction of NHQI.

Table 9: Are Inspectors More Careful?

Dependent Variable = Severity Level

Variables	Single Equation (1)	Single Equation (2)	Simultaneous Equations (3)
φ	**-0.205**	**-0.173**	**-0.162***
	(0.171)	**(0.163)**	**(0.098)**
History	-0.172	-0.182	-0.177
	(0.137)	(0.127)	(0.115)
Outcome	-24.946	-24.330	-24.517*
	(19.278)	(17.575)	(14.982)
Pattern	2.359***	2.076***	1.717***
	(0.238)	(0.250)	(0.238)
Widespread	3.124***	2.772***	2.362***
	(0.377)	(0.292)	(0.285)
Previous Deficiencies	-0.015**	-0.015*	-0.021*
	(0.007)	(0.008)	(0.009)
Nurses	-0.001	0.001	-0.001
	(0.005)	(0.007)	(0.009)
Correction Time		-0.001	
		(0.003)	
W0	24.429	97.526	24.634
	(25.681)	(140.110)	(23.655)
W1	2.621***	2.333***	-0.460
	(0.351)	(0.369)	(0.315)
W2	-12.157	-12.081	-17.482
	(10.437)	(10.134)	(9.771)
W3	-26.399	-25.850	-29.010*
	(19.342)	(17.616)	(16.172)
Tag	Y	Y	Y
State	Y	Y	Y
Year	Y	Y	Y

* p<0.10, ** p<0.05, *** p<0.01

Notes:

a. I use the shift of the severity distribution of citations to explore another potential reason for the increase of deficiency citations. The results show that inspectors might be more careful in detecting evidence of deficiencies after the introduction of NHQI.
b. Column 1 reports the results of the inspector evaluation equation without considering the unobserved quality changes in the error terms. Column 2 uses *Correction Time* as a control variable that controls the unobserved quality changes for the inspector evaluation equation. Column 3 shows the results of the simultaneous equations model controlling the unobserved quality changes.

Appendix: Distributions

A.1 Distribution of the υ's

The accumulated distribution of the υ in equation (9) and (10) is assumed to be approximated by the following step function:

$$\Pr(\upsilon = \theta_n) = \pi_n, \qquad \text{n} = 1, ..., \text{N} \tag{A.1}$$

where $\pi_n \geq 0$ and $\sum_{\text{n}=1}^{N} \pi_{\text{n}} = 1$ and υ_{n} is the *n*th point of support in the distribution of the factor. π_{n} is the probability that the factor takes the value of θ_n and there is N points of support for the υ. The parameters to be estimates are the α's, β's, η's, θ's, π's, ρ, q, W's and V's.

A.2: Joint Distribution of ε and ξ

The factor structure on the error terms are generated by:

$$\varepsilon_{ijt} = \varepsilon^*_{ijt} + \rho_k \nu \tag{9}$$

$$\xi_{ijt} = \xi^*_{ijt} + q_k \nu \tag{10}$$

where ε^*_{ijt} and ξ^*_{ijt} are mutually independent draws from different normal distributions; υ represents the unobserved quality factors which are assumed to be independent of regressors in both equation (5) and (8); Hence, the joint distribution of ε and ξ conditional on the υ is

$$f(\varepsilon, \xi \mid \nu) = \frac{1}{\sigma_\varepsilon}\phi\left(\frac{\varepsilon - \rho_k \nu}{\sigma_\varepsilon}\right) \cdot \frac{1}{\sigma_\xi}\phi\left(\frac{\xi - q_k \nu}{\sigma_\xi}\right) \tag{A.2}$$ where

σ_ε and σ_ξ are the standard deviation of ε^*_{ijt} and ξ^*_{ijt} and ϕ is the standard density function.

Integrating out the υ by the cumulative distribution function (A.1), the unconditional distribution of ε and ξ is

$$f(\varepsilon,\xi)=\sum_{n=1}^{N}\pi_n\cdot\frac{1}{\sigma_\varepsilon}\phi(\frac{\varepsilon-\rho_k\theta_n}{\sigma_\varepsilon})\cdot\frac{1}{\sigma_\xi}\phi(\frac{\xi-q_k\theta_n}{\sigma_\xi}) \qquad \text{(A.3)}$$

A.3 Full Information Maximum Likelihood (FIML)

The simultaneous equations model in this study includes two equations. One is the inspector evaluation equation and the other is the correction time equation. The full information maximum likelihood is the joint distribution of error terms (the ε's and the ξ's) in these two equations.

I start with the inspector evaluation equation system (5), (6) and (7). The probability[23] of falling into each category is

$$\Pr(H=m)=\Phi(W_{m-1}-\varphi G-\alpha_1 Q-\alpha_2 Z-\eta_i-\eta_t-\nu)-\Phi(W_m-\varphi G-\alpha_1 Q-\alpha_2 Z-\eta_i-\eta_t-\nu)$$
$$\text{where } m=\{1,2,3,4\}$$

For simplicity of notation, I assume *G = D * D2002*.Under the assumption that the ε_{ijt}^{*}'s have mean zero and standard deviation 1 independently normally distributed (σ_ε=1), the model yields the following distribution function of ε conditional on the υ's:

$$f(\varepsilon\mid\nu)=\prod_{m=1}^{4}\Pr(H=m)^{(H=m)} \qquad \text{(A.4)}$$

The ξ_{ijt}^{*}'s in the correction time equation (8) are assumed to have an independently normal distribution with mean zero and standard deviation σ_ξ. Hence, the distribution function of ξ conditional on the υ is

[23] When m=4, $\Pr(m=4)=\Phi(W_3-\varphi G-\alpha_1 Q-\alpha_2 Z-\eta_i-\eta_t-\nu)$.

$$f(\xi \mid \nu) = f(T) = \frac{1}{\sigma_\xi}\phi\left(\frac{T - \beta_1 Q - \beta_2 X - \eta_i - \eta_t - \rho\nu}{\sigma_\xi}\right) \qquad \text{(A.5)}$$

Consider that when R=0, both *H* and *T* are not observed. The truncated joint distribution of ε and ξ conditional on the υ is

$$f(\varepsilon, \xi) = \sum_{n=1}^{N} \pi_n \cdot \prod_{m=1}^{4} \Pr(H = m)^{(H=m)} \cdot f(T) \cdot \Pr(R = 1)^{-1} \qquad \text{(A.6)}$$

Where $\Pr(R = 1) = \Phi(W_0 - \varphi G - \alpha_1 Q - \alpha_2 Z - \eta_i - \eta_t - \rho_k \theta_n)$. And the FIML is

$$L = \prod_{i=1}^{I}\sum_{n=1}^{N} \pi_n \cdot \left\{\prod_{m=1}^{4}[\Phi(W_{m-1} - \varphi G - \alpha_1 Q - \alpha_2 Z - \eta_i - \eta_t - \rho_k \theta_n) - \Phi(W_m - \varphi G - \alpha_1 Q - \alpha_2 Z - \eta_i - \eta_t - \rho_k \theta_n)]^{(H=m)} \cdot \frac{1}{\sigma_\xi}\phi\left(\frac{T - \beta_1 Q - \beta_2 X - \eta_i - \eta_t - q_k \theta_n}{\sigma_\omega}\right) \cdot \Phi(W_0 - \varphi G - \alpha_1 Q - \alpha_2 Z - \eta_i - \eta_t - \rho_k \theta_n)^{-1}\right\}$$

A.4 Values for the θ's and the π's and Identification

There are many ways to parameterize the θ's and the π's. Mroz (1999) imposed a distribution to υ with E(υ)=0 and Var(υ)=1 and set the values to the π's. Here, I adopt the way proposed by Blau (1994), which provides a generalized method to estimate the θ's and the π's without setting values. He suggests to use a logit function to set the relationships among the θ's and the π's:

$$\theta_1 = -0.5s,$$
$$\theta_n = \left[\frac{\exp(a_n)}{1 + \exp(a_n)} - 0.5\right]s, \quad n = 2, \ldots, N-1$$
$$\theta_N = 0.5s,$$

where a_n and s need to be estimated, and

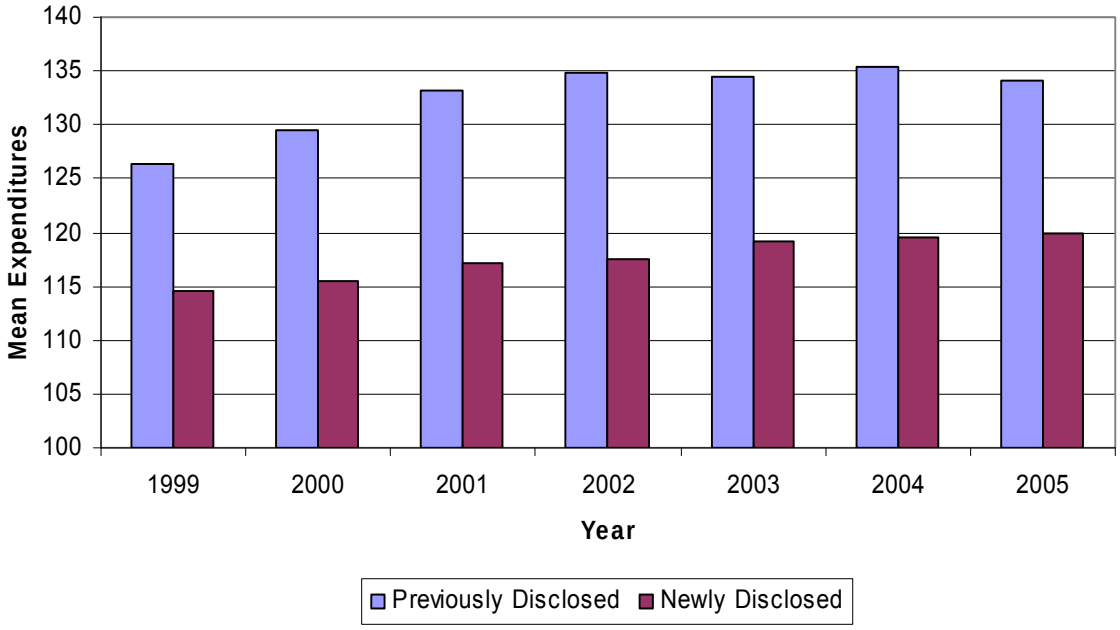
$$\pi_n = \frac{\exp(b_n)}{B}, \quad \text{n} = 1,\ldots, \text{N} - 1,$$
$$\pi_N = \frac{1}{B}, \quad \text{B} = 1 + \sum_{n=1}^{N-1} \exp(b_n),$$

where b_n are the parameters for estimation.

Two studies discussed the performance of this type of estimator in different context. Mroz and Guilkey (1992) present the Monte Carlo results on the discrete factor approximation for the simultaneous equation model with the endogenous dummy variable. They find that in general this discrete factor approximation performs well, even when using only two or three points of support, and suggest that one can have some confidence in placing conventional interpretations on the parameter estimates obtained from these discrete factor approximations. Cameron and Taber (1993) do not place assumptions on the number of points of support. They find that the semiparametric estimator performs well in uncovering both the parameters and the standard errors, even for small samples.

However, I still need to impose some normalization to solve the identification issues in this simultaneous equations model. First, in the equation of inspector evaluation, I set the constant term in this equation as zero to solve the location problem in the ordered model. Second, I normalize one factor loading in equation (9) as unity for the scale issue.

Figure A1: Yearly Trend of Mean Expenditures



Notes:

a. I use the average inflation-adjusted expenditure per resident day (mean expenditure) to measure the distribution of resident health status. This idea was proposed in Dranove et al. (2003). The rationale is that low expenditures imply a healthier cohort.
b. Figure A1 shows that the trends of mean expenditures for both the Newly-Disclosed Group and the Previously-Disclosed Group go upward after 2002. It suggests that there is no evidence that nursing homes pick healthier residents during the admission period.

Table A1: The NHQI-defined QM List in the Nursing Home Compare

Quality Measures
Long-Stay Measures
Percent of Long-Stay Residents Whose Need for Help With Daily Activities Has Increased
Percent of Long-Stay Residents Who Have Moderate to Severe Pain
Percent of High-Risk Long-Stay Residents Who Have Pressure Sores
Percent of Low-Risk Long-Stay Residents Who Have Pressure Sores
Percent of Long-Stay Residents Who Were Physically Restrained
Percent of Long-Stay Residents Who are More Depressed or Anxious
Percent of Low-Risk Long-Stay Residents Who Lose Control of Their Bowels or Bladder
Percent of Long-Stay Residents Who Have/Had a Catheter Inserted and Left in Their Bladder
Percent of Long-Stay Residents Who Spent Most of Their Time in Bed or in a Chair
Percent of Long-Stay Residents Whose Ability to Move About in and Around Their Room Got Worse
Percent of Long-Stay Residents with a Urinary Tract Infection
Percent of Long-Stay Residents Who Lose Too Much Weight
Short-Stay Measures
Percent of Short-Stay Residents with Delirium
Percent of Short-Stay Residents Who Had Moderate to Severe Pain
Percent of Short-Stay Residents with Pressure Sores

Source: See Nursing Home Compare http://www.medicare.gov/NHCompare/Static/Related/DataCollection.asp?dest=NAV|Home|DataDetails|DataCollection#TabTop, accessed on May 1st, 2007

Notes:

In November 2002, the NHQI released ten quality measures to the public. Since then, the CMS has revised those quality measures based on the feedback from nursing homes and consumers. The final version, with fifteen quality measures, dates from January 2004. In this paper, I use the first release time (2002) as the reference year, because the public could not have anticipated what kind of quality information would be disclosed at that time.

Table A2: The Selected Reported NHQI Quality Measures

Variable	Measure	Connection to Nursing Home Quality	Numerator [a]
ADL	Percent of residents whose need for help with daily activities has increased	It may take more staff time to allow residents to do these daily activities than to do the tasks for them. This can affect their health in a good way.	Residents with worsening late-loss ADL (bed mobility, transfer, eating or toileting) performance at t relative to t-1 [b]
Transfer	Percent of residents whose ability to move about in and around their room	Staff should create interventions that help residents move around more as they get older.	Residents with worsening transfer self performance at t relative to t-1
Bedfast	Percent of residents who spend most of their time in bed or in a chair	Staff should encourage residents to take part in physical activities and stay as active as possible as they age	Residents who are restricted in bed or in a chair on the target assessment
Bowel	Percent of residents who lose control of their bowels or bladders	Loss of bowel or bladder control is not a normal part of aging and can often be successfully treated in cognitively intact residents with the help of staff.	Residents who are frequently incontinent or fully incontinent on the target assessment (bowel or bladder incontinence)

Notes:

a. The table introduces the connections of NHQI-defined QMs to quality. The denominator is the number of total residents in each nursing home.

b. The available OSCAR data recorded data on transfer, eating and toileting in the category of ADL at the nursing home level. I cannot distinguish the difference between one resident getting worse in both eating and toileting and two residents getting worse in individual measures. So I calculate the percent of residents who need help in each activity and use the average percentage of the three activities to measure *ADL*. This variable is highly correlated with *ADL* provided by the Minimum Data Set (MDS) data from 2003 to 2005.

Table A3: Overview of Regulatory Standards for Citations

FTAG	Description
Resident Rights	
F151	Exercise of Rights
F152	Free of Reprisal
F153	Access to Records
F154	Informed of Condition
F155	Refuse Treatment
F156	Notice of Rights and Services
F157	Notice of Changes
F158	Resident Manage Financial Affairs
F159	Facility Manage Personal Funds
F160	Convey Funds
F161	Financial Security
F162	Limit on Charges to Funds
F163	Choice of Physician
F164	Privacy and Confidentiality
F165	Voice Grievances
F166	Resolve Grievances
F167	Survey Results
F168	Information
F169	Work
F170	Mail
F172	Visitors
F173	Ombudsman
F174	Telephone
F175	Married Couples
F176	Administer Own Drugs
F177	Refuse Transfer
Admission, Transfer and Discharge Rights	
F201	Transfer and Discharge
F202	Documentation
F203	Notice Before Transfer
F204	Orientation for Transfer or Discharge
F205	Notice of Policies
F206	Permitting Resident to return to Facility
F207	Equal Access to Quality Care
F208	Admission Policy
Resident Behavior and Facility Practices	
F221	Physical Restraints
F222	Chemical Restraints
F223	Abuse
F224	Staff Treatment of Residents
F225	Unemployment Individuals
F226	Policy and Procedures for Staff
Quality of Life	
F247	Notice Before Room Change
F248	Activities Program
F249	Activities Director
F250	Social Services
F251	Social Work Qualification
F252	Environment
F253	Housekeeping
F254	Clean Linens
F255	Private Closet
F256	Adequate Lighting
F257	Comfortable Temperatures
F258	Comfortable Sound
Resident Assessment	
F271	Admission Orders
F272	Comprehensive Assessment
F273	Frequency
F274	Change in Condition
F275	Annual Assessment
F276	Review of Assessments
F277	Coordination
F278	Accuracy of Assessments
F279	Comprehensive care Plans
F280	Plan Requirements
F281	Professional Standards
F282	Qualified Personnel
F283	Discharge Summary
F284	Post Discharge Plan
F285	Preadmission Screening
Quality of Care	
F309	Quality of Care
F310	Activities if Daily Living Maintenance
F311	Appropriate ADL Treatment
F312	ADL Services
F313	Vision and Hearing
F314	Pressure Sores
F315	Catheter Prevention
F316	Incontinence Care
F317	Range of Motion Maintenance
F318	Limited Range of Motion Services
F319	Mental and Psychosocial Services
F320	Maintenance of Psychosocial Functioning
F321	Nasogastric Tubes
F322	Nasogastric Care
F323	Accident Environment
F324	Accident Prevention

F240	Quality of Life
F241	Dignity
F242	Self-Determination/Participation
F243	Resident and Family groups
F244	Listen to Group
F245	Participate in Other Activities
F246	Accommodate Needs

FTAG	Description
F332	Medication errors
F333	Significant Medication Errors

Nursing Service

F353	Sufficient Nursing Staff
F354	Registered Nurse Staff

Dietary Services

F360	Well-Balanced Diet
F361	Qualified Staff
F362	Sufficient Staff
F363	Menus and Nutritional Adequacy
F364	Food
F365	Individual Needs
F366	Food Substitutes
F367	Therapeutic Diets
F368	Frequency of Meals
F369	Assistive Devices
F370	Sanitary Conditions
F371	Food Sanitation
F372	Garbage Disposal

Physician Services

F385	Physician Supervision
F386	Physician Visits
F387	Frequency
F388	Physician Alternates
F389	Availability
F390	Physician Delegation of Tasks

Rehabilitative Services

F406	Services
F407	Qualifications

Dental Services

F411	Routine and Emergency Service (SNF)
F412	Routine and Emergency Service(NF)

Pharmacy Services

F425	Pharmacy
F325	Nutrition
F326	Therapeutic Diet
F327	Hydration
F328	Special Needs
F329	Unnecessary Drugs
F330	Antipsychotic Drugs
F331	Drug Reduction

FTAG	Description
F445	Linens

Physical Environment

F454	General Health and Safety
F455	Emergency Power
F456	Space and Equipment
F457	Resident Rooms
F458	Room Space
F459	Exits
F460	Privacy
F461	Windows
F462	Toilets
F463	Resident Call System
F464	Dining and Activities
F465	Other Environment Condition
F466	Emergency Water
F467	Ventilation
F468	Equipment in Corridors
F469	Pest Control

Administration

F490	Administered Effectively
F491	Licensure
F492	Compliance With Laws
F493	Governing Body
F494	Required Training
F495	Employee Competency Program
F496	Registry Verification
F497	In-service Education
F498	Proficiency of Nurse Aides
F499	Qualified Professionals
F500	Outside Services
F501	Medical Director

Laboratory Services

F502	High Quality, Timely Services
F503	Meets Lab Standards
F504	Services Ordered by a Physician
F505	Notifies Physicians
F507	Clinical Records

F426	Procedure
F427	Service Consultation
F428	Drug Regimen
F429	Report Irregularities
F430	Facility Action
F431	Labeling
F432	Storage

Infection Control

F441	Infection Control
F442	Preventing Spread of Infections
F443	Direct Contact
F444	Hand washing
F508	Radiology and Other Services
F511	Radiology Notification of Physician
F513	Records Signed and Dated

Other Activities

F514	Clinical Records
F516	Records Safeguarded
F517	Plan for Emergency
F518	Emergency Training
F519	Transfer Agreement
F520	Quality Assurance Committee
F521	Quality Assurance Activities
F522	Disclosure of Ownership

Source:

Nursing Facilities, Staffing, Residents and Facility Deficiencies, 1998-2004 (Harrington et al., 2005)

Table A4: Does Bad/Good Quality Motivate States to Adopt Report Cards?

Dependent Variable= Report Card Adoption

	(1)	(2)	(3)	(4)	(5)	(6)
Deficiency Citations per Facility	-0.005		0.005	0.004	0.019	0.002
	(0.067)		(0.070)	(0.071)	(0.075)	(0.082)
Nursing Hours per Resident Day		-0.108	-0.114	-0.121	0.165	0.324
		(0.244)	(0.260)	(0.260)	(0.301)	(0.359)
Democratic/Republican Party in Power				0.16	0.158	0.146
				(0.368)	(0.393)	(0.444)
Income per Capita					0.109**	0.074
					(0.052)	(0.060)
Unemployment					-0.246	-0.434
					(0.208)	(0.274)
Population (Over 65)						1.299***
						(0.453)
Pseudo R2	0.0001	0.003	0.003	0.006	0.097	0.320
N	51	51	51	51	51	51

* p<0.10, ** p<0.05, *** p<0.01

Notes:

a. This table is used to verify econometrically that the decision of adopting report cards in each state is not significantly correlated with quality itself or with unobserved factors affecting quality and the adoption of report cards. This helps to rule out the main endogeneity issue related to quality.

b. I use the state average of *Deficiency Citations per Facility* and *Nursing Hours per Resident Day* in 1998 to help assess different aspects of quality. These two measures are observed by state governments when they make decisions on report card adoption. In Columns (1) through (3), neither of these two measures shows a significant correlation to the adoption of report cards.

Table A5: Changes of Citation Composition between Different Groups

	Newly Disclosed	Previously Disclosed	Between-Group Difference	Differences-in-Differences
Share of Citations	**Number of Citations in Group C over All Citations**			
2001	0.61	0.61	0.00	0.04
2003	0.63	0.60	0.04	(0.01)
Level of Citations	**Number of Citations in Group C**			
2001	4.49	4.57	-0.07	0.81
2003	4.60	3.86	0.74	(0.09)
Less Harm Citations	**Number of Less Harm Citations in Group C**			
2001	4.35	4.40	-0.05	0.75
2003	4.53	3.83	0.69	(0.09)

Standard deviations of differences are given in brackets

Notes:

Definitions for three variables describing the citation composition:
(See Table 4 for the classification of groups)

a. Share of Citations:
This variable measures the share of NHQI-unrelated citations

$$ShareofCitations = \left(\frac{\text{Num of Citations in Group C}}{\text{Total Number of Citations}} \right)$$

b. Level of Citations: the number of NHQI-unrelated citations (Group C)
c. Less Harm Citations: the number of NHQI-unrelated citations with less harm (a subset of Group C)

CHAPTER TWO

Ideals versus Dollars:

How Do Non-profits Respond to Quality Incentives?

I. Introduction

Do non-profit organizations behave differently from their for-profit counterparts in response to quality incentives? This paper investigates how non-profit firms, whose profits are not allowed by law to be distributed among shareholders, react to a quality information disclosure policy. This policy was designed to improve quality in nursing homes through mandatorily disclosing their quality information to the public, but resulted in an unintended multitasking problem: instead of increasing resources for quality improvement, profit-maximizing firms shifted resources away from unreported dimensions in order to show "nice" numbers on reported dimensions.[24] In this paper, I examine if non-profits whose organizational goals deviate from profit-maximizing will behave differently from for-profits in response to information disclosure.

To the best of my knowledge, this paper is the first attempt to investigate the effect of quality incentives on the behavior of non-profit organizations. I exploit a plausibly exogenous disclosure policy to test two different streams of theories about the behavior of non-profits, to detect the incentives of non-profits in face of information disclosure and then to assess the impact of disclosure on welfare in the non-profit sector. The response pattern of non-profits helps to shed light on the maximization problem[25] of a non-profit organization and is of

[24] See Epstein (1998), Harrington et al. (2003), Zinn (2005), Werner and Asch (2005), Lu (2008) and Norton et al. (2008). These papers discuss the potential problems of report cards in nursing homes.

[25] The maximization problem of a non-profit firm is undetermined theoretically. How non-pecuniary incentives enter into the value function of non-profits is still disputable. See Easley and O'Hara (1983) and Hansmann (1987).

importance to understand how financing means in non-profit organizations affect their corporate governance, especially organizational goals.

One stream of theories about non-profit behavior emphasizes non-pecuniary motives and regards non-profits as organizations with a strong sense of mission. Rose-Ackerman (1996) argues that decision makers in non-profits have an altruistic nature. Newhouse (1970) considers that non-profits maximize quality or quantity. Weisbrod (1989) views the non-profit ownership as a system rewarding quality that is hard to measure. If mission goals dominate in the maximization problem, then a non-profit firm will have few incentives to use the multitasking strategy in response to information disclosure because the marginal cost of betraying its ideals is much greater than the marginal benefit of multitasking.

An alternative stream of theories argues that profitability also plays an important role in determining the behavior of non-profits. The imperfect enforcement of the non-distribution of profits allows non-profit organizations to distribute "perquisites" (Glaeser and Shleifer, 1998). Some previous work regards a non-profit organization as a profit maximizing firm with cost advantage (Lakdawalla and Philipson, 2005). An extreme viewpoint even depicts non-profits as for-profit in disguise (Hirth, 1999; Brickley and Van Horn, 2002). Within this analytical framework, two different types of incentives will result in "teaching-to-the-test" behavior in non-profits:

- One type of incentive is related to the special financing means of non-profits: fund-raising from contributors. "No money, no mission". It is possible that concerns about losing potential contributors may motivate non-profits to show "nice" numbers publicly without necessarily improving overall quality.

- The other type of incentive is a result of market competition. Under certain circumstances, non-profits may mimic the behavior of for-profits when competing with them (Duggan, 2002). In other words, competition may eliminate performance differences among organizations with different ownerships (Picone et al 2002).

If non-profit firms care about their profits in some sense, it is hard to tell how responsive non-profits are as compared to their profit maximizing counterparts in reaction to information disclosure.

I explore a plausibly exogenous disclosure policy to test which stream of theories can better explain the behavior of non-profit organizations in the face of information disclosure. In 2002, the Center for Medicare and Medicaid Services (CMS) introduced a mandatory disclosure policy, the Nursing Home Quality Initiative (NHQI), publicly reported a set of comparable quality measures on some dimensions of quality of care. The decision about which quality measures were to be disclosed was hard for both nursing homes and the public to anticipate. Thus we have a testing ground to see how non-profits choose their service quality for both reported and unreported dimensions.

The empirical results in the first set show that secular non-profits are as responsive as for-profits in response to quality incentives, while religious ones are significantly less responsive than for-profits. After the NHQI policy was implemented, the number of deficiency citations along the unreported dimensions increased significantly more than that along the reported dimensions in for-profit nursing homes. The response pattern of secular non-profits is quite similar to that of for-profits, while religious nursing homes are less likely to shift the citation composition in favor of problems not included in the NHQI quality measures. The results of

secular non-profits provide evidence against the theories that suggest that non-profits may have few incentives for "teaching-to-the-test" in response to quality information disclosure.

In the second set of empirical results, I investigate how the role of contributions affects the behavior of non-profits in the face of information disclosure. My findings reveal that secular non-profits which regards contributions as an important financing means are more likely to shift the citation composition in favor of multitasking than the other secular non-profits. The secular non-profit results support the contributor effect, e.g., that non-profits may use a multitasking strategy because of concerns about losing potential contributors. However, the contributor effect fails to explain the behavior of religious non-profits.

I examine if non-profits would have similar behavior as for-profits when they are in a market with high for-profit penetration. Hitherto, there has been no evidence that either type of non-profit mimics the "teaching-to-the-test" behavior of for-profits when competing with them.

Taken together, the two sets of results about secular non-profit nursing homes support the theories which views non-profits as profit-appropriators and predicts that the pressure from losing potential contributors may cause non-profits to have the "teaching-to-the-test" behavior. The results of religious non-profits suggest that religion may soften economic motivations and deter firms from multitasking in response to information disclosure. I thus infer that the stream of theories that regards non-profits as mission-dominated decision makers may better explain the behavior of religious nursing homes.

My final set of empirical results shows that the introduction of the NHQI policy is not associated with any changes in nursing inputs or firm profits in the non-profit sector. Considering that the nursing home market is dominated by public payers (Mukemel and Spector, 2003), prices may not significantly change due to the disclosure policy. Without taking into

account the cost for the CMS to disclose the NHQI quality measures, I estimate that the introduction of the NHQI has little impact on welfare improvement in the non-profit sector.

II. The Behavior of Non-profits under Information Disclosure

There are many ways to approach the behavior of non-profit organizations. In this paper, I only focus on one aspect, how non-profits respond to information disclosure.

The legal distinction between for-profit and non-profit organizations lies in the distribution of accounting profits (Sloan, 2000). The constraint of the non-distribution of profit complicates the organizational goals of a non-profit firm. Some theories emphasize its mission goal while others remind us not to overlook its motive for profitability. Different theories may generate different predictions about non-profit behavior in response to information disclosure. This paper is the first attempt to understand the disclosure reaction of non-profits from the perspective of organizational goals.

A. Mission-dominated Decision-makers

One stream of non-profit theories emphasizes mission goals. The decision-makers of non-profit organizations may have a strong sense of mission, and their utility function may depend on the satisfaction gained from the realization of mission or the good reputation and prestige that result from their charitable behaviors. Rose-Ackerman (1996) describes non-profits as ideological entrepreneurs with altruistic motives. Newhouse (1970) proposes that non-profits may maximize quantity and quality, subject to break-even budget constraint. Motivated by the example of blood donation, Weisbrod (1989) describes non-profits as systems for rewarding hard to measure performance. These theories agree that non-pecuniary motives make non-profits more

trustworthy than for-profits, especially for those dimensions that are hard to measure. For simplicity's sake, I group these theories together under the rubric of *mission dominated* theories.

If the mission dominates the other goals in the maximization problem, then a non-profit firm will be less responsive than a for-profit to quality information disclosure. When quality information on some dimensions is released to the public, non-profits may have few incentives to divert resources away from the unreported dimensions as compared to their profit-maximizing counterparts. The underlying rationale is that the marginal cost of teaching-to-the-test, which hurts the mission value of a non-profit firm, is larger than the marginal benefit from showing "nice" numbers to the public.

B. Profit-appropriating Decision-makers

The other stream of theories regards non-profit organizations as profit-appropriators with a weak sense of mission. Though they are forbidden to distribute profit among their shareholders by law, non-profits can actually game with this constraint. Instead of obtaining profit, decision-makers may get some perquisites (Gleaser and Shileifer, 1998). They solicit donations from the communities and lobby governments for grants. As such, they may be viewed as a profit-maximizing firm with cost advantage (Lakdawalla and Philipson, 2005). These theories highlight the fact that non-profit organizations may have pecuniary incentives as well. Under certain circumstances, profitability may also influence non-profits' choices of quality and sometimes even determine their behavior.

When the profitability goal plays an important role in the maximizing problem of non-profits, two effects may cause a non-profit firm to take the "teaching-to-the-test" strategy in response to information disclosure.

One effect is related to the role of contributions, one of the means by which non-profits finance themselves. As we know, many non-profit organizations rely heavily on donations from society and grants from the government for their daily operation. "No money, no mission" (Hansmann, 1990). Contributions to a non-profit firm are important for its sustainable development. According to a 2004 IRS report, the amount of contributions accounted for 21.6% of total revenues, on average, in non-profit charitable organizations (Arnsberger, 2007).

Mandatory disclosure may cause non-profits to worry about their scores. They are afraid that contributors may be sensitive to the scores. The ugly numbers may reduce the amount of money they collect and deter potential contributors from donating. The possible pressure from contributors gives non-profits great incentives to behave in a "teaching-to-the-test" way.

The other effect comes from market competition with for-profit firms. Non-profits may mimic the behavior of for-profits when competing with them (Duggan, 2002). When quality information on some dimensions is disclosed, a profit-maximizing firm takes the "teaching-to-the-test" strategy by shifting resources away from the unreported dimensions. The pressure from market competition with for-profits may lead a non-profit organization to behave the way a profit-maximizing firm does. In other words, competition may eliminate performance differences among organizations with different ownerships (Picone et al., 2002).

If either of these two effects holds, then information disclosure may motivate a non-profit firm, with a tendency to appropriate profits, to behave in a "teaching-to-the-test" way by shifting resources away from the unreported dimensions to the reported ones[26]. And, it is hard to tell how responsive these profit appropriators are, in response to information disclosure, compared to their profit-maximizing counterparts.

[26] For a description of multitasking, see Kerr (1975), Holmstrom and Milgrom (1991) and Baker (2002)

III. Data Setting

A. The Disclosure Policy

In November 2002, the CMS launched a mandatory disclosure policy, the NHQI, which publicly reports information on ten quality measures of Medicare and Medicaid-certified nursing homes,[27] at the website of the Nursing Home Compare (NHC). To help raise awareness of the NHQI throughout the country, the CMS ran informational advertisements (in English and Spanish) in 71 major daily newspapers on November 13, 2002. During this time, there was no adverse news about quality in nursing homes reported locally and nationwide.[28]

In this study, I take advantage of this information shock to investigate how non-profit firms respond to quality information disclosure. In particular, the released quality information is about multiple dimensions. The decision on which dimensions to be disclosed could neither be predicted by nursing homes nor expected by the public. This creates a testing ground which allows us to observe how quality along reported and unreported dimensions changes.

B. Data

I use the SNF Cost Reports and the Online Survey, Certificate and Report (OSCAR) data . The SNF Cost Reports are available from the CMS website. The cost reports provide information regarding each nursing home's financials including information on contributions. The OSCAR data are available annually on the website of Nursing Home Compare. The facility-level dataset contains detailed information about the service mix, size, staffing, deficiency citation and type of ownership.

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[27] In April 2002, the Centers for Medicare & Medicaid Services (CMS) launched a six-state pilot in Colorado, Florida, Maryland, Ohio, Rhode Island and Washington.

[28] I searched some news banks (Proquest, the New York Times, CNN and Fox News) and did not find adverse news during the period when the NHQI was introduced.

As we know, some states have already released quality information on nursing homes in their states before the introduction of the NHQI. To help understand the effect of information disclosure in a clear way, this empirical analysis only focuses on the nursing homes in those states without any form of information disclosure before 2002. Table A1 shows the list of those states (Kelley, 2003; Castle and Lowe, 2005).

I match the two datasets together and exclude any nursing home satisfying any of the following conditions: (1) it did not exist before 2002; (2) it no longer existed after 2002; or, (3) it converted its ownership type in the years from 2001 to 2003. As a result of these conditions/exclusions, there are 5,154 nursing homes covering six years from 2000 to 2005 in my sample. Based on the information of 2001,[29] 3,838 are for-profits (FP), 293 are church-owned non-profits (Religious NFP), 839 are private secular non-profits (Secular NFP) and 184 are owned by government (GOV). Non-profit firms account for about 22% of the nursing homes in the sample.

C. Changes in the Deficiency Citation Composition

I also use the deficiency citation file in the OSCAR data. This file annually records the deficiencies each nursing home made at the citation level. Every year, an inspection team will randomly visit a nursing home. They have a checklist of quality dimensions. If quality of a certain dimension does not satisfy the minimum quality requirements, then a deficiency citation will be issued to that dimension.

This deficiency citation file provides detailed quality information on about 190 dimensions including those dimensions quantified by the NHQI quality measures. In Lu (2008), I explore the

[29] Some nursing homes converted their ownership in very early or later years.

relationship between the NHQI quality measures and deficiency citations to document the evidence for the multitasking behavior of for-profits. In that paper, I classify the deficiency citations into two groups. One group, the "reported" group, includes those citations that are overlapping with or complements to the dimensions quantified by the NHQI quality measures. The other group, the "unreported" one, includes those citations that are substitutes for the reported ones. The paper goes on to describe further details about the classification of deficiency citations and to conclude that the introduction of the NHQI is associated with the shift of citation composition in favor of multitasking.

In this paper, I use the deficiency citation classification described in Lu (2008) to investigate the disclosure reaction of non-profit organizations. Figure 1 depicts the trends of the number of deficiency citations for the "reported" and the "unreported" groups. It shows that the number of deficiency citations on the reported dimensions remains flat throughout, while that on the unreported dimensions is flat before 2002, the year when the NHQI was implemented, but then goes significantly upward. Table 1 provides the information on citation composition by ownership type. As we can see, all types, except for church-owned non-profits, have similar trends, in that the number of citations on the unreported dimensions increases more than that on the reported ones after the introduction of the NHQI.

IV. Do Non-profits Exhibit the "Teaching-to-the-test" Behavior?

Information disclosure may motivate a profit-maximizing firm to use the multitasking strategy. Such firms may shift resources away from the unreported to the reported dimensions. Without considering vertical differentiation, we would expect that quality improves along the reported dimensions and diminishes along the unreported ones. When considering vertical

differentiation, we should be aware that disclosed quality might not necessarily become better (Tirole, 1988). Nevertheless, at least, we could expect that quality on the unreported dimensions gets relatively worse than on the reported ones.

In this section, I first document the empirical evidence showing that citation composition shifts in favor of problems not included in reported NHQI quality measures. Then, I construct a variable measuring citation composition. Finally, I use this new variable to test if non-profits are less responsive to information disclosure than for-profits in shifting citation composition.

A. The "Teaching-to-the-test" Behavior

Both Figure 1 and Table 1 suggest that the introduction of the NHQI is associated with more deficiency citations along the unreported dimensions and no changes in citations along the reported ones. In this subsection, I verify the shift of citation composition by running the following specification:

$$CITATIONS_{ijt} = \alpha + \sum_{t=2000}^{2005} \beta_t * REPORTED_i * YEAR_t + \gamma X_{ijt} + REPORTED_i + YEAR_t + HOME_j + \varepsilon_{ijt} \quad (1)$$

Here, the dependent variable $CITATIONS_{ijt}$ refers to the number of deficiency citations in group i in nursing home j at time t. *REPORTED* is a binary variable that equals 1 for the reported group and 0 for the unreported group. X includes some time-varying firm characteristics: the number of beds (*BEDS*) and the proportion of Medicaid residents (*MEDICAID*). βs capture the differences of changes in citations between the reported group and the unreported group year after year. I also control for group effects, year effects and nursing home specific effects.[the group effects, the year effects and the nursing home specific effects.]ε is the error term. I normalize the year

2002 when the NHQI was implemented as the reference year. A correction of standard deviations based on asymptotic approximation of an arbitrary variance–covariance matrix is adopted (Bertrand et al., 2004).

Columns (1) and (2) of Table 2 summarize the trend of the shift of citation composition from 2000 to 2005. The insignificance of the βs of 2000 and 2001 indicates that the trend is flat before the introduction of the NHQI. After 2002, the coefficients of βs are negative and significant. Column (3) presents the result from a difference-in-difference specification. The difference-in-difference coefficient is -0.311 at the one percent significance level. It means that the citation composition shifts in such a way that the number of deficiency citations in the unreported group significantly increases by 0.311 relative to that in the reported ones after the introduction of the NHQI. Columns (4) and (5) show similar results, using a subsample that includes only for-profit nursing homes.

These results combined with those depicted in Figure 1 indicate two important facts. First, the changes in sign and the significance of βs over the years suggest that the introduction of the NHQI is econometrically exogenous. Second, the negative βs after 2002 show that the citation composition shifts in favor of problems not included in reported NHQI measures. Both facts together imply that the release of quality information results in the "teaching-to-the-test" behavior in nursing homes, especially in the case of for-profit facilities.

B. Measuring Citation Composition

Based on the changes in deficiency citations in different groups, I construct a new variable to measure citation composition: the share of the unreported citations (*UR-Share*). This variable is

equal to the number of citations on the unreported dimensions divided by the total number of deficiency citations.

$$UR\text{-}Share_{jt} = \frac{Unreported\ Citations_{jt}}{Total\ Citations_{jt}} \qquad (2)$$

Thus, the higher the share of the unreported citations in a firm, the fewer the resources allocated to the unreported dimensions. The underlying assumption is that, without the implementation of the NHQI, the allocation of resources for a firm would remain unchanged and the share of the unreported citations would stay constant.

For the purpose of identification, I take advantage of the within-firm time variation in the share of the unreported citations. However, this variable is not perfect for measuring the multitasking behavior of firms. It has two main limitations.

First, this variable cannot rule out the possibility that, after the implementation of the NHQI, inspectors might be more demanding on the unreported than the reported dimensions. This effect will bias the estimation. Regarding this issue, I introduce for-profits as the control group in the estimation to cancel out the effect of such changed inspector behavior.

Second, two firms with the same share of the unreported citations may have different strategies for allocating resources across groups. One certainty is that, if the share of the unreported citations increases in a firm, then resources allocated to the dimensions in the unreported group are reduced relative to the reported group. To reduce potential bias from the measurement error, I control firm specific effects and some time-varying firm characteristics in the specifications.

As Table 2 shows, for-profit nursing homes significantly increase the deficiency citations on the unreported dimensions. In Figure 2, I set the trend of the share of the unreported citations in

for-profit nursing homes as the benchmark and compare it with the trends for both religious and secular non-profits. Clearly, the secular non-profits have a trend very similar to that of for-profits while the religious non-profits have a very different trend from the benchmark. This indicates that secular non-profits may well have the "teaching-to-the-test" behavior in response to information disclosure.

C. Are Non-profits Less Responsive to Information Disclosure than For-profits?

I compare the "teaching-to-the-test" behavior of non-profits in response to information disclosure with that of for-profits. To do this, I separate the non-profit nursing homes into two groups. One group includes those church-owned nursing homes that may have a strong sense of mission. The secular non-profits are in the other group. Then I examine if religious and/or secular non-profits respond to information disclosure differently from their profit maximizing counterparts.

I use the difference-in-difference approach to investigate this issue. The for-profit nursing homes are treated as the control group. The estimation equation of primary interest is as follows:

$$\begin{aligned} UR\text{-}Share_{jt} = {} & \alpha + \beta * OWN_{jt} * NHQI_t + \gamma * BEDS_{jt} + \eta * MEDICAID_{jt} \\ & + \delta * OWN_{jt} + YEAR_t + HOME_j + \varepsilon_{jt} \end{aligned} \qquad (3)$$

Here $UR\text{-}Share_{jt}$ represents the proportion of the deficiency citations on the unreported dimensions received by nursing home j in year t. $Year_t$ is a year fixed effect and $Home_j$ is a nursing home fixed effect. OWN_{jt} refers to the ownership type. $NHQI_t$ is a binary variable capturing the timing of the adoption of the NHQI, which equals one if the NHQI takes effect. β captures the differences of changes in response to the NHQI between for-profits and the other ownerships. If $\beta<0$, it means that other ownerships increase the share of the unreported citations

less than for-profits after the introduction of the NHQI. I also include variables to control for a nursing home's resident mix (*MEDICAID*) and its size (*BEDS*). Summary statistics for all of these variables are provided in Table A2.

Column (1) and (2) of Table 3 treat all non-profits as a whole and summarize the observations/findings that non-profits do not respond to the NHQI very differently from for-profits, as the trivial and insignificant coefficient of NFP*NHQI suggests. Column (3) and Column (4) separate non-profits into two types of ownership: religious NFP and secular NFP. The coefficient of NPS*NHQI is close to zero and insignificant, which means that there are no corresponding differences between secular non-profits and for-profits in response to the NHQI as a result of shifting citation composition.[30] The results are consistent with Figure 2 in that non-profits and for-profits have the similar upward trend in the share of the unreported citations.

However, the church-owned non-profits have a different response pattern. The negative and significant coefficient of NPR*NHQI shows that the religious non-profits are less responsive to the NHQI than for-profits in shifting citation composition. The results suggest that religious nursing homes may be less likely to shift resources in response to information disclosure than those profit-maximizing firms.

To summarize, the results for secular non-profits provide evidence against the "mission-dominated decision makers" theory. The insignificant difference between secular non-profits and for-profits suggests that secular non-profits may well take the "teaching-to-the-test" strategy in response to information disclosure and may not assign great weight to their mission in their maximization problem. The results for religious non-profits provide preliminary support for the

[30] Duggan (2000) uses a plausibly exogenous financial incentive policy to test the ownership differences between for-profits and secular non-profits. He also finds that the behavior of secular non-profits is quite similar to that of for-profits.

belief that a religious orientation may lead to the development of new motivations and moral activities that differ from the economic incentives (Weber, 1905; Eisenstadt, 1968).

V. The Incentives of Non-profits in Response to Information Disclosure

In the literature, a non-profit organization is traditionally viewed as a profit deviator, who is willing to sacrifice profit for quality or consumer wellbeing (Newhouse, 1970; Weisbrod, 1989). One may wonder what motivates a profit-deviating firm to reallocate resources in the face of information disclosure. As we know, a profit-maximizing firm may use the "teaching-to-the-test" strategy because of cost minimization and pressure from consumer demand (Lu 2008). However, the incentives for a non-profit firm in response to information disclosure are complicated because its maximization problem is unclear.

To understand the multitasking incentives of non-profits, I adopt the assumption that non-profit organizations have two major goals: mission and profitability (Weisbrod, 2008). When the marginal benefit (increasing profitability) from multitasking is greater than the marginal cost (hurting the mission), a non-profit firm may shift resources away from the unreported dimensions to the reported ones. As such, the number of citations on the unreported increases compared to that on the reported ones and the share of the unreported citations becomes larger.

In this section, I decompose the incentives for profitability in a non-profit organization into two effects, the contributor effect and the for-profit penetration effect, so as to better understand the behavior of non-profits under information disclosure. In the contributor effect, pressure from contributors may constitute a substitute for pressure from consumer demand. The for-profit penetration effect suggests that non-profits may mimic the behavior of for-profits when

competing with them. For secular non-profits, the empirical results support the contributor effect but not the competition effect. For religious non-profits, neither effect is supported

A. The Contributor Effect

Raising funds from contributors is one of the important financing means in the non-profit sector. Every year, many non-profit firms spend time and money raising funds from donors or local governments. Contributions helps to lower the costs of the non-profit firms and thus provide them with a competitive advantage over for-profit firms (Lakdawalla and Philipson, 2005). Contributions may also increase the "perquisites" for the people working for a non-profit when the constraint of the non-distribution of profit is imperfectly enforced (Glaeser and Shleifer, 2001).

The released quality information provides firms with an effective way of advertising. For example, many top business schools often show their rankings in *US News* or *Business Week* to the public so as to promote their reputation, which can benefit them with more donations. Nursing homes may use the NHQI quality measures to advertise themselves and compete for contributions from local communities or governments. Since they are afraid of losing potential contributors, they may have powerful incentives to show "nice" numbers to the contributors.

To investigate if the potential pressure from contributors motivates non-profits to reallocate resources in response to information disclosure, I run the following specification by ownership type:

$$\begin{aligned} UR\text{-}Share_{jt} = {} & \alpha + \beta * DONATION_j * NHQI_{jt} + \gamma * BEDS_{jt} \\ & + \eta * MEDICAID_{jt} + YEAR_t + HOME_j + \varepsilon_{jt} \end{aligned} \qquad (4)$$

Here, $DONATION_j$ is a dummy variable that equals 1 if a nursing home seeks contributions before 2002, and 0 otherwise.[31] I interact it with $NHQI_{jt}$ so as to see how information disclosure affects the behavior of non-profits with contributions relative to those without contributions. If β appears to be positive, it means that non-profit nursing homes with contributions are more likely to shift citation composition than those without contributions after the introduction of the NHQI. All the other variables remain the same as Equation (3).

The results of Table 4 show that, after the NHQI was implemented, secular non-profits with contributions increase the share of the unreported citations more than those without. The coefficient of the *DONATION*NHQI* in Column (1) is 0.051 at the one percent significance level. This means that the introduction of NHQI is associated with a 5.1% higher share of the unreported citations in the secular non-profit nursing homes with contribution management than those without such management.

Column (2) gives information about whether nursing homes accepting contributions are more financially constrained. Financial constraints might also result in shifting resources. I include the debt asset ratio (*DEBT/ASSET*) to control this effect. The coefficient of the *DONATION*NHQI* remains positive and significant.

Column (3) addresses the possibility that nursing homes with contributions may be located in a more competitive market. Competition might change the behavior of non-profits. I define the boundary of a market based on the definition of the Health Service Area and calculate the

[31] The information about the amount of contributions received and the cost of fund raising is available in the cost reports. I regard a nursing home that spends money to raise funds and also gets contributions as a facility seeking contributions.

Herfindahl Index (*HHI*) for each market[32]. Controlling the competition effect, I still obtain the positive and significant coefficient for the *DONATION*NHQI.*

Columns (4) and (5) include all the controls for the robustness check. Column (6) compares the difference of the share of the unreported citations (*UR-share*) between nursing homes with and without contributions year by year. It shows that the differences before 2002 are small and insignificant and become large and significant, starting in 2003. This trend reinforces the notion that the introduction of NHQI is exogenous statistically and that non-profit nursing homes with contributions are more responsive to the NHQI, in terms of "teaching-to-the-test," than those without such contributions.

Columns (7) and (8) use religious non-profits as the sample. The results make a dramatic contrast to those of secular non-profits. The coefficient of the *DONATION*NHQI* is close to zero and insignificant. And there are no significant differences between church-owned nursing homes with and without contributions year by year.

Based on the analysis above, I conclude that secular non-profits may teach to the test in response to information disclosure because they are concerned that contributors may be aware of those particular quality measures. However, the contributor effect in response to the NHQI is not that significant for religious non-profit nursing homes.

B. The For-profit Penetration Effect

Non-profits may mimic the behavior of nearby for-profits. The existing literature suggests that the presence of for-profit hospitals in a market may affect the behavior of non-profits (Cutler and Horwitz, 1998; Silverman and Skinner, 2001). Duggan (2002) demonstrates that the

[32] To obtain the Herfindahl Index, I use all the nursing homes in each market. The sample includes all kinds of nursing homes, such as hospital-based nursing homes and so on, which is larger than what I used in this paper.

behavior of private non-profits is systematically related to the share of nearby for-profits and non-profits may mimic the behavior of for-profits when competing with them.

I use the specification proposed by Duggan (2002) to investigate if the behavior of non-profits in response to information disclosure is influenced by nearby for-profits. Here, the fraction of for-profits ($FRAC_{01}$) is measured by the number of for-profits over all nursing homes within five miles of each facility.[33] I define the variable $\Delta UR\text{-}Share_{02\text{-}05}$ to be the change in the share of deficiency citations on the unreported dimensions from 2002 to 2005. I also include $\Delta UR\text{-}Share_{00\text{-}02}$ to control the pre-existing trend in the home-specific citation composition.

As we know, a nursing home's type of ownership is endogenous. There is also the concern that some unobserved factors that cause the entry of for-profits to a particular market may also lead other firms to behave differently from those of the same ownership type in a market with relatively few for-profits. In this paper, I exploit an information shock, the introduction of NHQI, to deal with this identification problem.

Table 5 shows no evidence that the penetration of for-profit nursing homes motivates non-profits to mimic the "teaching-to-the-test" behavior. Columns (1) - (4) consistently show that there is no significant correlation between the fraction of for-profit penetration and the shift of citation composition in either religious or secular non-profits. Columns (5) and (6) replace $\Delta UR\text{-}Share_{02\text{-}05}$ with $\Delta UR\text{-}Level_{02\text{-}05}$, the change in the number of the citations on the unreported dimensions from 2002 to 2005, for the robustness check. The results of Table 5 suggest that competition with for-profits does not cause either religious or secular non-profit nursing homes to shift resources in response to information disclosure.

[33] I also tried the alternative market definitions, including the fraction within ten miles of the nursing home or the share within each nursing home's county. The results remain unchanged.

To summarize, all the results for secular non-profits support the "profit-appropriating decision-makers" theory. Secular non-profits may assign a significant weight to the profitability goal in their maximization problem and the motivation for contributions encourages them to adopt the "teaching-to-the-test" strategy. The results for religious non-profits in this section do not support both the contributor effect and the for-profit penetration effect. The rejection helps to rule out the alternative "profit-appropriating decision-makers" hypothesis for religious non-profits. From the results in section IV and V together, I infer that the behavior of religious non-profits is consistent with the "mission-dominated decision makers" theory. The dominating sense of mission in their maximization problem may help to deter their multitasking behavior.[34]

VI. The Real Response of Non-profits

In this section, I document some evidence about the real response of non-profits under information disclosure. I ask two questions. First, does information disclosure motivate non-profit nursing homes to increase quality related inputs? Second, do non-profits benefit from information disclosure? The answers to these two questions can help us to get some insight into the impact of information disclosure on social welfare in the non-profit sector.

A. The Impact on Nursing Inputs

Quality in the nursing home industry is mainly based on what nurses do on a day-to-day basis. Nurses are responsible for taking care of the health and life of the elderly. There are significant correlations between quality and nursing inputs in nursing homes (Gambassi et al., 1999;

[34] The difference in behavior between secular and religious non-profits on the unreported dimensions is consistent with the findings provided by Weisbrod and Schlesinger (1986) as applied to a different setting.

Harrington et al., 2000, 2001, 2003). Understanding the changes in nursing inputs can help us to better understand the behavior of non-profits and the impact of disclosure on quality.

To investigate if non-profits change their nursing inputs, I use the following specification:

$$Y_{jt} = \alpha + \beta_1 * DONATION_j * NHQI_{jt} + \beta_2 * NHQI_{jt} + \gamma * BEDS_{jt} + \eta * MEDICAID_{jt} + STATETREND_{jt} + HOME_j + \varepsilon_{jt} \quad (5)$$

Here, the dependent variable Y_{jt} refers to the daily nursing hours per resident at nursing home *j* in year *t*. β_1 captures the difference between nursing homes with and without contributions. If $\beta_1 > 0$, it implies that the introduction of NHQI is associated with more nursing inputs in facilities with contributions than those without. β_2 summarizes the change of nursing inputs in the non-profits without contributions due to the implementation of NHQI. I also control time-varying facility characteristics and facility specific effects. To avoid the multicolinearity problem between the *NHQI* and year specific effects, I replace the year dummies with the year trend in each state (*STATETREND*). ε is the error term.

Columns (1)-(4) of Table 6 use secular non-profits as the sample and consider different specifications with and without controlling for year-specific effects. The results are quite robust. The insignificance of the coefficient on the *NHQI* indicates no change in the daily nursing hours per resident in the non-profits without contribution after the introduction of NHQI. The coefficient of the *CONTRIBUTION*NHQI* is small, negative and insignificant, which suggests that there is no difference in nursing inputs between non-profits with or without contributions. Moreover, the F test for $\beta_1 + \beta_2$ is insignificant. Columns (5)-(8) show a similar response pattern in nursing inputs, using religious non-profits as the sample.

The results shown in Table 6 substantiate two findings. First, after the introduction of the NHQI, there is no evidence that non-profits of both ownership types increase nursing inputs, and,

second, there is no significant difference between non-profits with or without contributions in nursing inputs.

B. The Impact on Financials

I also examine some financial evidence to see if non-profits benefit from information disclosure. Table 7 shows the changes in financials in response to information disclosure for both types of non-profits.

On the revenue side, there is no evidence that secular non-profits increase their total revenue due to the NHQI policy. The church-owned non-profits reduce their revenue by 10.4% at the ten percent significance level. More interestingly, for both type of facilities, those with contributions earn significantly more than those without On the direct cost side, secular non-profits decrease their costs by 11% while there is no change in religious non-profits. There is no significant difference in cost reduction between facilities with and without contributions..

On the profitability side, there is no significant evidence that both types increase their profits after the introduction of the NHQI. The opposite signs of the coefficients for both types indicate that secular non-profits are slightly more profitable than religious ones.

The picture of changes in financials across types of ownership and contribution status shows that secular non-profits spend less on their direct costs, while religious non-profits earned less revenue after the NHQI was implemented. We can thus infer that religious non-profits may be slightly more altruistic than secular ones in dealing with incentives resulting from an information shock.

C. Interpretation

The results concerning nursing inputs and financial outcomes have three interesting implications.

First, the fact that there is no change in nursing inputs is consistent with both theories. If non-profit firms have a strong sense of mission, information disclosure may have little influence on their nursing input. Their altruistic nature may deter them from gaming with information asymmetry. Their behavior remains the same with or without information disclosure.[35] For this reason, one would expect to see no changes in nursing inputs in religious nursing homes. Similarly, if profitability is of importance in non-profit nursing homes, cost minimization would cause non-profits not to increase nursing inputs. It is not surprising to see no evidence that non-profits increase staffing hours for their residents.

Second, the triviality of the differences in nursing inputs and direct costs between secular non-profits that do or do not receive contributions further supports the contributor effect. As shown above, concerns about losing potential contributors encourage secular non-profits to play the "teaching-to-the-test" game. Instead of increasing quality-related resources, they may shift resources away from the unreported dimensions to the reported ones. If this is the case, the change of quality-related inputs in firms with contributions would be expected to be the same as that in those firms without contributions.

Third, there is no sign of improvement in quality and welfare in the non-profit sector. The introduction of the NHQI did not bring about changes in quality improvement. Many papers about nursing homes use staffing as the measure for quality. High quality is associated with more

[35] Chou (2002) argues that those theories based on non-profits' altruistic nature do not consider the problem of information asymmetry. This point is another possible explanation of why information disclosure may have no effect on those non-profits with a strong sense of mission.

nursing hours per resident.[36] I find no evidence that non-profits increase staffing for their residents. As far as consumer welfare is concerned, as shown in Figure 1 and Table 2, is that the total number of deficiency citations increases after 2002. Given that the nursing home market is dominated by public payers (Mukemel and Spector, 2003), price may not change significantly after the introduction of the NHQI. From the insignificant changes in both price and quality, we may infer that the introduction of the NHQI may not have improved consumer welfare.

Non-profit nursing homes also do not greatly benefit from the release of the NHQI quality measures. The financial outcomes suggest that there is no evidence that non-profit nursing homes increase their profit significantly. Without considering the cost for disclosing quality information by the CMS, I estimate that the total welfare in the non-profit sector may not have improved after the NHQI was implemented.

VII. Conclusion

This study exploits an exogenous information shock to examine if non-profit organizations adopt the "teaching-to-the-test" strategy in response to quality information disclosure. I use two competing theories to interpret the behavior of non-profits. My findings about religious non-profits support the "mission-dominated decision makers" theory that an altruistic nature may deter non-profits from playing multitasking tricks. In contrast, the behavior of secular non-profits can be better explained by the "profit-appropriating decision-maker" theory that non-profits with a strong tendency for profitability may encourage the "teaching-to-the-test" behavior.

In particular, I explore the role of contributions in non-profit organizations. The results support the contributor effect that concerns about losing potential contributors may induce

[36] See Munroe (1990), Braun (1991), O'Neill et al. (2003), Bates-Jensen et al. (2004), Schnelle (2004), Schnelle et al. (2004) and McGregor et al. (2005).

secular non-profit nursing homes to adopt the multitasking strategy. But this effect fails to explain the behavior of religious non-profits. Moreover, there is no evidence that supports the for-profit penetration effect that non-profits may mimic the multitasking behavior of for-profits when competing with them.

In the final section of this paper, I examine the impact of disclosure on nursing inputs and financials in non-profit nursing homes. I find no evidence that non-profit nursing homes increase their nursing inputs after the introduction of the disclosure policy. The results are consistent with the two competing theories. Religious non-profits have no need to change inputs, thanks to their altruistic nature, while secular non-profits have few incentives to increase inputs because of cost minimization. I thus infer that the disclosure policy may not necessarily encourage non-profits to improve overall quality. I also find that non-profit nursing homes do not benefit from the implementation of the NHQI and there is no sign of welfare improving in the non-profit sector.

Taking all the results together, the findings suggest that organizational goals other than profit maximization may not successfully prevent firms from distorting the released quality measures. Only non-profit organizations with strong mission-based motivations, such as church-owned firms, might be immune from taking the multitasking trick. Non-profit ownership may not be as trustworthy as it signals to the public.[37] The result can be applied to other sectors (i.e. hospitals, schools and day care) in which for-profit and non-profit firms coexist. Moreover, the result may have implications for other policies (i.e. pay-for-performance) that also give firms powerful incentives to adopt the multitasking strategy (Mullen et al., 2007).

An important contribution of this paper is to shed light on how contribution, as one of the major financing means in the non-profit sector, plays its role in corporate governance. In this

[37] Herzlinger (1996) is concerned that non-profit and government ownerships may make mistakes unknown to the public.

paper, I explore the impact of financing from contributors on the behavior of non-profits in response to quality information disclosure. The results show that non-profits do care about the advertising effect of public rankings on donors' decisions. A question that remains unanswered is if donors with different backgrounds would have different impact on corporate governance. This is left for future research.

References

Arnsberger, P. "Charities, Social Welfare, and Other Tax-Exempt Organizations, 2004." edited by Internal Revenue Service: Department of the Treasury, 2007.

Baker, G. "Distortion and Risk in Optimal Incentive Contracts." *Journal of Human Resources* 37, no. 4 (2002): 728-51.

Bates-Jensen, B. M., J. F. Schnelle, C. A. Alessi, N. R. Al-Samarrai, and L. Levy-Storms. "The Effects of Staffing on In-bed Times of Nursing Home Residents." *Journal of the American Geriatrics Society* 52, no. 6 (2004): 931-38.

Bertrand, M, E. Duflo, and S. Mullainathan. "How Much Should We Trust Differences-in-Differences Estimates?" *Quarterly Journal of Economics* 119, no. 1 (2004): 249-75.

Braun, B. I. "The Effect of Nursing-Home Quality on Patient Outcome." *Journal of the American Geriatrics Society* 39, no. 4 (1991): 329-38.

Brickley, J.A. and R. L. Van Horn. "Managerial Incentives in Nonprofit Organizations: Evidence from Hospitals." *Journal of Law and Economics*, vol. 45 (2002): 227-49

Castle, N. G., and T. J. Lowe. "Report Cards and Nursing Homes." *Gerontologist* 45, no. 1 (2005): 48-67.

Chou, S.Y. "Asymmetric Information, Ownership and Quality of Care: An Empirical Analysis of Nursing Homes." *Journal of Health Economics* 21, no. 2 (2002): 293-311.

Cutler, D and Horwitz, J. R. "Converting Hospitals from Not-for-Profit to For-Profit Status." In *NBER Working Papers*, 1998.

Duggan, M. "Hospital Ownership and Public Medical Spending." *Quarterly Journal of Economics* 115, no. 4 (2000): 1343-73.

———."Hospital Market Structure and the Behavior of Not-for-Profit Hospitals." *Rand Journal of Economics* 33, no. 3 (2002): 433-46.

Easley, D, and M. O'Hara. "The Economic Role of the Nonprofit Firm." 531-38: The RAND Corporation, 1983.

Eisenstatdt, S.N. *Max Weber on Charisma and Institution Building*. London: University of Chicago, 1968.

Epstein, A. M. "Rolling Down the Runway - The Challenges Ahead for Quality Report Cards." *Journal of the American Medical Association* 279, no. 21 (1998): 1691-96.

Gambassi, G., F. Landi, K. L. Lapane, A. Sgadari, V. Mor, and R. Bernabei. "Predictors of Mortality in Patients with Alzheimer's Disease Living in Nursing Homes." *Journal of Neurology Neurosurgery and Psychiatry* 67, no. 1 (1999): 59-65.

Glaeser, E. L., and A. Shleifer. "Not-for-Profit Entrepreneurs." *Journal of Public Economics* 81, no. 1 (2001): 99-115.

Hansmann, H. *Economic Theories of the Nonprofit Sector*. New Haven: Yale University Press, 1987.

———. "Why Do Universities Have Endowments?" 3-42: The University of Chicago Press, 1990.

Harrington, C., J. O'Meara, M. Kitchener, L. P. Simon, and J. F. Schnelle. "Designing a Report Card for Nursing Facilities: What Information Is Needed and Why." *Gerontologist* 43 (2003): 47-57.

Harrington, C., and J. H. Swan. "Nursing Home Staffing, Turnover, and Case Mix." *Medical Care Research and Review* 60, no. 3 (2003): 366-92.

Harrington, C., S. Woolhandler, J. Mullan, H. Carrillo, and D. U. Himmelstein. "Does Investor Ownership of Nursing Homes Compromise the Quality of Care?" *American Journal of Public Health* 91, no. 9 (2001): 1452-55.

Harrington, C., D. Zimmerman, S. L. Karon, J. Robinson, and P. Beutel. "Nursing Home Staffing and Its Relationship to Deficiencies." *Journals of Gerontology Series B-Psychological Sciences and Social Sciences* 55, no. 5 (2000): S278-S87.

Herzlinger, Regina E. "Can Public Trust in Nonprofits and Governments Be Restored?" *Harvard Business Review* 74, no. 2 (1996): 97-107.

Hirth, Richard A. "Consumer Information and Competition between Nonprofit and For-Profit Nursing Homes." *Journal of Health Economics* 18, no. 2 (1999): 219-40.

Holmstrom, B., and P. Milgrom. "Multitask Principal Agent Analyses - Incentive Contracts, Asset Ownership, and Job Design." *Journal of Law Economics & Organization* 7 (1991): 24-52.

Kelley, J. I. "State-by-State Guide to Nursing Home Performance Data." AARP, 2001.

Kerr, S. "Folly of Rewarding a, While Hoping for B." *Academy of Management Journal* 18, no. 4 (1975): 769-83.

Lakdawalla, D, and T. Philipson. "The Nonprofit Sector and Industry Performance." *Journal of Public Economics* 90, no. 8-9 (2006): 1681-98.

Lu, S. F. "Multitasking, Information Disclosure and Product Quality: Evidence from Nursing Homes." *memo*, 2008.

McGregor, M. J., M. Cohen, K. McGrail, A. M. Broemeling, R. N. Adler, M. Schulzer, L. Ronald, Y. Cvitkovich, and M. Beck. "Staffing Levels in Not-for-Profit and For-Profit Long-Term Care Facilities: Does Type of Ownership Matter?" *Canadian Medical Association Journal* 172, no. 5 (2005): 645-49.

Mukamel, D. B., and W. D. Spector. "Quality Report Cards and Nursing Home Quality." *Gerontologist* 43 (2003): 58-66.

Mullen, K. J., R. G. Frank, and M. B. Rosenthal. "Can You Get What You Pay For? Pay-for-Performance and the Quality of Healthcare Providers " *memo,* 2007.

Munroe, D. J. "The Influence of Registered Nurse Staffing on the Quality of Nursing-Home Care." *Research in Nursing & Health* 13, no. 4 (1990): 263-70.

Newhouse, J. P. "Toward a Theory of Nonprofit Institutions - An Economic Model of a Hospital." *American Economic Review* 60, no. 1 (1970): 64-74.

O'Neill, C., C. Harrington, M. Kitchener, and D. Saliba. "Quality of Care in Nursing Homes - Ann Analysis of Relationships among Profit, Quality, and Ownership." *Medical Care* 41, no. 12 (2003): 1318-30.

Picone, G., S.Y. Chou and F. Sloan. "Are For-Profit Hospital Conversions Harmful to Patients and to Medicare? " Rand Journal of Economics, Vol 33, no. 3(2002): 507-23

Rose-Ackerman, S. "Altruism, Nonprofits, and Economic Theory." *Journal of Economic Literature* 34, no. 2 (1996): 701-28.

Schnelle, J. F. "Determining the Relationship between Staffing and Quality." *Gerontologist* 44, no. 1 (2004): 10-12.

Schnelle, J. F., S. F. Simmons, C. Harrington, M. Cadogan, E. Garcia, and B. M. Bates-Jensen. "Relationship of Nursing Home Staffing to Quality of Care." *Health Services Research* 39, no. 2 (2004): 225-50.

Silverman, E, and J. Skinner. "Medicare Upcoding and Hospital Ownership." *Journal of Health Economics* 23, no. 2 (2004): 369-89.

Sloan, F. A. "Not-for-Profit Ownership and Hospital Behavior." *Handbook of Health Economics* 1 (2000): 1141-74.

Tirole, J. *The Theory of Industrial Organization*: MIT Press, 1988.

Weber, M. *The Protestant Ethic and the Spirit of Capitalism*. http://xroads.virginia.edu/~HYPER/WEBER/toc.html, 1905.

Weisbrod, B.A., and M. Schlesinger, eds. *Public, Private, Nonprofit Ownership and the Response to Asymmetric Information: The Case of Nursing Homes*. Edited by S. Rose-Ackerman, *The Economics of Nonprofit Institutions: Studies in Structure and Policy* 1986.

Weisbrod, B. A. "Rewarding Performance That Is Hard to Measure: The Private Nonprofit Sector." *Science*, 1989: no. 4904 (1989): 541-46

Werner, R. M., and D. A. Asch. "The Unintended Consequences of Publicly Reporting Quality Information." *Journal of the American Medical Association* 293, no. 10 (2005): 1239-44.

Zinn, J., W. Spector, L. Hsieh, and D. B. Mukamel. "Do Trends in the Reporting of Quality Measures on the Nursing Home Compare Web Site Differ by Nursing Home Characteristics?" *Gerontologist* 45, no. 6 (2005): 720-30.

Table 1: Changes in Citation Composition by Ownership Type

Ownership Type	Reported				Unreported			
	2000	2002	2005	$\Delta_{00\text{-}05}$%	2000	2002	2005	$\Delta_{00\text{-}05}$%
For-profit (FP)	2.5	2.3	2.4	-1.7%	4.9	5.0	5.5	11.5%
Non-profit (NFP)								
Secular NPF	2.1	1.9	2.1	2.5%	3.8	3.9	4.6	19.6%
Religious NFP	1.9	1.8	2.4	21.2%	3.6	3.6	4.2	20.0%
Government-owned (GOV)	1.8	1.8	2.5	38.2%	3.3	3.7	4.9	46.6%
All Nursing Homes	2.4	2.2	2.4	1.0%	4.6	4.7	5.2	13.8%

Notes:

(1) The number of citations on the unreported dimensions increases more than that on the reported ones after the introduction of the NHQI in for-profits, secular non-profits and government-owned nursing homes.

(2) There is trivial difference in changes of the number of citations between the reported and unreported dimensions in religious non-profits.

Table 2: The Effect of NHQI on the Reported and Unreported Dimensions

Dependent Variable: Number of Deficiency Citations

	All Nursing Homes			For-profits	
Variables	(1)	(2)	(3)	(4)	(5)
Reported*2000	0.219	0.219		0.193	
	(0.152)	(0.152)		(0.175)	
Reported*2001	0.021	0.021		0.006	
	(0.119)	(0.119)		(0.147)	
Reported*2003	-0.229**	-0.229**		-0.225*	
	(0.105)	(0.105)		(0.117)	
Reported*2004	-0.133	-0.133		-0.119	
	(0.197)	(0.198)		(0.231)	
Reported*2005	-0.403*	-0.403*		-0.423*	
	(0.216)	(0.216)		(0.237)	
Reported*NHQI			-0.311***		-0.290***
			(0.051)		(0.061)
Proportion of Medicaid	0.017	-0.055	0.017	0.083	0.099
	(0.246)	(0.215)	(0.157)	(0.267)	(0.188)
Beds	0.080	0.388*	0.080	0.242	0.153
	(0.329)	(0.214)	(0.145)	(0.275)	(0.201)
Reported	-2.467***	-2.467***	-2.348***	-2.629***	-2.530***
	(0.235)	(0.235)	(0.042)	(0.263)	(0.050)
Year Dummy	Y	Y	Y	Y	Y
State Trend (Year*State)	N	Y	N	Y	N
Nursing Home Dummy	Y	Y	Y	Y	Y
R-Squared	0.399	0.420	0.399	0.418	0.396
N	61578	61578	61578	45882	45882

* p<0.10, ** p<0.05, *** p<0.01

Notes:

(1) I normalize 2002, the year when the NHQI was implemented, as the reference year. The unit of observation is group/home/year.

(2) The trend (*Reported*Year*) is almost flat before 2002 and negative after that. This suggests that the introduction of the NHQI is econometrically exogenous;

(3) The negative and significant coefficients of *Reported*NHQI* suggest that the number of citations in the unreported group increases relatively more than that in the reported group after the introduction of the NHQI.

Table 3: Do Non-profits Behave Differently from For-profits?

Dependent Variable: Share of the Unreported Citations (*UR-Share*)

	Nonprofits United		Nonprofits Separate	
	(1)	(2)	(3)	(4)
GOV*NHQI	-0.023	-0.013	-0.023	-0.014
	(0.018)	(0.018)	(0.018)	(0.018)
NFP*NHQI	-0.011	-0.009		
	(0.008)	(0.008)		
NPR*NHQI			-0.034**	-0.031**
			(0.015)	(0.015)
NPS*NHQI			-0.004	-0.002
			(0.009)	(0.009)
GOV	-0.008	-0.018	-0.008	-0.017
	(0.049)	(0.049)	(0.049)	(0.049)
NFP	-0.004	-0.007		
	(0.019)	(0.019)		
NPR (Religious NFP)			0.006	0.0002
			(0.025)	(0.025)
NPS (Secular NFP)			-0.008	-0.012
			(0.020)	(0.020)
Proportion of Medicaid	0.041**	0.032	0.041**	0.033
	(0.020)	(0.020)	(0.020)	(0.020)
Beds	-0.008	-0.006	-0.008	-0.006
	(0.019)	(0.019)	(0.019)	(0.019)
Year Dummy	Y	Y	Y	Y
State Trend (Year*State)	N	Y	N	Y
Nursing Home Dummy	Y	Y	Y	Y
R-Squared	0.292	0.312	0.293	0.312
N	30789	30789	30789	30789

* p<0.10, ** p<0.05, *** p<0.01

Notes:

(1) There are no corresponding differences between secular non-profits and for-profits in response to the NHQI in shifting citation composition.

(2) Religious non-profits are less responsive to the NHQI than for-profits in shifting citation composition.

Table 4: Do Contributions Play an Important Role in the Behavior of Non-profits?

Dependent Variable: Share of the Unreported Citations (*UR-Share*)

	Secular Nonprofits						Religious Nonprofits	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Donation*NHQI	0.051***	0.055***	0.050***	0.050***	0.055***		0.002	
	(0.020)	(0.021)	(0.020)	(0.019)	(0.021)		(0.037)	
Donation*2000						0.005		0.008
						(0.034)		(0.061)
Donation*2002						0.040		0.034
						(0.033)		(0.061)
Donation*2003						0.060*		0.039
						(0.033)		(0.061)
Donation*2004						0.042		-0.047
						(0.033)		(0.061)
Donation*2005						0.086**		-0.002
						(0.033)		(0.061)
Proportion of Medicaid	0.070	0.055	0.069	0.070	0.054	0.053	0.024	0.025
	(0.057)	(0.059)	(0.057)	(0.058)	(0.059)	(0.059)	(0.105)	(0.105)
Beds	-0.001	-0.007	-0.001	-0.016	-0.007	-0.007	-0.012	-0.013
	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.052)	(0.052)
Debt/Asset		-0.348		-0.343	-0.349	-0.367		
		(0.233)		(0.233)	(0.233)	(0.234)		
HHI			0.073	0.111	0.089	0.089		
			(0.078)	(0.078)	(0.080)	(0.081)		
Year Dummy	Y	Y	Y	Y	Y	Y	Y	Y
State Trend (Year*State)	Y	Y	Y	N	Y	Y	Y	Y
Nursing Home Dummy	Y	Y	Y	Y	Y	Y	Y	Y
R-Squared	0.340	0.339	0.340	0.300	0.339	0.340	0.386	0.387

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N	4980	4773	4980	4773	4773	4773	1754	1754

* p<0.10, ** p<0.05, *** p<0.01

Notes:

(1) Secular non-profits seeking contributions are more likely to shift citation composition in favor of multitasking than those not.

(2) The contributor effect fails in religious non-profit nursing homes.

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Table 5: Do Non-profits Mimic the Behavior of For-profits when Competing with Them?

Dependent Variable: Share of the Unreported Citations (*UR-Share*)

	ΔUR-share$_{02\text{-}05}$		ΔUR-share$_{02\text{-}05}$		ΔUR-level$_{02\text{-}05}$	
	(1)	(2)	(3)	(4)	(5)	(6)
NFP*FOR-FRAC$_{01}$	0.014	0.124			0.149	
	(0.037)	(0.107)			(1.525)	
FP*FOR-FRAC$_{01}$	0.027	0.082	0.027	0.097	0.032	0.027
	(0.029)	(0.059)	(0.029)	(0.059)	(0.842)	(0.842)
GOV*FOR-FRAC$_{01}$	0.040	0.016	0.040	0.003	1.896	1.901
	(0.092)	(0.092)	(0.092)	(0.093)	(1.311)	(1.311)
NPR*FOR-FRAC$_{01}$			0.017	0.031		-3.817
			(0.073)	(0.289)		(4.047)
NPS*FOR-FRAC$_{01}$			0.012	0.119		0.830
			(0.043)	(0.117)		(1.648)
GOV$_{01}$	0.033	0.120*	0.033	0.151**	0.094	0.090
	(0.043)	(0.071)	(0.043)	(0.072)	(1.011)	(1.011)
NFP$_{01}$	0.02	-0.061			-0.402	
	(0.029)	(0.115)			(1.640)	
NPR$_{01}$ (Religious NFP)			0.021	0.058		3.155
			(0.044)	(0.284)		(3.972)
NPS$_{01}$ (Secular NFP)			0.019	-0.038		-0.948
			(0.031)	(0.124)		(1.736)
ΔUR-share$_{00\text{-}02}$	-0.466***	-0.465***	-0.466***	-0.466***		
	(0.013)	(0.012)	(0.013)	(0.013)		
ΔUR-level$_{00\text{-}02}$					-0.435***	-0.435***
					(0.014)	(0.014)
Beds	-0.003	0.0005	-0.003	-0.005	0.229	0.227
	(0.010)	(0.010)	(0.010)	(0.010)	(0.142)	(0.142)
ONLY-NH$_{01}$		-0.031*		-0.035**	0.294	0.298
		(0.016)		(0.016)	(0.232)	(0.232)
NFP*NFP-FRAC$_{01}$		0.157			1.158	
		(0.107)			(1.527)	
FP*NFP-FRAC$_{01}$		0.03		0.055	0.574	0.578
		(0.063)		(0.063)	(0.895)	(0.895)
GOV*NFP-FRAC$_{01}$		-0.219*		-0.238*	1.261	1.280
		(0.123)		(0.125)	(1.748)	(1.749)
NPS*NFP-FRAC$_{01}$				0.143		1.67
				(0.117)		(1.648)

Table 5: Do Non-profits Mimic the Behavior of For-profits when Competing with Them?

Dependent Variable: Share of the Unreported Citations (*UR-Share*)

(Continue)

	ΔUR-share$_{02\text{-}05}$		ΔUR-share$_{02\text{-}05}$		ΔUR-level$_{02\text{-}05}$	
	(1)	(2)	(3)	(4)	(5)	(6)
NPR*NFP-FRAC$_{01}$				0.039		-2.289
				(0.287)		(4.011)
State Dummy	N	Y	N	Y	Y	Y
R-Squared	0.228	0.267	0.228	0.230	0.236	0.236
N	4709	4709	4709	4709	4709	4709

* p<0.10, ** p<0.05, *** p<0.01

Table 6: Do Non-profit Nursing Homes increase Nursing Inputs?

Dependent Variable: Nursing Hours per Resident Day

	Secular Non-profits				Religious Non-profits			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Donation*NHQI	-0.071	-0.103	-0.071	-0.103	-0.147	-0.095	-0.147	-0.094
	(0.062)	(0.067)	(0.062)	(0.067)	(0.108)	(0.114)	(0.108)	(0.114)
NHQI			0.005	0.194			-0.054	-0.149
			(0.050)	(0.340)			(0.093)	(0.320)
Proportion of Medicaid	-0.067	-0.068	-0.065	-0.065	0.476	0.808**	0.487	0.804**
	(0.189)	(0.193)	(0.189)	(0.193)	(0.313)	(0.323)	(0.312)	(0.322)
Beds	-0.268**	-0.127	-0.269**	-0.127	-0.408**	-0.292*	-0.405**	-0.293*
	(0.134)	(0.137)	(0.134)	(0.137)	(0.158)	(0.158)	(0.158)	(0.158)
Year Dummy	Y	Y	N	N	Y	Y	N	N
State Trend (Year*State)	N	Y	N	Y	N	Y	N	Y
Nursing Home Dummy	Y	Y	Y	Y	Y	Y	Y	Y
Donation*NHQI+NHQI				0.091				-0.243
F-value				0.070				0.060
R-Squared	0.761	0.773	0.761	0.773	0.784	0.818	0.784	0.818
N	4952	4952	4952	4952	1746	1746	1746	1746

* p<0.10, ** p<0.05, *** p<0.01

Notes:

(1) There is no evidence that non-profits of both types increase staffing for their residents after the introduction of the NHQI.

(2) There is no significant difference in the changes in staffing between nursing homes with and without contributions.

Table 7: Do Non-profit Nursing Homes Benefit from the Disclosure Policy?

	Secular Non-profits			Religious Non-profits		
	Ln(Revenue)	Ln(Cost)	Profit	Ln(Revenue)	Ln(Cost)	Profit
Donation*NHQI	0.050***	0.017	0.084	0.083***	0.021	0.115
	(0.013)	(0.011)	(0.143)	(0.021)	(0.021)	(0.141)
NHQI	-0.080	-0.110**	0.014	-0.104*	-0.008	-0.373
	(0.061)	(0.052)	(0.679)	(0.059)	(0.060)	(0.397)
Proportion of Medicaid	-0.004	-0.028	0.811**	0.063	0.092	0.019
	(0.037)	(0.032)	(0.413)	(0.058)	(0.060)	(0.395)
Beds	0.047*	0.086***	-0.543*	0.091***	0.048	0.567***
	(0.026)	(0.023)	(0.294)	(0.029)	(0.030)	(0.196)
State Trend (Year*State)	Y	Y	Y	Y	Y	Y
Nursing Home Dummy	Y	Y	Y	Y	Y	Y
Donation*NHQI+NHQI	-0.030	-0.093*	0.098	-0.021	0.013	-0.258
F-value	0.240	3.090	0.020	0.140	0.050	0.440
R-Squared	0.943	0.951	0.688	0.948	0.947	0.731
N	4977	4977	4977	1754	1754	1754

* p<0.10, ** p<0.05, *** p<0.01

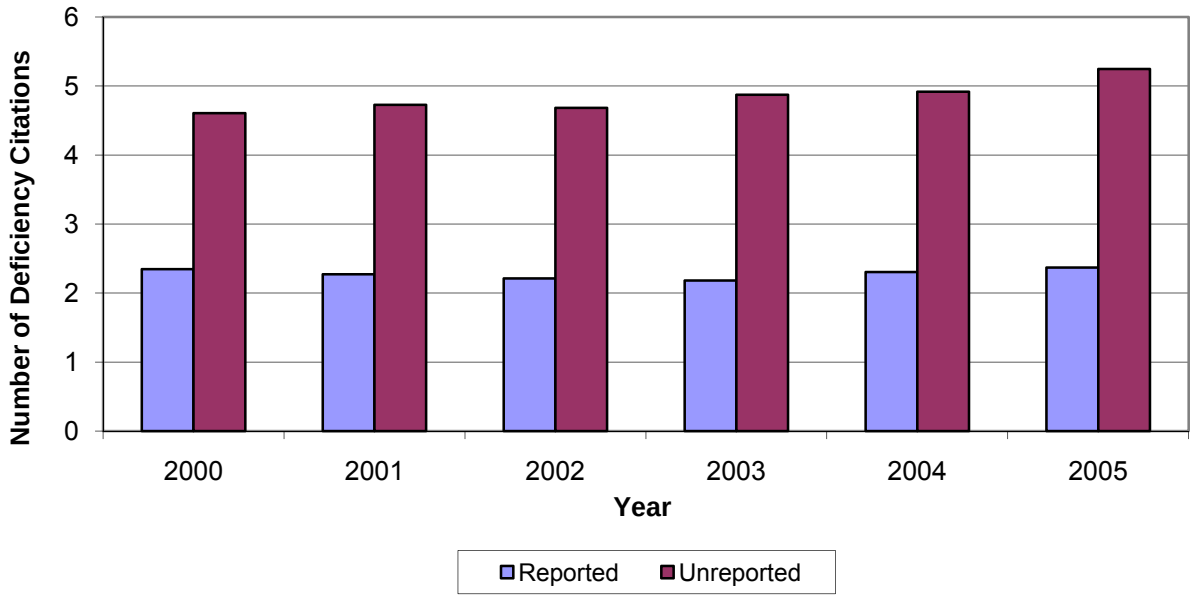
Notes:

(1) Secular non-profits spend less on their direct cost after the introduction of the NHQI.

(2) Religious non-profits earn less on revenue after the introduction of the NHQI.

(3) There is no significant evidence that both types of non-profits increase profits after the introduction of the NHQI.

Figure 1: Yearly Trend for Citation Composition

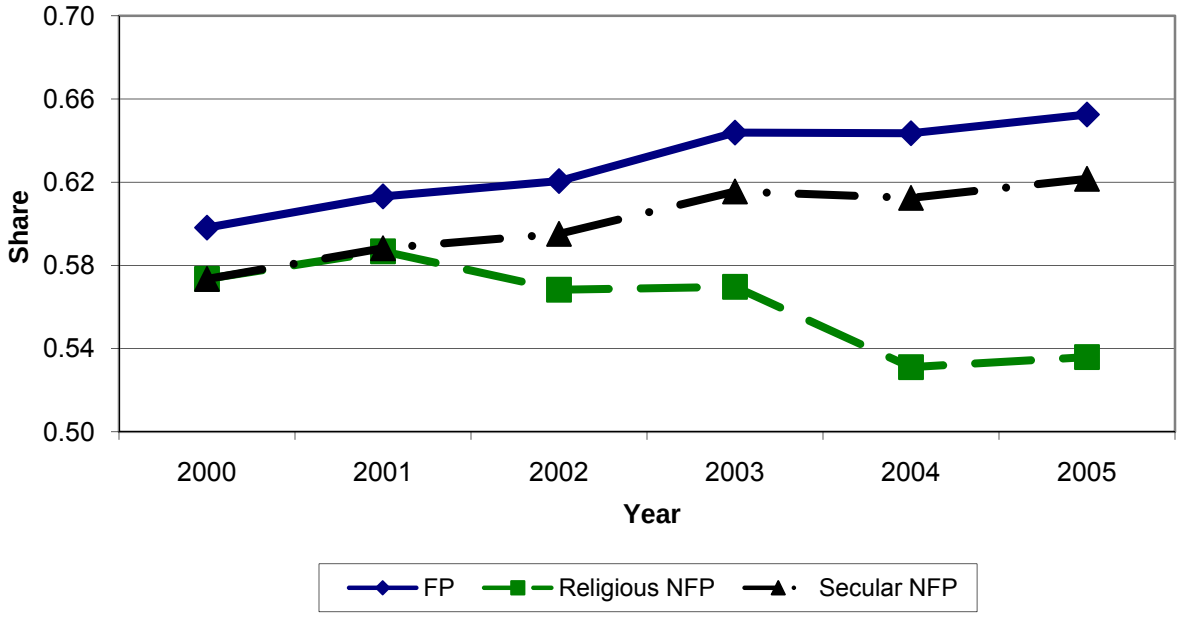


Notes:

(1) The trend for the number of deficiency citations along the reported dimensions is flat.

(2) The trend for the number of deficiency citations along the unreported dimensions is flat before 2002 and goes upward after that.

Figure 2: Yearly Trend for the Share of the Unreported Citations by Ownership Type



Notes:

(1) The trend for the share of the unreported citations of for-profits is flat before 2002 and goes upward after then.

(2) The trend of secular non-profits is quite similar to that of for-profits.

(3) The trend of religious non-profits is very different from that of for-profits.

Table A1: States With/Without Quality Information Disclosure before 2000

Group		Kelley's List
States without any quality information disclosure before 2000 ***Newly Disclosed***		AK, AL, AR, *AZ, CO,* CT, DC, DE, GA, HI, ID, KS, KY, LA, ME, MI, MN, MO, MT, NC, ND, NE, NH, NM, OK, OR, SC, SD, TN, VA, WA,WV and WY
States with quality information disclosure before 2000 ***Previously Disclosed***	Report Cards	FL, IN, IA, MD, MA, NJ, NY, OH, PA, RI and TX
	Other Forms	CA, IL, NV, UT, VT and WI

Notes:

(1) Kelley's List comes from an AARP Bulletin: "State-by-state Guide to Nursing Home Performance Data" . It is annually updated.