QUALITY REPORTING AND PRIVATE PRICES: EVIDENCE FROM THE NURSING HOME INDUSTRY

Richard A. Hirth and Sean Shenghsiu Huang*

Preliminary and Incomplete - Please Do Not Cite
This Draft, May 12th, 2014

ABSTRACT

We use the rollout of five-star rating of nursing homes to study how private-pay prices response to quality reporting. On average, the prices of top-ranked facilities increased by 3.0 to 7.3 percent more than the prices of bottom-ranked facilities. The price increases are stronger for facilities located in states with CON laws or with higher occupancy rates. We also provide suggestive evidence that price responses are stronger in markets with lower concentration and higher elderly-density. Compared to prior quality reporting, our results suggest that with proper design, consumers are responsive to public reporting and market efficiency can be enhanced.

Keywords: quality reporting, nursing home, price, market structure

*Richard Hirth (rhirth@umich.edu) is at University of Michigan, Department of Health Management and Policy and Sean Huang (ssh60@georgetown.edu) is at Georgetown University, Department of Health Systems Administration. We thank John Bowblis and participants at ASHEcon and AcademyHealth conferences for comments on an earlier draft of this paper.

1 Introduction

Throughout the health care sector, efforts to improve quality and contain costs increasingly rely on consumers as agents of change. Consumer-oriented strategies include public and private data releases about quality, efforts to enhance price transparency, education aimed at making consumers more informed about and engaged in clinical decisions, and greater use of financial incentives through mechanisms such as value-based insurance design and high deductible health plans. Public reporting of quality data has been a particularly common consumer strategy, encompassing health plans, hospitals, physicians, nursing homes, renal dialysis facilities, fertility clinics, and other types of providers. Quality reporting is intended to relieve informational asymmetries that inhibit the efficient operation of markets. Accessible and credible information can help consumers select better providers, motivate providers to compete on quality by increasing the reward (market share and/or price) for better performance, and provide benchmark data to facilitate quality improvement efforts as providers may have intrinsic motivations to improve their scores.

Not surprisingly, a large body of literature investigates the impacts of quality reporting on quality and patient choice of facility. In the nursing home context, the largest quality reporting effort has been the Nursing Home Compare (NHC) system operated by the Centers for Medicare and Medicaid Services (CMS). Grabowski and Norton (2012) summarize the literature on the effects of reporting on nursing home quality by stating there is a "modest (but inconsistent) positive effect on quality." Several key papers in this literature found improvements in some but not all quality measures (Zinn et al., 2005; Mukamel et al., 2008; Werner et al., 2009). Castle et al. (2007) found increased quality in competitive and lower occupancy markets but mixed evidence on the overall effect of reporting on quality, and Grabowski and Town (2011) showed only minimal quality changes. Mukamel et al. (2010) found some corroborating evidence of facility

responses to enhance quality, showing that nursing home spending shifted to areas more likely to affect measured clinical quality. In terms of facility choice in the nursing home context, Werner et al. (2012) found that consumers were more likely to choose high quality post-acute facilities after quality reporting, that the magnitude of the effect was small. Grabowski and Town (2011) found no quantity response to NHC reports.

In contrast to the significant literature on how reporting affects quality and choice, perhaps due to the lack of price transparency, the effects of public quality reporting on prices has not been studied extensively in the nursing home or other health care contexts. Theoretically, public reporting can affect private-pay prices by increasing the ability of consumers to distinguish the quality of different providers. In a competitive marketplace, the ability to navigate quality would lead to price differentiation reflecting differences in the marginal cost of producing different quality levels. In a non-competitive market, similar price differentiation by quality would occur, but prices would reflect consumers' willingness to pay for different quality levels as well as differences in marginal costs of production.

In this paper, we use the rollout of five-star rating of nursing home care to provide exogenous variation in quality information. The five-star quality rating was rolled out in December 2008 by the CMS. The new rating system synthesizes complex quality information and provides an aggregated quality rating that aims to improve the usability of information. On the CMS website, each nursing home is assigned an overall rating and ratings for the domains of health inspection, staffing, and clinical quality measures. Furthermore, because the CMS provides detailed documentation of the algorithm for calculating the ratings, we can simulate and compute the quality ratings prior to implementation of the five-star rating. The simulated rating is used in the pre-post analysis to provide more robust inferences.

Compared to other healthcare markets, the nursing home industry provides several advantages for studying price effects. First, most private-pay revenues are out-of-pocket

expenditures that are paid by consumers directly. Second, the bundle of services delivered by nursing homes is relatively standard (compared to, say, hospital services), allowing more accurate calculation of the private price and comparisons of prices across facilities. We collected the private-price of nursing home care from several state-administered datasets of nursing home care, including California, Florida, Ohio, New York, Minnesota, Pennsylvania, and Texas, during the period between 2006 and 2011.

The first and most fundamental question is whether private prices respond to quality reporting. A finding of such an effect would be important evidence that consumers respond to quality reporting. Furthermore, differential price responses between top- and bottom-rated facilities would provide important evidence that quality reporting improves market efficiency by promoting matching between providers and consumers.

Using a panel dataset consisting of more than 4,000 unique nursing homes, we find significant and substantial price increases after implementation of the five-star rating. The price of top-ranked facilities rose 3.0% more than those of the bottom-ranked facilities. We also find that positive price-response mostly comes from the markets that are less concentrated, with higher elderly-density, and under certificate of need (CON) laws. The primary contribution of this paper is new empirical evidence of the price effects of quality reporting, particularly when many private-pay consumers lack insurance coverage. We also advance the understanding of market structures in implementing quality reporting. We see stronger price response in marketplaces where providers face higher competitive pressures. We argue that implementation of public reporting and other forms of market regulation may act as policy complements and should be considered jointly. Overall, with increasing interest in using consumers to drive healthcare quality improvements and cost control, these findings may have broader implications for consumer engagement and price and quality transparency in settings other than nursing homes.

2 Quality Reporting and Nursing Home Prices

2.1 Five-star Quality Rating

The CMS introduced its original nursing home quality reporting in 2003. That system provided data on multiple quality measures (i.e., 3 staffing and 19 resident-based measures, and all elements of the facility's health and life safety inspection). As noted above, the effects of the earlier reporting system on quality and choice were small and inconsistent. Grabowski and Norton (2012) suggests that the limited response to quality reports may arise from the difficulty of interpreting complex report card data. Similarly, a literature review on how consumers use quality information concluded that easy-to-read presentation formats and messages are important (Faber et al., 2009). The five-star rating system, rolled out in December 2008, may simplify and enhance the usability of the NHC quality data. This modification provides an overall star rating that synthesizes data across multiple dimensions of quality measures to better enable consumers to use the quality information effectively (CMS, 2008). Calculation of the overall rating is based on ratings in three subcomponents: health inspection, staffing, and clinical quality. The ratings of overall quality and subcomponents are published and can be accessed freely on the Nursing Home Compare website[1] (see Appendix A). Among three quality domains, The health inspection is the most important dimension in calculating overall quality rating (CMS, 2008).

The process of generating quality ratings starts with calculations regarding health inspections. Each nursing home facility receives a scheduled health inspection by state personnel every 9 to 15 months as well as unexpected complaint inspections. Each facility is assigned a composite inspection score consisting of the past three standard inspections and complaint inspections in the past 36 months. The documented deficiencies are then assigned numeral points based on their scale and severity. To account for different stan-

[1] http://www.medicare.gov/nursinghomecompare/search.html

dards and practices during health inspections across states, the aggregated inspection scores of individual facilities are compared to those of other facilities within the same state. The facilities with the lowest 10% deficiency scores receive five-star rating (best quality) in the inspection domain and the facilities with the highest 10% deficiency scores receive one-star ratings (worst quality). The facilities with scores in the middle range of the deficiency distribution are ordered and proportionally distributed among four-star, three-star, and two-star ratings. The overall quality rating starts with this inspection rating and then adjusts for performance in the staffing and resident quality domains. A facility's overall rating can be up to 2 stars above or below its inspection rating (CMS, 2008). Importantly, different rating rules are applied in each quality domain. For health inspection and resident outcomes, only a fixed percentage of facilities will receive a specific rating. For example, the top 10% receives a five-star rating. For staffing, specific cutoff values are used in assigning ratings. Thus, the numbers of facilities that receive five-star staffing rating can vary over time.

2.2 Nursing Home Private Prices

Self-pay skilled nursing facility (SNF) expenditures represent a major financial burden for the elderly who are not eligible for Medicaid coverage. Annual costs often exceed $60,000 (Stewart et al., 2009) and only a small minority of the elderly has private long-term care insurance coverage. Out-of-pocket payments are estimated to account for 33% of formal long-term care spending among the elderly, while only 4% of the expenditure is paid through private insurance (CBO, 2004; Catlin et al., 2007). Several studies have examined pricing in the nursing home industry. Stewart et al. (2009) examined the evolution of private-pay prices from 1977 to 2004, but did not explore facility or market variation in prices or attempt to assess the impact of quality reporting that had been initiated near the end of their study period. They concluded that the annual growth rate was 7.5%, which outpaced growth in both the medical and general consumer price

indexes and the growth in Medicaid payment rates. This price growth includes both "pure" inflation, the increase in price of a fixed level of service, and changes due to the changing nature of the services provided. By 2004, the private price was $60,249, which implied a 25% premium above Medicaid prices. Several prior studies (pre-dating major quality reporting efforts) linked nursing home prices to market characteristics, often focusing on states with regulations such as CON and construction moratoria. Nyman (1994) used data from Wisconsin nursing homes in 1988 to show that higher concentration led to higher prices. Likewise, Mukamel and Spector (2002) calculated private-pay markups above marginal costs and above Medicaid rates using a sample of for-profit facilities in New York State in 1991.

To our knowledge, the only study that has examined the effect of public quality reporting on prices is Clement et al. (2012). Using a data set for Wisconsin (a CON state) nursing homes from 2001-2003, they find no effect on prices for medium or high quality homes. Among low quality homes, they find a small increase in prices. Because that increase is accompanied by reductions in restraint use, they suggest that the price increase may reflect an increase in quality spurred by reporting.

3 Hypothesis

The central hypothesis of our paper is that the five-star rating alleviates asymmetric information and facilitates quality sorting based on consumers' willingness to pay and providers' marginal costs of providing a specific level of quality. Instead of absolute price increases, we focus on the relative price changes between higher and lower quality homes. That is, if the five-star rating effectively achieves its policy purposes, the price differentials between top- and bottom-ranked facilities should widen when the market moves toward separating equilibrium. This leads to our first hypothesis, as follows:

H1: *Quality reporting increases private-pay prices for the high quality facilities relative to low quality facilities.*

As noted in the nursing home literature (Scanlon, 1980), the presence of regulatory barriers to entry (e.g., CON) may create capacity constraints and lead to excess demand. While the capacity constraint has become less binding in some states due to the expansion of alternative modes of care (e.g., home care, assisted living) (Grabowski, 2008), in 2009, the average occupancy rates vary from 64.9% (Oregon) to 97.1% (South Dakota)[2] across states. Because capacity constraints can increase the scarcity of top-ranked facilities, in the presence of capacity constraints, quality reporting enables good-quality facilities to raise prices more than those have lower occupancy rates and in markets with lower barriers of entry. However, at the same time, CON laws or other capacity constraints may limit consumers' alternatives and inhibit price response. Thus, the effects of capacity constraints can be ambiguous. To account for the variations in capacity constraints across markets and facilities, we identify facilities as more likely to face capacity constraints if they reside in CON states or their existing occupancy rates are above the sample median of 90.4%.

H1a: *Capacity constraints have ambiguous effects of price response to reporting.*

We further examine the role of market structure in the price response to reporting. In addition to asymmetric information, other forms of market imperfections (e.g., market concentration, high transaction costs) exist concurrently. Ideally, better quality information facilitates consumer selection of nursing facilities that provide care that maximizes consumer surplus. However, the effects of reporting can be compromised if marketplaces are not competitive (Grabowski and Town, 2011). Because the nursing

[2]Based on authors' calculation

home industry is highly regulated by state governments, we can exploit the variations in state regulations and local demographics. Building on the literature (Gaynor, 2006), we relax the assumption of administrative pricing and use private-pay prices to empirically examine the interplay between quality reporting and competition. We focus on the provider concentration and the elderly density (Bloom et al., 2010). Both measures proxy for consumers' ease of switching or choosing the alternatives based on reported quality. By increasing the elasticity of demand with respect to quality, we hypothesize that price response to reporting is stronger in marketplaces that are more competitive:

H2: *The effect of reporting on prices is stronger in less-concentrated and dense than concentrated and non-dense markets.*

4 Data and Empirical Strategy

4.1 Data

The main analysis relies on several state-administered datasets to compute facility-level private-pay prices. The dataset includes all nursing homes in California, Florida, Minnesota, New York, Ohio, and Texas from 2006 to 2011 (more than 4,000 unique nursing homes per year, 27% of U.S. facilities). These nursing facilities provide information on revenues from specific service lines (i.e., skilled nursing care, intermediate care, sub-acute care, other routine and ancillary services) and from different payers including Medicare, Medicaid, Self-Pay, Managed Care, and others. The richness of information allows us to calculate daily average prices by payer and by service line. To enhance the comparability of price information across providers, we exclude the ancillary revenues outside direct patient care. Therefore, we have clean private price data on skilled nursing services. For example, private-pay price in California is calculated as the rev-

enues from the skilled nursing care (SNC) dividing by SNC resident days. Because the cost reporting forms[3] have slightly different classifications of service lines and payers, direct comparison across states should be taken with caution. Overall, our price measure excludes sub-acute care and ancillary services and it most closely represents the out-of-pocket expenditures borne by patients who are not eligible for Medicaid and do not have long-term care insurance.

The price information is then merged with quality ratings downloaded from the Nursing Home Compare website. The quality ratings include four measures: overall quality, health inspection, staffing, and resident quality outcomes. The analytical dataset also incorporates the LTC Focus dataset maintained by Brown University and the Area Health Resources Files, (AHRF) maintained by the Health Resources and Services Administration. All facility-level information is matched by Medicare provider number and market-level information is matched by county code.

The key dependent variables are private price per day and percentage change in private price over a year. The price data show significant and large price variations across geographic areas. For example, the 2010 median private prices (per resident day) are \$309, \$203, and \$124 in New York, California, and Texas. After adjusting for inflation, private prices remained relatively stable between 2004 and 2008 but rose significantly in 2009, coincident with the rollout of the five-star quality rating system in December 2008. Note that the price increase diminishes quickly after 2009 and becomes stable again. To account for potential reporting and administrative errors, we exclude the observations with the highest and lowest 2.5% prices and percentage price changes.

In terms of market structures, we are interested in market concentration and elderly density. To measure the market concentration, we calculate the conventional Herfindahl-Hirschman Index (HHI) based on the number of beds and using the county as the geographic market boundary. We define the market to be less (more) concentrated if its

[3]The detailed report form of each state is available from authors upon requested.

HHI is smaller (greater) than 0.15. The elderly density is defined as the number of elderly (65+) per square mile in each county. The median of the elderly density is 67.7 elderly residents per square mile. We then use the median as the cutoff value to identify high or low elderly density markets. We use elderly population density as an exogenous proxy for potential information flows or availability of decision support services, as well as travel costs (consumers in higher density areas may have more available choices and lower transactions costs associated with switching providers).

4.2 Empirical Strategy

Our analysis strategy is based on two modeling approaches. In both, we narrow the analysis period to 2008 and 2009, the years before and after the implementation. The first approach uses OLS to test the hypothesis of differential price changes by star rating. A limitation of that approach is that it cannot rule out the possibility that better facilities would have higher price increases even without the new reporting system. That is, modeling the change in price rather than the level of price allows for the possibility that better facilities have higher prices at each point in time, but still requires as an identifying assumption that better and worse facilities would have had similar growth in prices over time absent the new reporting. To address this limitation, we employ a second approach that uses CMS data and the star rating data to simulate what each facilities star rating would have been in 2008. Using that approach, the primary variable of interest is the interaction between star-rating and the post-implementation dummy estimates the differential price effect of top rating after quality reporting. In this way, we address the concerns of unobservable secular trends that top-ranked facilities have larger price growth regardless of public reporting and more directly test the incremental effect of the star rating above and beyond the effect of the prior releases of higher dimensional, unsummarized quality measures. The limitation of the latter approach (detailed below)

is that due to data reporting issues the simulated rating predicts the actual rating well, but not perfectly.

4.3 Baseline Model

As a first step, we run the basic ordinary least squares (OLS) analysis to illustrate the association between private-pay prices and five-star ratings:

$$ln(P)_{2009} = \alpha + \beta_\gamma Rating_{i,2009} + \beta_f X_{f,2008} + \beta_p X_{p,2009} + \beta_m X_{m,2009} + \beta_s X_{s,2009} + \epsilon_i \quad (1)$$

where P is the set of private-price variables, including the log price in 2009 and the percentage change in price between 2008 and 2009. Rating is the five-star quality rating reported by CMS in January 2009. Because of data availability, we use this rating to proxy the initial rating in December 2008, on the assumption that quality does not change drastically in one month. To avoid the simultaneity between private-pay prices and control variables (e.g., payer-mix, occupancy rates), we use the 2008 values for the facility characteristics. X_f is a vector of standard facility-level characteristics, including for-profit status, payer-mix, number of beds, occupancy rate, and system affiliation; X_p includes important patient characteristics that are aggregated at the facility level, like racial and gender composition and average activities of daily living (ADL) index. Because patients with severe conditions may require more care resources, we include patient characteristics to account for different intensity in treatments among facilities. X_m is a vector that includes county-level control variables, including the standard HHI based on the market share in the county, log-transformed median household income, and the density of the elderly population (thousands of 65 + years old per square mile). X_s includes several state-specific variables, such as state dummies and the average Medi-

caid reimbursement rates. All standard errors were corrected to account for potential clustering at the county level due to the existence of multiple facilities within a county.

One obvious concern is that the error term in equation (1) may be correlated with quality rating leading to biased inferences. In particular, high-quality facilities may always increase prices more than the low-quality facilities, even before reporting. If this is true, the observed price change may not be attributable to the quality reporting system. Therefore, we simulated the star ratings prior to their becoming public.

4.4 Simulated Rating and Pre-Post Analysis

We first collect the underlying quality measures reported by CMS prior to the roll-out of the five-star rating system and then follow the CMS' algorithm to calculate the equivalent star rating. This equivalent rating serves as our best estimate of what the star rating would have been in each year based on the information that was reported on the NHC. Because all the quality information was publicly available prior to the rollout of five-star rating, this pre-post analysis enables use to tease out the effects of synthesizing high-dimensional information into simple star ratings. The facility fixed-effect regression is described in the following equation (2):

$$ln(P)_{i,t} = \alpha + \beta_\gamma Rating_{i,t} + \beta_p post + \beta_i Rating_{i,t} * post + \beta_x X_{(i,m,s),t} + \theta_i + \epsilon_{i,t} \quad (2)$$

where $Rating_{i,t}$ is the simulated ratings that we calculate as of December 2007 and December 2008, respectively. *post* is a dummy variable indicating the period after the launch of five-star rating system in December 2008. Therefore, for each facility we have two observations: the prices in 2008 and 2009, as well as the change in price from 2007

to 2008 and the change from 2008 to 2009. The coefficient of the interaction term, β_i, represents the difference in the effects of ratings, before and after the ratings were publicly calculated and reported. If the summarization of the higher dimensional quality data into publicly reported star rankings did not enhance consumers' responses to quality reporting, this interaction term would be zero (that is, consumers would respond the same way to the simulated star ranking before and after the actual star ranking became available). X is a vector of time varying variables as we include in the OLS model. θ_i represents the time-invariant unobservables at the facility level. The standard errors are clustered at the facility level. Because rating on health inspection is the only domain in which we see significant association with private-pay price. Thus, our analysis mainly uses the simulated inspection ratings. The simulation works well, but not perfectly. We know the facility's survey data, but there is a variable lag of up to three months between the survey and when those data become available to CMS to calculate the star rating[4]. Using the actual 2009 star ratings, we determine that assuming a two-month lag maximizes the match between simulated and actual ratings. Because our simulated ratings are most reliable for the five-star and one-star ratings (93% and 84% agreement, respectively, vs. about 71% in the middle groups), we regroup the four-, three-, and two-star ratings into a middle-rated group. The reference group is the bottom-rated facilities. While a six-year panel dataset is available, we narrow the study window to 2008 and 2009, to limit the threats of unobservable demand and supply shifts.

4.5 Alternative Specification

To assess the impact of market structure on price changes, we estimated several models stratified by CON status, market concentration and/or elderly density status, or with interactions between these market structure variables. It should be noted that

[4]CMS 5 Star rating: Q&A

these stratifying variables are moderately correlated with each other (e.g., the correlation between elderly density and market concentration is 0.6). Therefore, the different stratifications should not be viewed as fully independent.

In addition, we estimate the association between star rankings and the volume of private-pay days and total private-pay revenues to provide a more complete picture of the effects of reporting on the private-pay market for SNC.

5 Results and Discussion

5.1 Descriptive Data on Price Changes in Response to Quality Reporting

The states included in this study in their CON status shown in Figure 1. Year-to-year growth in real private-pay price per day across the entire sample is shown in Figure 2. Real prices were relatively stable throughout the study period, except for a 4.7% increase in 2009, the first year after the implementation of the five-star reporting system. Prices were relatively stable prior to the implementation, and also after the first year of implementation. The one-time price adjustment is similar to the volume response to the five-star rating in Medicare Advantage markets (Darden and McCarthy, 2014). Price changes by state are reported in Figure 3, and median prices by state and year are reported in Table 1. All seven states experienced substantial price increases in 2009, the median price change ranging from 4.1 to 5.6 percentage points.

Figures 4A-4D illustrate the relationship between star rating and the 2009 price change by type of market or facility (low density vs. high density, low concentration vs. high concentration, CON vs. non-CON, and low occupancy vs. high occupancy). The gradient between star ranking and price is only apparent in high density and low concentration markets, as well as facilities in CON states and with higher occupancy

rates. Several possible reasons exist for the more significant price response in more dense markets. The markets with a higher density of the elderly population may have more frequent exchanges of information through the word-of -mouth, or the supporting activities to facilitate nursing home decisions based on the public quality information. Another rationale for this relationship is that residents and potential residents have higher travel costs to alternative facilities when the population density is low. Therefore, the price response may be stronger in markets with higher population density due to lower costs of switching cost to alternative providers.

Among the seven states included in our analysis, three states (Florida, New York, and Ohio) have CON state laws, whereas the other four states (California, Texas, Minnesota, and Pennsylvania) do not have similar regulations. CON creates entry barriers that protect incumbents by adding time, cost and uncertainty to the entry process. CON laws may limit consumers' alternatives and inhibit price response, but at the same time, increase the scarcity of top-ranked facilities. While previous studies suggest that CON may no longer be binding as occupancy rates decline, the different price responses as shown in Figure 4C suggest that CON may still have significant effects on nursing home markets. In Figure 4D, we also observe that the price gradient only exists among the facilities with occupancy rates above the median. Because occupancy rates and the CON laws are positively correlated, the figures should not be interpreted independently.

5.2 Regression Results of Private-Pay Price Change

Descriptive statistics for the regression sample are reported in Table 2. Table 3 reports the OLS results (Equation 1), for the both the overall star ranking and the health inspection domain (the other two domains did not significantly predict price changes). For both overall and health inspection-based rankings, five star facilities had significantly higher prices and insignificantly larger price increases than one star facilities. Two, three

and four star facilities' price increases did not differ significantly from those of one star facilities.

Tables 4 and 5 report the results for estimates from pre-post analysis using the simulated star ratings (Equation 2). Again, five star facilities raised prices significantly relatively to one star facilities only after reporting. Those increases are larger in certain types of markets (low concentration, high elderly density, CON). The effects of higher occupancy rates are rather mixed (significant in Table 4. Panel A and Panel B, but not in Panel C).

Table 5 provides a more detailed view of the role of market concentration. Columns 1 and 2 show that a simulated rating of five stars after reporting increased prices only for facilities in low concentration markets. Columns 3 and 4 show that when limiting the sample to facilities in CON states, a simulated five star rating increased prices after reporting only for those facilities in low concentration markets. Finally, columns 5 and 6 restrict the sample to facilities with occupancy rates above the median, again showing that prices for high quality facilities on rise relative to low quality facilities in low concentration markets.

The second panel of Table 5 repeats the analysis, but predicts percentage changes in price rather than changes in log price. The results are similar except that the magnitudes are larger in the percentage change results. When restricting to CON states or high occupancy facilities, prices again rise for high quality facilities post-reporting in low concentration markets.

Using the low-end of the estimates, on average, the price effect of five star facilities in less-concentrated markets, can be translated into \$2,843 per resident per year (median = \$74,825/year based on 2009 prices). For a five-star facility in less-concentrated markets and also in CON states, the price effect can be \$7,715 per resident per year (median = \$77,933/year). Overall, our results suggest that the price effects have substantial economic impacts on both the consumers and providers.

5.3 Private-Pay Volume and Revenue

To comprehensively assess the effects of quality reporting on private-pay markets, we replicate the same analysis on private-pay days and private-pay revenue in Figures 5A-5D and Table 8. We also find significant and similar associations with reporting. Although private-pay days declined overall each year from 2006-2011 (likely due to the ongoing growth of assisted living and home care options), lower rated facilities saw substantially larger declines in private-pay days. Similarly, the higher ranked facilities gained private-pay revenues relative to lower ranked facilities. On average, after the public reporting, the top-ranked facilities gained 7.2% more private-pay days and 5.8% more private revenues relative to the lowest-ranked facilities. Again, these effects are particularly strong in markets that are less concentrated and with higher elderly density. For example, in less concentrated markets, private days and private revenues of top-rating facilities rose by as much as 12.1% and 10.8%, respectively. The results of private days and private revenues are consistent with our main price analysis.

5.4 Welfare Implication

While our results imply that the five-star system effectively alleviates information asymmetry and improves market efficiency, the welfare implications are less straightforward. Seeing effects primarily in less concentrated markets suggests that reporting causes prices to better reflect the marginal cost of different levels of quality and facilitates better sorting on the basis of willingness to pay for quality. Of course, some individual private-pay consumers, such as those who would have received care in a five star facility at a lower price had reporting not occurred, may be worse off after reporting. Had price increases occurred primarily in highly concentrated markets, there would be greater con-

cern that the increased price differentiation would reflect primarily willingness to pay rather than marginal cost of production, and hence represent primarily a transfer from residents to facilities on the basis of enhanced price discrimination.

Reporting may have beneficial or detrimental spillovers for Medicaid residents. Within the nursing home, the level of quality is likely to be a public good shared by Medicaid and private-pay residents. On one hand, the top-ranked facilities can charge higher prices that may in turn be used to enhance quality that can be shared with other public-pay residents within the facilities. Likewise, lower ranked facilities have a greater incentive to raise quality as the market can reward those efforts better under an effective the reporting regime. On other hand, the shift to private-pay days may crowd Medicaid residents out of high-quality facilities with high occupancy rates, and losses of private revenues by low-quality facilities may further impair quality.

A further evaluation of the quality disparity between top- and low-ranked facilities will provide a clearer assessment of the overall welfare impacts of quality reporting.

6 Concluding Remark

In the context of nursing home markets, we show that quality reporting has meaningful effects on private-pay prices and quantities. The highest ranked nursing homes in more competitive markets have the largest price, private day, and private revenue increases. We believe quality reporting improves market efficiency, because it enables prices to reflect the marginal costs of differing qualities, allowing consumers to sort into facilities that offer the quality that maximizes their consumer surplus. In addition, compared to the original NHC quality reporting in 2003, the five-star quality system enables consumers to use quality information more effectively. The greater responsiveness of prices and quantities to the star rating system than found in prior research on the

original NHC system may inform the design of information reports.

On the other hand, the difference in price response between more and less competitive markets suggests that regulations regarding quality reporting and market structure are policy complements and not substitutes. Therefore, public reporting and entry regulation should be considered jointly. Like the nursing home industry, the market structure of other healthcare subsectors varies across the nation (e.g. concentration and demographics). Our results point out the limitation of quality reporting in certain markets and supplementary initiatives may be necessary to mitigate market imperfections.

This paper adds to the literature by studying quality reporting's effect on private-pay prices. We believe this paper provides encouraging results to efforts toward quality transparency. Due to increasing interest in using consumers to drive healthcare quality improvements and cost control, these finding may have broader implications for consumer engagement and price and quality transparency in settings other than nursing homes. For example, consumers in high-deductible health plans have a considerable financial stake in their care choices. Finally, as more detailed data become available, future research may be able to explore the price response to quality reporting in other healthcare sectors.

References

Nicholas Bloom, Carol Propper, Stephan Seiler, and John Van Reenen. The impact of competition on management quality. *working paper*, 2010.

NG Castle, J. Enberg, and A. Emn. Nursing home staff turnover: Impact on nursing home compare quality measures. *The Gerontologist*, 47(5):650–661, 2007.

Aaron Catlin, Cathy Cowan, Heffler Stephen, and Benjamin Washington. National health spending in 2005: The slowdown continues. *Health Affairs*, 26(1):142–153, 2007.

CBO. Financing long-term care for the elderly. *CBO Paper*, 2004.

Jan P. Clement, GJ. Bazzoli, and M. Zhao. Nursing home price and quality responses to publicly reported quality information. *Health Services Research*, 47:86–105, 2012.

CMS. Design for nursing home compare 5-star rating system: Users guide. 2008.

Michael Darden and Ian McCarthy. The start treatment: Estimating the impact of star ratings on medicare advantage enrollments. *working paper*, 2014.

Marjan Faber, Marije Bosch, Hub Wollersheim, Sheila Leatherman, and RIchard Grol. Public reporting in health care: How do consumers use quality-of-care information? a systematic review. *Medical Care*, 47(1):1–8, 2009.

Martin Gaynor. What do we know about competition and quality in health care markets? *NBER Working Paper*, 2006.

David Grabowski and Edward Norton. Nursing home quality of care. *The Elgar Companion to Health Economics*, 2012.

David Grabowski and Robert Town. Does information matter? competition, quality, and

the impact of nursing home report cards. *Health Services Research*, pages 1698–1719, 2011.

David C. Grabowski. The market for long-term care services. *Inquiry*, 45:58–47, 2008.

DB Mukamel and WD Spector. The competitive nature of the nursing home industry: Price mark ups and demand elasticities. *Applied Economics*, 34(4):413–420, 2002.

DB Mukamel, DL Weimer, WD Spector, H Ladd, and JS Zinn. Publication of quality report cards and trends in reported quality measures in nursing homes. *Health Services Research*, 43(4):1244–1262, 2008.

DB Mukamel, WD Spector, JS Zinn, DL Weimer, and Ahn R. Changes in clinical and hotel expenditures following publication of the nursing home compare report card'. *Medical Care*, 48(10):869–874, 2010.

John A. Nyman. The effectof market concentration and excess demand on the price of nursing home care. *Journal of Industrial Economics*, 42(2):193–204, 1994.

W.J. Scanlon. A theory of the nursing home market. *Inquiry*, 17(1):25–41, 1980.

KA Stewart, DC Grabowski, and DN Lakdawalla. Annual expenditures for nursing home care: Private and public payer price growth, 1977 to 2004. *Medical Care*, 47(3): 295–301, 2009.

Rachel M Werner, R.T. Konetzka, E.A. Stuart, E.C. Norton, D. Polsky, and J. Park. Impact of public reporting on quality of postacute care. *Health Services Research*, pages 1189–1187, 2009.

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

JS Zinn, DL Weimer, WD Spector, and DB Mukamel. Do trends in the reporting of quality measures on the nursing home compare website differ by nursing home characteristics? *The Gerontologist*, 45(6):720–730, 2005.

Figure 1: **States Included in the Price Analysis**

This study is based on the nursing homes in California, Florida, Ohio, New York, Pennsylvania, Minnesota, and Texas. Among these states, Florida, New York, and Ohio have Certificate-of-need state laws of nursing home beds.

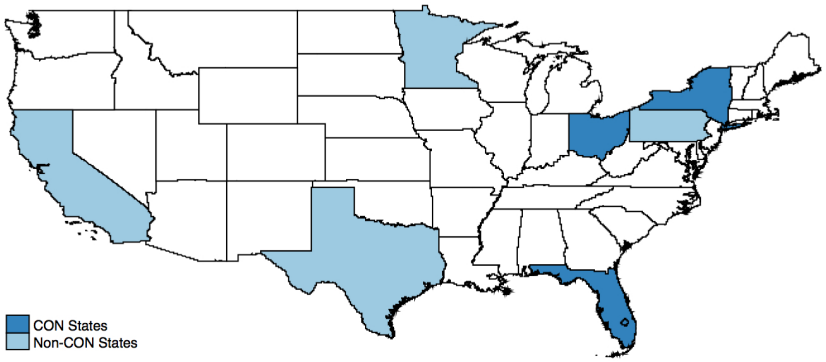

Figure 2: **Median Change of Private-Pay Price, 2006-2011**

Prices adjusted for inflation. Florida and New York prices are not available in 2011

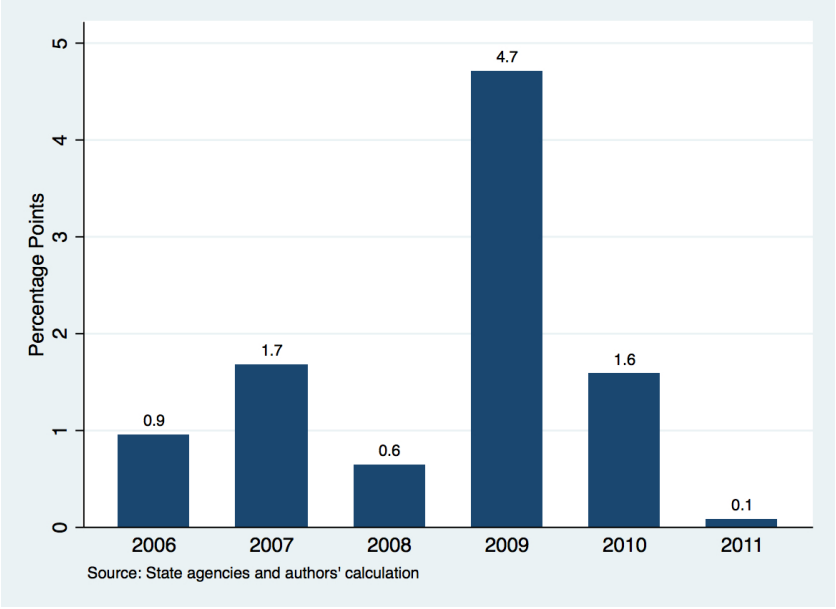

Figure 3: **State by state Median Percentage Points Change of Private-Pay Prices, 2006-2011**

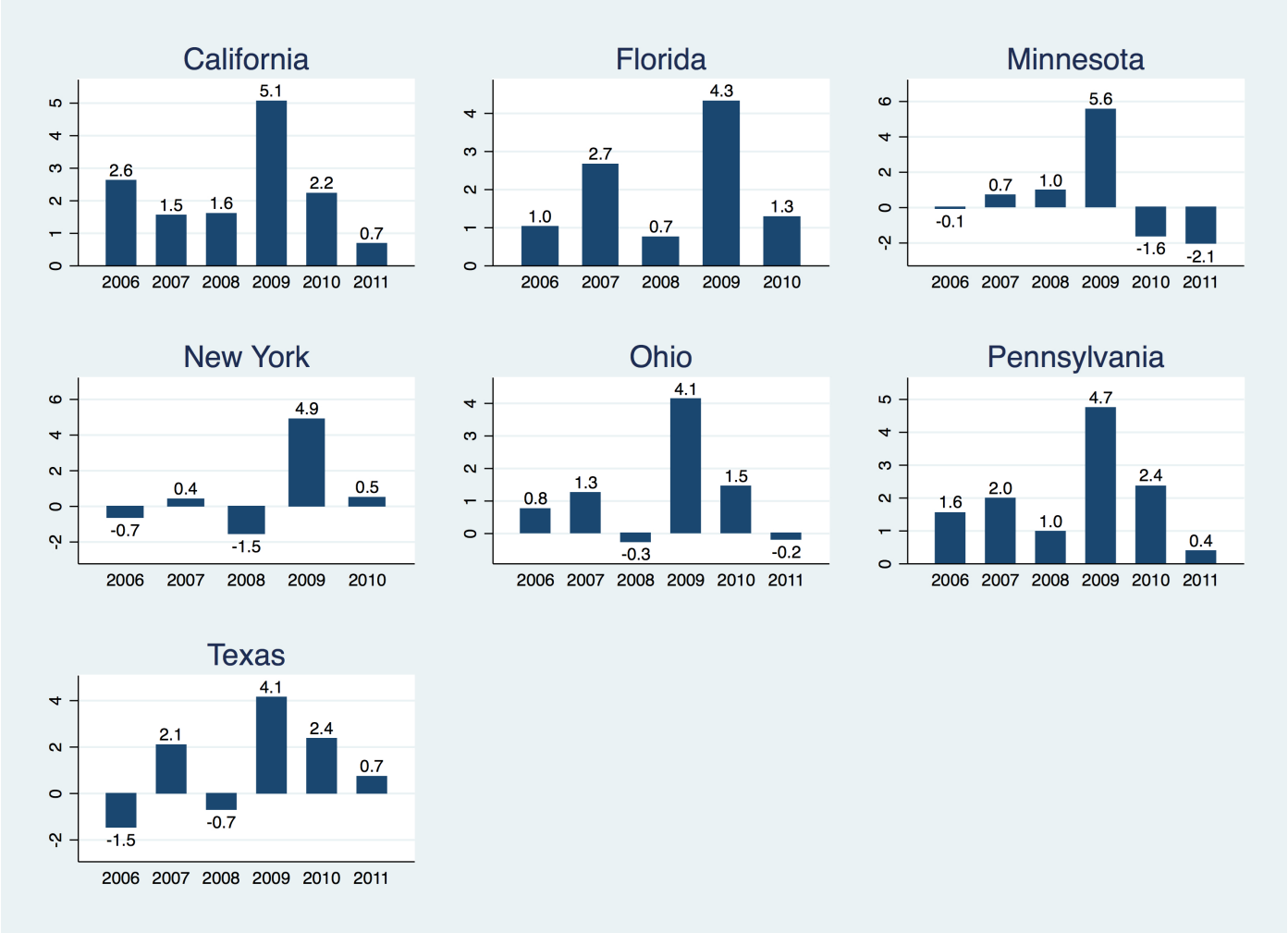

Figure 4: **Average Price Change by Ratings and Market/Facility Characteristics, 2009**

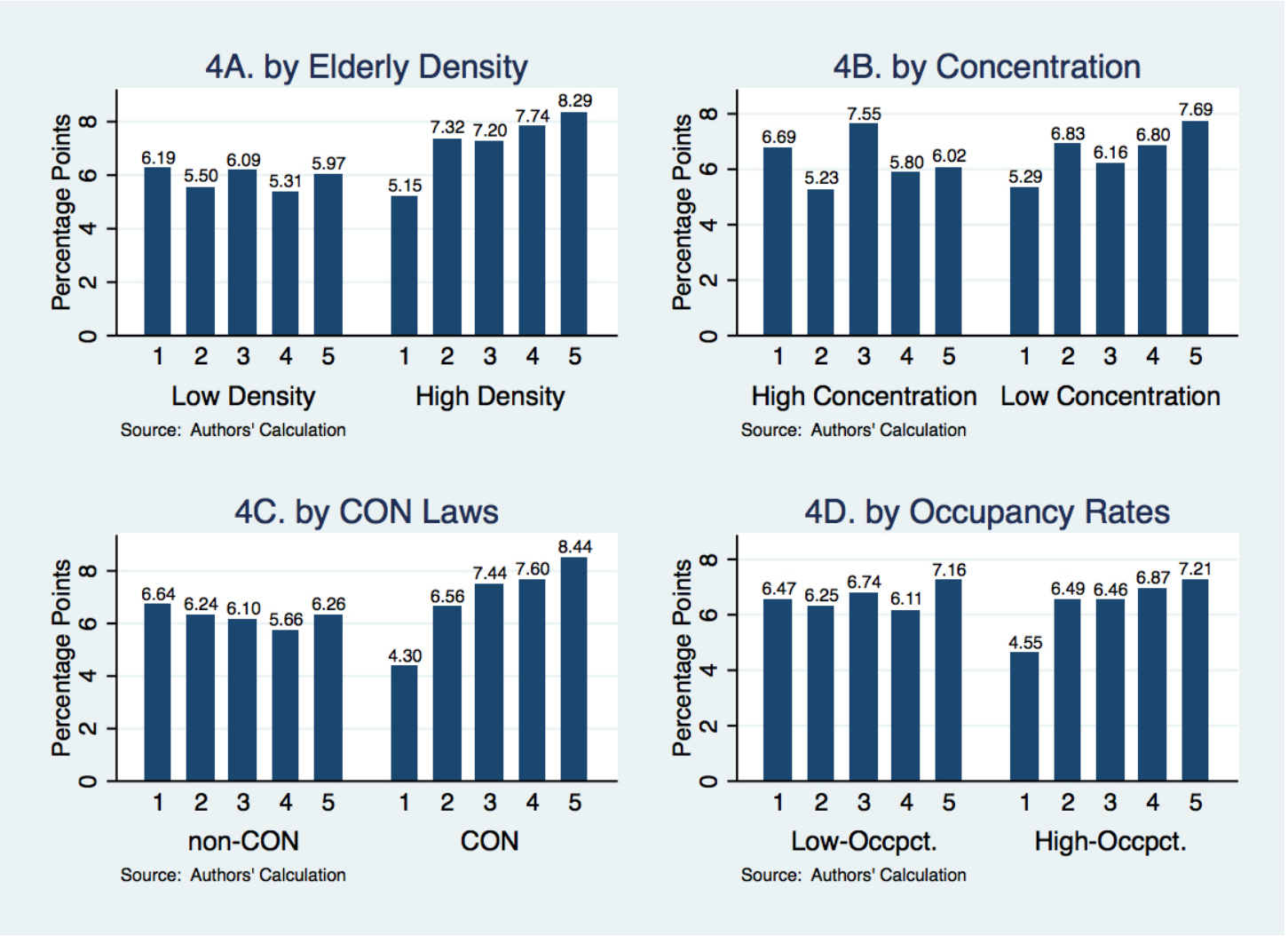

Figure 5: **Average Private Days and Revenues Change by Ratings and Market Structure, 2009**

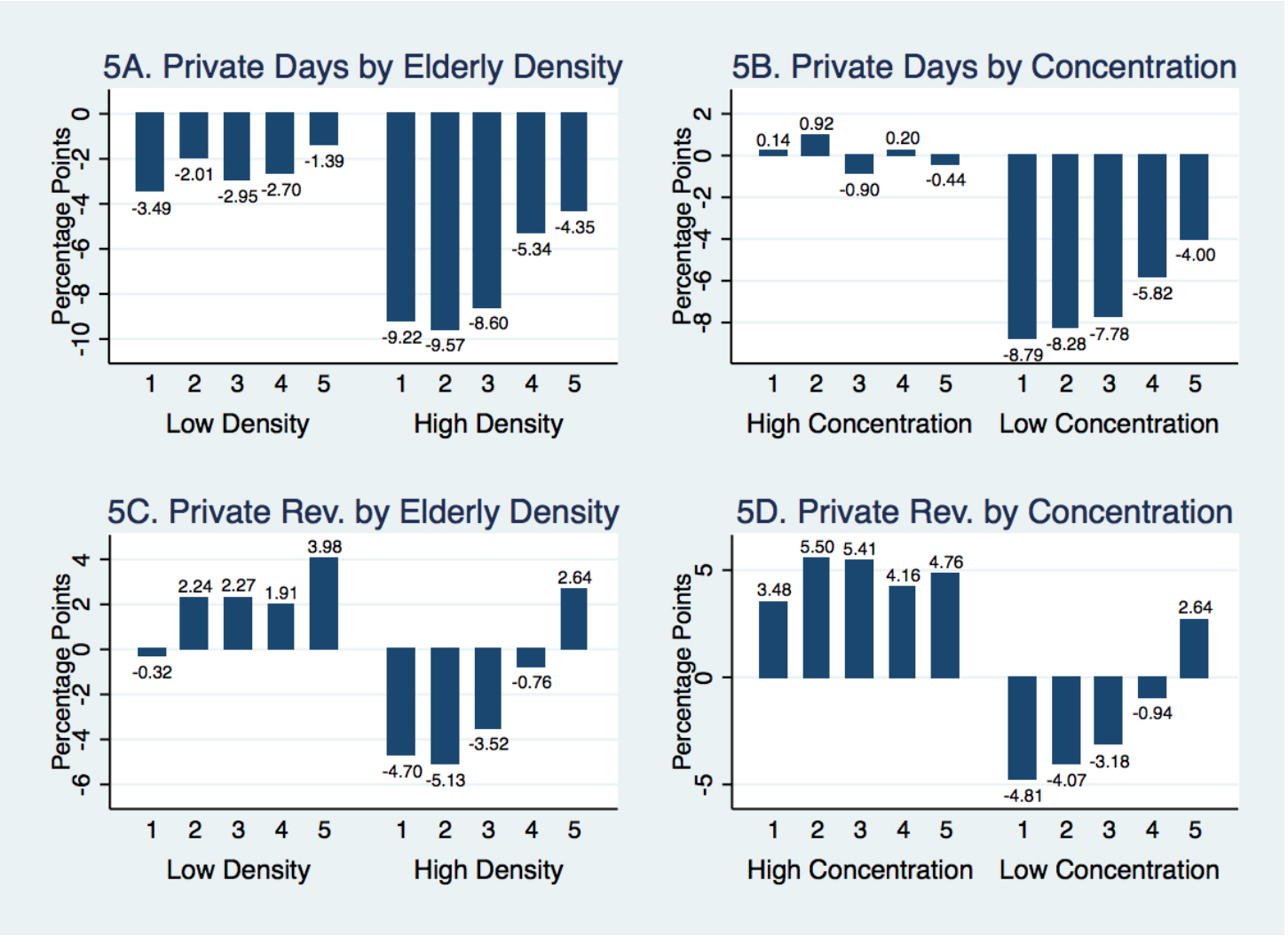

Table 1: Median Price per Day by States and by Years (Inflation Adjusted)

	CA	**FL**	**MN**	**NY**	**OH**	**PA**	**TX**
2005	156.54	164.84	143.47	259.65	163.22	192.00	103.49
2006	161.61	166.40	143.98	256.59	165.78	195.69	101.20
2007	165.96	173.69	146.60	265.87	168.20	199.73	104.48
2008	168.34	176.63	146.98	260.35	168.95	204.10	104.87
2009	177.25	183.36	157.53	277.48	177.62	213.97	110.44
2010	182.23	185.73	155.06	275.85	180.75	218.49	110.87
2011	186.21		150.94		179.68	217.96	111.99

All prices are adjusted for consumer price index that pegged to 2005 price level. The highest and lowest 97.5% and 2.5% are excluded.

Table 2: Summary Statistics

			Percentiles			
	Mean	Std	25%	50%	75%	Obs
Private Price						
Price	179.75	72.60	140.48	169.96	204.86	20524
% ΔPrice	2.63	15.81	-2.75	1.77	6.64	20524
Private Day						
ΔDay	-198.71	1070.66	-778.22	-150.67	403.00	20524
% ΔDay	9.19	257.66	-18.84	-4.12	11.95	20500
Private Revenue						
ΔRevenue	-616.78	266890.77	-105755.00	-300.00	101082.00	20524
% ΔRevenue	13.71	261.39	-15.93	-0.08	16.82	20500
Facility-Level						
For-Profit	0.71	0.45	0.00	1.00	1.00	20524
Government	0.04	0.19	0.00	0.00	0.00	20524
Occupancy Rate (%)	86.67	12.38	81.90	90.50	95.35	20471
# of Beds	116.98	68.20	75.00	104.00	138.00	20488
Chain-affiliated	0.54	0.50	0.00	1.00	1.00	20488
Medicaid Share (%)	63.79	18.29	54.61	66.33	76.14	20488
Medicare Share (%)	13.38	10.02	7.14	11.54	17.03	20488
Patient Characteristic						
Hypertension (%)	54.28	15.30	47.22	55.74	64.05	20524
Female (%)	69.10	14.58	63.64	71.70	78.02	20524
White (%)	78.97	25.82	69.05	89.74	97.83	20524
Hispanic (%)	4.90	14.17	0.00	0.00	0.00	20524
Avg. Age	79.61	10.77	77.35	81.73	84.86	20524
Avg. ADL	16.50	3.28	15.00	16.89	18.49	20524
Acuity Index	11.41	1.41	10.59	11.43	12.25	20524
Market/State-Level						
HHI	0.15	0.19	0.03	0.08	0.19	20524
65+ ('000s)/sq. mile	0.22	0.67	0.02	0.06	0.20	20477
Ln(Household Income)	10.80	0.23	10.64	10.77	10.90	20477
Unemp Rate	7.02	2.82	4.80	6.30	8.70	20477
State Medicaid Rate	166.35	31.47	153.78	167.25	184.28	20461
California	0.20	0.40	0.00	0.00	0.00	20524
Florida	0.10	0.30	0.00	0.00	0.00	20524
Pennsylvania	0.14	0.35	0.00	0.00	0.00	20524
Minnesonta	0.08	0.27	0.00	0.00	0.00	20524
New York	0.11	0.31	0.00	0.00	0.00	20524
Ohio	0.19	0.39	0.00	0.00	0.00	20524
Texas	0.18	0.39	0.00	0.00	0.00	20524

Table 3: OLS Results of Actual Rating on 2009 Price Change

	Overall Quality		Inspection Quality	
	ln($)	% change	ln($)	% change
	(1)	(2)	(3)	(4)
5 star $_{t-1}$	**0.05*** **	**1.67**	**0.05*** **	**2.15**
	[0.016]	[1.227]	[0.016]	[1.349]
4 star $_{t-1}$	-0.01	1	-0.01	-0.62
	[0.015]	[0.926]	[0.016]	[0.946]
3 star $_{t-1}$	-0.02	0.94	0	0.56
	[0.019]	[1.050]	[0.018]	[1.008]
2 star $_{t-1}$	-0.01	0.6	0	-1.24
	[0.015]	[0.859]	[0.016]	[0.807]
For-Profit $_{t-1}$	-0.04**	0.51	-0.04***	0.45
	[0.017]	[0.912]	[0.017]	[0.903]
Government $_{t-1}$	-0.03	-0.63	-0.03	-0.53
	[0.023]	[2.044]	[0.023]	[2.050]
Occupancy Rate $_{t-1}$	0	-0.03	0	-0.03
	[0.000]	[0.038]	[0.000]	[0.038]
# of Beds $_{t-1}$	0.00***	0	0.00***	0
	[0.000]	[0.008]	[0.000]	[0.008]
Chain-affiliated $_{t-1}$	-0.01	-0.92	-0.01	-0.99
	[0.013]	[0.603]	[0.013]	[0.608]
Medicaid-Share (%) $_{t-1}$	-0.00*	0.03	-0.00*	0.03
	[0.000]	[0.029]	[0.000]	[0.030]
Medicare-Share (%) $_{t-1}$	0.00***	0.07*	0.00***	0.07*
	[0.001]	[0.042]	[0.001]	[0.043]
HHI	-0.09***	-1.04	-0.09***	-1.12
	[0.030]	[2.042]	[0.030]	[2.047]
65+ ('000s)/sq. mile	0.07***	3.45	0.07***	3.44
	[0.020]	[2.125]	[0.020]	[2.118]
Ln(Household Income)	0.19***	0.95	0.19***	1.03
	[0.037]	[1.986]	[0.038]	[2.022]
Unemp Rate	0	0.04	0	0.04
	[0.004]	[0.198]	[0.004]	[0.197]
State Medicaid Rate	0.00***	-0.07***	0.00***	-0.07***
	[0.001]	[0.021]	[0.001]	[0.021]
R^2	0.43	0.04	0.43	0.04
N	4214	4214	4214	4214

* significant at 10%, ** significant at 5%, *** significant at 1%; Control for aggregated patient characteristics and state indicators.

Table 4: Results from Simulated Rating and Facility Fixed-Effect

Panel A: Results on Log(price)

	All Facilities	CON Laws		Occpct>Median	
		Yes	No	Yes	No
	(1)	(2)	(3)	(4)	(5)
5 star	-0.021	-0.023	-0.019	-0.050**	-0.022
	[0.015]	[0.029]	[0.016]	[0.024]	[0.023]
5 star X post	0.030**	0.073***	0.002	0.037*	0.028
	[0.012]	[0.023]	[0.013]	[0.019]	[0.021]
N	7885	3213	4672	4008	3891

Panel B: Results on % Price Change

	All Facilities	CON Laws		Occpct>Median	
		Yes	No	Yes	No
	(1)	(2)	(3)	(4)	(5)
5 star	-2.621	-2.892	-1.958	-5.578	-2.825
	[2.458]	[4.652]	[2.485]	[3.774]	[3.428]
5 star X post	4.359**	10.759***	-0.365	6.667*	2.887
	[2.091]	[4.040]	[1.888]	[3.512]	[3.080]
N	7885	3213	4672	3999	3891

Panel C: Triple Interaction of rating, pre-post, and CON/Occupancy

	Ln($)		% Price Change	
	CON	Occpct>Median	CON	Occpct>Median
	(1)	(2)	(3)	(4)
5 star	-0.019	-0.003	-1.999	-0.618
	[0.016]	[0.019]	[2.473]	[2.966]
5 star X post	0	0.021	-0.633	1.657
	[0.013]	[0.019]	[1.934]	[2.893]
5 star X post X CON	0.069***		11.545***	
	[0.026]		[4.462]	
5 star X post X High Occpct		0.02		5.84
		[0.028]		[4.656]
N	7885	7890	7885	7890

* significant at 10%, ** significant at 5%, *** significant at 1%; Control for aggregated patient characteristics and state indicators.

Table 5: Role oF Market Concentration (Facility Fixed Effects)

Panel A: Results on Log(price)

	All Markets Concentration		CON-states Concentration		Occupancy >Median Concentration	
	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
Post	0.056***	0.050***	0.033	0.019	0.056**	0.046**
	[0.015]	[0.016]	[0.031]	[0.033]	[0.026]	[0.020]
5 star	-0.035	-0.013	-0.049	-0.013	-0.033	-0.045
	[0.023]	[0.020]	[0.038]	[0.036]	[0.031]	[0.030]
Middle	-0.01	-0.009	-0.014	0.001	-0.005	-0.018
	[0.016]	[0.011]	[0.028]	[0.020]	[0.025]	[0.017]
5 star X post	**0.016**	**0.038****	**0.028**	**0.099*****	**0**	**0.053****
	[0.019]	[0.016]	[0.032]	[0.031]	[0.029]	[0.024]
Middle X post	-0.002	0.008	0.019	0.029	0.012	0.013
	[0.014]	[0.010]	[0.025]	[0.019]	[0.023]	[0.016]
N	2339	5546	786	2427	995	3004

Panel B: Results on % Price Change

	All Markets Concentration		CON-states Concentration		Occupancy >Median Concentration	
	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
Post	7.85***	8.69***	7.42	1.15	8.51**	2.74
	[2.606]	[2.356]	[5.957]	[4.918]	[4.189]	[3.255]
5 star	-4.45	-1.55	-6.28	-1.82	-1.17	-7.26
	[3.582]	[3.179]	[6.838]	[5.744]	[4.945]	[4.893]
Middle	0.42	-0.19	-0.52	1.58	1.26	-1.83
	[2.493]	[1.446]	[4.952]	[2.610]	[4.240]	[2.331]
5 star X post	**4.26**	**5.33***	**6.03**	**15.46*****	**2.25**	**10.06****
	[2.716]	[2.782]	[4.764]	[5.621]	[3.970]	[4.526]
Middle X post	-0.32	-0.02	2.19	3.55	1.42	2.4
	[2.212]	[1.442]	[4.442]	[2.933]	[3.494]	[2.727]
N	2346	5556	787	2429	998	3011

* significant at 10%, ** significant at 5%, *** significant at 1%; Control for aggregated patient characteristics and state indicators.

Table 6: Role of Elderly Density (Facility Fixed Effects)

Panel A: Results on Log(price)

	All Markets		**CON-states Only**		**Occupancy >Median only**	
	Elderly Density		Elderly Density		Elderly Density	
	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
Post	0.039*	0.051***	0.025	0.016	0.007	0.061***
	[0.022]	[0.013]	[0.051]	[0.026]	[0.029]	[0.019]
5 star	-0.028	-0.023	-0.049	-0.026	-0.081**	-0.022
	[0.025]	[0.018]	[0.046]	[0.028]	[0.040]	[0.022]
Middle	-0.02	-0.002	-0.017	0.003	-0.03	-0.007
	[0.014]	[0.011]	[0.025]	[0.021]	[0.021]	[0.017]
5 star X post	**0.055****	**0.012**	**0.135*****	**0.019**	**0.074****	**-0.005**
	[0.022]	[0.014]	[0.041]	[0.023]	[0.034]	[0.020]
Middle X post	0.026**	-0.012	0.049**	0.009	0.03	-0.002
	[0.013]	[0.010]	[0.024]	[0.020]	[0.021]	[0.016]
N	3929	3956	1875	1338	2211	1788

Panel B: Results on % Price Change

	All Markets		**CON-states Only**		**Occupancy >Median only**	
	Elderly Density		Elderly Density		Elderly Density	
	High	Low	High	Low	High	Low
	(1)	(2)	(3)	(4)	(5)	(6)
Post	6.622*	6.541***	-1.42	1.429	-3.85	6.907**
	[3.416]	[2.017]	[8.015]	[4.135]	[4.780]	[3.022]
5 star	-2.04	-4.395	-8.753	-1.239	-10.844*	-0.453
	[4.216]	[2.783]	[7.377]	[4.626]	[6.377]	[3.480]
Middle	-1.021	0.361	-1.466	2.816	-1.917	0.322
	[1.904]	[1.724]	[3.441]	[3.429]	[2.893]	[2.800]
5 star X post	**6.172**	**2.756**	**19.846*****	**3.361**	**12.436****	**0.201**
	[3.900]	[2.110]	[7.373]	[3.613]	[6.279]	[2.934]
Middle X post	1.797	-1.873	6.113	0.431	3.868	-0.05
	[1.944]	[1.530]	[3.761]	[3.082]	[3.643]	[2.563]
N	3929	3956	1875	1338	2211	1788

* significant at 10%, ** significant at 5%, *** significant at 1%; Control for aggregated patient characteristics and state indicators.

Table 7: Alternative Specification (Facility Fixed-Effects)

In the alternative specification, we separate the nursing homes into 6 categories: (5star, middle, 1star) by (low concentration, high concentration) or by (high elderly density, low elderly density). We then interact each with the dummy variable to indicate the pre-and post-implementation period. The following table shows the regressions run on the log (price).

Panel A: Interaction Term of Rating and Market Concentration on Log(price)

	All	CON laws		Occupancy >Median	
	Markets	Yes	No	Yes	No
	(1)	(2)	(3)	(4)	(5)
(5 star, LC) x Post	**0.031***	**0.096*****	**-0.016**	**0.048**	**0.01**
	[0.018]	[0.035]	[0.019]	[0.030]	[0.030]
(5 star, LC) x Post	0.009	0.021	0.008	-0.009	0.022
	[0.019]	[0.032]	[0.024]	[0.030]	[0.030]
(Middle, LC) x Post	0.001	0.028	-0.014	0.011	-0.011
	[0.013]	[0.025]	[0.014]	[0.023]	[0.018]
(Middle, HC) x Post	-0.006	0.019	-0.018	0.013	-0.022
	[0.014]	[0.026]	[0.015]	[0.024]	[0.020]
(1 star, LC) x Post	-0.008	-0.003	-0.013	-0.007	-0.02
	[0.015]	[0.029]	[0.015]	[0.026]	[0.022]
N	7885	3213	4672	3994	3891

Panel B: Interaction Term of Rating and Elderly Density (ED) on Log(price)

	All	CON laws		Occupancy >Median	
	Markets	Yes	No	Yes	No
	(1)	(2)	(3)	(4)	(5)
(5 star, LC) x Post	**0.035***	**0.131*****	**-0.035****	**0.056***	**-0.007**
	[0.021]	[0.040]	[0.015]	[0.031]	[0.031]
(5 star, LC) x Post	0.013	0.026	0.014	-0.003	0.034
	[0.014]	[0.024]	[0.019]	[0.021]	[0.026]
(Middle, LC) x Post	0.003	0.040*	-0.008	0.012	-0.001
	[0.010]	[0.021]	[0.010]	[0.017]	[0.015]
(Middle, HC) x Post	-0.012	0.011	-0.019*	0	-0.015
	[0.010]	[0.020]	[0.011]	[0.017]	[0.015]
(1 star, LC) x Post	-0.022	-0.006	-0.019	-0.024	-0.018
	[0.014]	[0.028]	[0.014]	[0.024]	[0.022]
N	7885	3213	4672	3994	3891

* significant at 10%, ** significant at 5%, *** significant at 1%; Control for aggregated patient characteristics and state indicators.

Table 8: Volume and Revenue Responses (Facility Fixed-Effects)

Panel A: Log(Private Days)

	Overall	Concentration		Elderly Density		CON	
		High	Low	High	Low	Yes	No
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
post	-0.008	-0.022	-0.004	0.003	-0.006	-0.112***	0.105***
	[0.024]	[0.036]	[0.035]	[0.047]	[0.030]	[0.034]	[0.035]
5 star	-0.006	0.008	-0.025	-0.045	0.02	0.026	-0.021
	[0.031]	[0.051]	[0.038]	[0.048]	[0.038]	[0.038]	[0.045]
middle	-0.001	-0.02	0.005	0.011	-0.015	0.035	-0.026
	[0.024]	[0.033]	[0.030]	[0.039]	[0.028]	[0.028]	[0.034]
5 star X post	**0.072*** **	**-0.039**	**0.121*** **	**0.131*** **	**0.026**	**0.046**	**0.079** **
	[0.025]	[0.039]	[0.031]	[0.039]	[0.031]	[0.033]	[0.035]
middle X post	0.023	0.033	0.016	-0.002	0.047*	0	0.037
	[0.019]	[0.031]	[0.024]	[0.029]	[0.026]	[0.025]	[0.027]
N	7973	2355	5618	4008	3965	3280	4693

Panel B: Log(Private Revenue)

	Overall	Concentration		Elderly Density		CON	
		High	Low	High	Low	Yes	No
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
post	0.050**	0.072**	0.037	0.027	0.052*	-0.051	0.149***
	[0.025]	[0.033]	[0.038]	[0.051]	[0.030]	[0.038]	[0.035]
5 star	-0.024	-0.021	-0.033	-0.08	0.012	0.004	-0.042
	[0.033]	[0.058]	[0.040]	[0.050]	[0.042]	[0.043]	[0.047]
middle	0.001	-0.006	0.004	-0.001	-0.001	0.027	-0.02
	[0.024]	[0.035]	[0.030]	[0.039]	[0.028]	[0.027]	[0.034]
5star X post	**0.058** **	**-0.051**	**0.108*** **	**0.141*** **	**-0.003**	**0.026**	**0.079** **
	[0.027]	[0.041]	[0.035]	[0.043]	[0.035]	[0.039]	[0.038]
middle X post	0.005	-0.005	0.006	-0.011	0.026	-0.006	0.014
	[0.020]	[0.029]	[0.025]	[0.031]	[0.026]	[0.027]	[0.027]
N	7854	2349	5505	3905	3949	3204	4650

* significant at 10%, ** significant at 5%, *** significant at 1%; Control for aggregated patient characteristics and state indicators.

Appendix A: Example of NHC Five-Star Webpage

Medicare.gov | Nursing Home Compare

The Official U.S. Government Site for Medicare

98 hospitals within 25 miles from the center of 20057.

Nursing Home Search Results

Nursing Home Information	Overall Rating	Health Inspections	Staffing	Quality Measures	Distance
BRINTON WOODS HEALTH & REHAB CENTER AT DUPONT CIRC 2131 O STREET NW WASHINGTON, DC 20037 (202) 785-2577	★★★★★ Much Above Average	★★★★★ Average	★★★★★ Above Average	★★★★★ Much Above Average	**1.6 Miles**
METHODIST HOME 4901 CONNECTICUT AVENUE, NW WASHINGTON, DC 20008 (202) 966-7623	★★★★★ Much Above Average	★★★★★ Much Above Average	★★★★★ Much Above Average	★★★★★ Much Above Average	**2.0 Miles**
HEALTH & REHABILITATION CENTER AT THOMAS CIRCLE 1330 MASSACHUSETTS AVENUE NW WASHINGTON, DC 20005 (202) 628-3844	★★★★★ Much Above Average	★★★★★ Above Average	★★★★★ Much Above Average	★★★★★ Above Average	**2.5 Miles**
CHERRYDALE HEALTH AND REHABILITATION CENTER 3710 LEE HIGHWAY ARLINGTON, VA 22207 (703) 243-7640	★★★★★ Below Average	★★★★★ Much Below Average	★★★★★ Below Average	★★★★★ Much Above Average	**2.5 Miles**
SIBLEY MEM HOSP RENAISSANCE 5255 LOUGHBORO ROAD NW WASHINGTON, DC 20016 (202) 537-4000	★★★★★ Much Above Average	★★★★★ Above Average	★★★★★ Much Above Average	★★★★★ Much Above Average	**2.8 Miles**
THE WASHINGTON HOME 3720 UPTON STREET NW WASHINGTON, DC 20016 (202) 966-3720	★★★★★ Average	★★★★★ Below Average	★★★★★ Above Average	★★★★★ Above Average	**3.0 Miles**