ECONOMIC DETERMINANTS OF QUALITY OF CARE IN NURSING HOMES

by

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Chapter 1

Introduction

This dissertation is a compilation of two essays addressing the effects of economic factors on the quality of care in U.S. nursing homes. Both papers make used of nationally representative data for 2010 on nursing homes in the U.S., state regulation of long-term care providers, particularly Medicaid policy towards nursing homes, the economic structure of local markets in which the facilities operate, including the extent of competition from other long-term care providers, such as assisted living facilities and home healthcare agencies, and county-level population demographic characteristics.

Over the last 20 years nursing homes in many markets across the U.S. have experienced increased competition from home health agencies and assisted living facilities, yet little is known about how these more recent sources of competition affect the quality of care they provide. The first essay examines how nine different measures of nursing home care quality respond to the greater levels of local market competition from these alternative providers of long-term care, as well as other nursing homes. The findings from this empirical analysis reveal that faced with greater competition from assisted living facilities, nursing homes are left to care for more disabled, less healthy patients. Although the nursing home's staff-to-bed ratios rises in response, significant declines occur in other measures of care quality, such as more process- and outcome-based measures. Competition from home health agencies likewise has mixed effects on the nursing home's care quality, and competition from other nursing homes in a market tends to decrease care quality. These finding suggest that care quality in nursing homes

may continue to erode as the market for alternative, community-based long-term care services expands.

The second essay examines the important effects of state Medicaid regulations on nursing home care quality. Unlike earlier studies on the effects of Medicaid, this analysis adopts a richer model specification for care quality that controls for the economic structure of the nursing home's local market, as well as how the state regulates assisted living facilities, who compete with nursing homes for residents. Most previous studies of the effects of state Medicaid policies on care quality analyzed nursing homes in isolation, ignoring the presence of nearby competitor firms, and how state regulation of assisted living facilities might also affect care quality in nursing homes. The findings from the analysis reveal that a higher Medicaid reimbursement rate leads to significant improvements in nine distinct aspects of nursing home quality, while state certificate-of-need programs for nursing homes lead to significant declines in several (but not all) dimensions of care quality. A large presence of assisted living beds in a local market also tends to reduce nursing home quality, and state regulations regarding assisted living facilities indirectly affect nursing home care quality by altering the nature of local market competition. Overall, these results suggest that state laws related to all long-term care providers, not just nursing homes, are important determinants of nursing home care quality.

Chapter 2

Effects of Long-term Care Market Competition on Nursing Home Quality

2.1 Introduction

Long-term care encompasses a broad range of services, including medical and non-medical care provided to people who need assistance performing activities of daily living. Current estimates suggest that at least 70 percent of individuals over age 65 will need long-term care services at some point in their lifetime (CMS 2014). In 2010, total spending for long-term care services was $207.9 billion, or 8 percent of all U.S. personal health care spending (O'Shaughnessy 2011), most of which is paid by state Medicaid programs.

Historically, nursing homes have been the major providers of long-term care to older adults. In recent decades, however, alternatives to nursing homes have emerged in many areas, such as assisted living facilities and home health care providers. Some states have even begun to cover care in these alternative settings under Medicaid, by established Medicaid 1915(C) waiver programs. With these changes in the structure of the market for long-term care, and changes in Medicaid policy in some states, the overall demand for nursing home care in the U.S. is also changing. More and more seniors are shifting away

from receiving care in a nursing home to receiving home and community-based assisted living care instead.

Assisted living facilities are community-based residential long term care centers that provide housing and supportive services for older adults. Since 1990 the total number of beds in assisted living facilities has grown rapidly. Nationwide the number of beds more than doubled between 1990 and 2002 (Harrington et al 2001), and since then they have continued to grow steadily. As of 2010 there were 51,367 licensed assisted living facilities in the U.S. with a total bed capacity of 1,233,690 beds. Much different from the earliest form, assisted living facilities are able to provide more professional medical care and more services to assist activities of daily living. They are closer substitutes for nursing home services than before.

Recent research suggests that many older adults have moved out from nursing homes into assisted living facilities in order to achieve greater independence and more dignity (Perkins et al 2012). There are now 1.8 million adults who live in this nation's 16,000 nursing homes (Kaye et al 2010), and more than 735,000 adults who live in assisted living facilities (NSAL 2012). With their rapid growth rate, assisted living facilities are expected to eventually surpass nursing homes to become the major providers of long-term care services in the U.S..

Home care providers, which supply long-term care services at a patient’s home, are also an important substitute for nursing home care. Studies have consistently found that most older adults strongly prefer staying in their own home to any other alternative (Gibson et al 2003).

Despite the growing importance of home and community based services in long-term care, few studies have looked at whether and how home care providers and assisted living facilities are affecting nursing homes. This is surprising because economics suggests that nursing homes likely compete not only with other nursing homes, they compete with other types of firms that provide alternatives to institutional care. This implies that when a nursing home chooses care quality for its residents, for example, the structure of the market in which it operates may be influencing its choices. With all the competitive forces now shaping the long-term care market, we should not be examining nursing homes in isolation from the rest of the market. If market competition is having effects on nursing homes, then ignoring these effects could lead to biased results and false conclusions.

This study examines how competition from nearby assisted living facilities and home care providers affects the quality of care provided by nursing homes. Unlike the few previous studies that addressed interactions between assisted living facilities and nursing homes using state-specific data sets, this study analyzes data from a large, nationwide sample of nursing homes. It is the first paper to study the effects of competition from assisted living facilities and home health providers on the quality of care within nursing homes. It also examines the effects of state-level regulations and policies on nursing homes and assisted living facilities.

The paper is organized as follows. Section 1 provides background information on the long-term care market and briefly reviews the literature on nursing home quality. Section 2 describes the data used for the analysis and the specification of variables, while Section 3 describes the statistical methods used. The results are reported in Section 4.

Section 5 summarizes the key findings and their policy implications, and describes possible future work.

2.2 Background

With the growing population of older adults and forthcoming wave of baby boomers, long-term care has been a heated topic among health economists. Being the major provider of long-term care, nursing homes have typically been the center of discussion. Early studies, including Chiswick(1975), Scanlon(1980), and Mukamel et al(2002), focused on the demand for nursing home services and the price elasticities for care, trying to figure out what factors influence the demand function, in order to have a clearer view of how this market operates. Since 2000 researchers have began to focus more on nursing home quality, investigating how state regulations and facility characteristics influence nursing home quality. Although it is difficult to measure quality directly, a whole host of quality measures have been proposed. Zimmerman et al. (1995) suggested quality measures in twelve different domains, discussed their nature and characteristics, and examined their validation using a pilot test. On the other side of the equation, factors from all sorts of aspects are being used to check their effects on nursing home quality.

Facility characteristics, including for-profit status, have been evaluated by Grabowski et al (2003). Their study found that a higher non-profit market share could induce a spillover to the for-profit side of the nursing home market and thereby increase overall quality in a market. This finding is consistent with a review done by Hillmer et al (2005) that found that studies conducted between 1990 and 2002 on the relationship

between nursing home for-profit status and quality of care collectively suggest that non-profit nursing homes provide better quality, measured in many important areas, and the quality difference between for-profit and non-profit nursing homes are systematic. Harrington et al. (2001) also concluded that investor-owned nursing homes have worse residents' health outcomes than do non-profit homes.

Another line of literature focused on the effects of Medicaid reimbursement rates on nursing home care quality. Cohen and Spector(1996) studied the effects of both the reimbursement method and the Medicaid payment rate in their analysis. They found that both affect nursing home staffing intensity. With the direct link of staffing intensity to nursing home residents' health outcomes, a higher level of reimbursement rate could increase the staffing level that induces a possible quality increase.

David Grabowski has conducted several studies on the effects of Medicaid payment rates. In a 2001 study he found the reimbursement rate had a small positive effect on nursing home quality, as measured by the proportion of residents with facility-acquired pressure sores as well as the number of registered nurses. In another study based on longitudinal data, Grabowski (2004) found uniformly positive effects on several nursing home quality indicators with an increase in the Medicaid reimbursement rate. This improvement in the strength of the latter analysis is not only attributed to a better model setting, but also to the incorporation of the market competition and changes over time. In fact, competition in the nursing home sector can be a really important factor that influences the interaction between nursing home characteristics and quality outcomes. Zinn(1994) uses market share concentration in terms of Herfindahl index to indicate

competition and finds there are significantly lower prevalence of catheter, restraint use, and not toileted in markets with higher concentration.

Since 1990 there have been significant changes in the long-term care market with the emergence of substitutes for nursing home care. More research is needed examining the effects of the new market structures. The effect of competition on nursing home quality is not as straight forward as the effect of competition on price to see through based on economic theories. Morrisey (2001) pointed out two possible circumstances in which competition might drive quality into completely different directions. On one hand, if quality is related to more services being provided, a lower price caused by competition might tend to bring down quality. On the other hand, if competition leads to greater efficiency and cost savings, quality might rise. These two opposite possibilities call for more evidence based on empirical work.

To date, only a few studies have considered the effects of assisted living facilities on nursing home care quality. Competition from home care agencies has only been addressed crudely with home health staff per capita and percentage of women aged15-64 not in the workforce as proxies. (Zinn 1994). Grunier et al (2007) is one of the few who pay attention to assisted living facilities. By mainly looking at the dementia special care units in nursing homes, they find that competition from assisted living facilities only affected the profile of residents in special care units but not nursing home investment or other aspects. Bowblis (2012) checked the effect from both nursing home market structure and expansion of assisted living on nursing home quality using data in Ohio state. His regression results show that assisted living facilities do have significant, mainly negative, effects on nursing home quality. Although this study is only based on data in

one state, these effects give a good sketch of the long-term care market interaction in Ohio state and suggest a more integrated regulation method for assisted living facilities and it also provides strong empirical evidences and supports to include competition from other sectors in nursing home quality analysis in the future research.

The present study is the first to consider how the quality of nursing home care responds empirically to local market competition from assisted living facilities, home care agencies, as well as other nursing homes. Using nationally representative data from a large sample of nursing homes observed in 2010, two questions are examined. First, is the quality of care provided by a nursing home influenced by local market competition from these three types of firms, and if so, how? Second, is the competition from assisted living facility and home care agency taking the form of a battle over price or services?

2.3 Data Sources

Nursing home-level, county-level, and state-level data from several sources were assembled to conduct the analysis. The data sources include the 2010 Certification And Survey Provider Enhanced Reports (CASPER), the 2010 Nursing Home Compare (NHC) data, the Provider of Services File (POS), the Area Resource File (ARF), the MetLife Market Survey of Nursing Homes data, the Assisted Living, Adult Day Services, and Home Care Costs (MetLife Market Survey) data, the State Data Book on Long Term Care (State Data Book), the Assisted Living State Regulatory Review (AL Regulatory Review), and assisted living facility supply data collected by Stevenson and Grawboski (2010).

The facility level nursing home data are from the CASPER and NHC data sets. The CASPER data set replaced the Online Survey, Certification, and Reporting (OSCAR) System, and is maintained by the Center for Medicare and Medicaid Services (CMS). This data set provides comprehensive information for every Medicare or Medicaid certified nursing home facility with its operational characteristics and aggregate resident information. The CASPER data was merged at the facility-level with the Nursing Home Compare data, which provides information on the quality of care at the nursing home, as reported by the Center for Medicare and Medicaid Services (CMS).

Because our interest centers on the effects of competition between nursing homes, home care agencies, and assisted living facilities, nursing homes that were certified as a skilled nursing facility (SNF) only were dropped from the sample of facilities to be analyzed. The care provided by SNFs is much more intense nursing care, and it is not a substitute for the intermediate-level care provided by home care agencies and assisted living facilities. Dropping the SNF-only facilities leads the total number of observations to decrease by 9.44%, from 14827 to 13426. Without any further sampling, this data set is a near-complete census of all the non-SNF certified nursing homes in the U.S. in 2010.

Several variables such as the staffing level per bed, the total number of health deficiencies, the percentage of empty beds in the county, a Herfindahl index, and case-mix measurement were all calculated for each facility using the data sets listed above. The staffing level was calculated as full-time-equivalent staff per bed, defined as the sum of full-time staff, part-time staff (upon conversion into full-time-equivalent persons), and contract staff (upon conversion into full-time-equivalent persons). The percentage of empty beds was derived from the difference between the total number of resident and

total number of certified nursing home beds for each facility as a percentage of the total number of beds, and then averaged at the county level where the nursing home was located. The Herfindahl index was calculated at the county-level and is based on each facility's share of beds, defined as the number of beds in that nursing home divided by the total number of beds in that facility's county.

Data from the Provider of Service file, which provides information on all certified health care institutional providers across the U.S., and the assisted living facility supply data collected by Stevenson and Grabowski were merged with the nursing home facility file based on each nursing home's zip code. The assisted living data collected by Stevenson and Grabowski describes assisted living facilities across the entire U.S., as of 2007. Before merging their data with the 2010 nursing home file, their variables were each adjusted to reflect 2010 levels, based on the aggregate growth rate in assisted living facilities, as reported by the AARP report on Assisted Living and Residential Care in the States in 2010. Data from the ARF were likewise merged to the nursing home file based on the county. Variables from the ARF include county-specific demographic characteristics, such as per capita income, race, gender, poverty rate, mortality rate, and region identifier.

The MetLife Market Survey was collected by the MetLife Mature Market Institute. It contains daily private-pay price levels for nursing homes, monthly rates for assisted living facilities, hourly rates for home health care agencies, and daily prices for adult day services. The private rates are mainly at the state-level with some metropolitan areas reported as well. Using state-level price information instead of recording it at facility level could help avoid the endogeneity problem between price and quality, thus

the state average private price levels were merged with the other previous mentioned data sets to provide private-pay rates for each long-term care facility.

Data on state regulations covering long-term care facilities were also added to the nursing home file. Most of the variables describing nursing home and assisted living facility regulation take the form of (0,1) indicators. These variables were derived from information reported in the State Data Book on Long Term Care (2007) Program and Market Characteristics (funded by the U.S. Department of Housing and Urban Development) and the Assisted Living State Regulatory Review (2007) (prepared by the National Center for Assisted Living).

According to the State Date Book on Long Term Care, there are four types of rate-setting systems for nursing homes, including prospectively set, flat rate, case-mix based, and combination-type systems. The strictest is a flat rate system because it sets a uniform level of reimbursement for the same class of homes, regardless of their variation in costs. In contrast, a case-mix based system adjusts a nursing home's rate based on its residents' case-mix which reflects differences in need. Under a prospective rate system a nursing home's reimbursement rate is set in advance, based on the previous costs level of each facility, but it doesn't account for the actual costs. A combination system has both prospective and retrospective elements to how rates are set, so that interim rates eventually align closer to actual costs. Since only one state has a flat rate system and one state has a case-mix based system, this analysis could control for only the prospective and combination systems in the regression models estimated.

State rate-setting systems for assisted living facilities can be categorized into five approaches: flat rate, tiered rate, case-mix based rate, fee-for-service (FFS) rate, and

negotiated rate systems. A flat rate system for assisted living facilities, just like a flat rate system for nursing homes, does not allow any adjustments for conditional differences across assisted living facilities. Rather, each facility receives the same flat rate. A case-mix based system has the same basic logic as a case-mix reimbursement system for nursing homes. A tiered rate system is quite similar to a case-mix based system, except it typically has fewer rate categories than a case-mix based system. Under a fee-for-service rate setting scheme, instead of receiving a monthly payment, the assisted living facility has to send bill to the payment agency based on the services delivered to the resident. Finally, a negotiated rate system is a method that combines some or all of the other four systems. Table 2.1 describes all of the variables used in the analysis and their sources.

2.4 Empirical Specification of Variables

2.4.1 *Quality Measures*

Quality is a multidimensional concept. Measures of it fall into three categories: structural measures, process-of-care measures, and outcome measures. Structural measures are organizational characteristics of nursing homes, and include staffing levels as well as the scope of the nursing home's health-related deficiencies, such as the number of federal minimum quality standards the facility fails to fulfill. Process measures include the prevalence of indwelling catheters in the nursing home, the prevalence of tube feeding, the prevalence of physical restraints, and the facility's drug error rate. In general, process measures depend on and reflect the interactions that are occurring between the nursing home staff and its patients. Outcome measures, such as the prevalence of pressure sores in the nursing home, are widely regarded as the most straight forward

measures of care quality. Outcome measures represent changes in resident characteristics that are directly attributable to the practice and environment of the nursing home.

In this paper measures from all three categories are used. Table 2.2 lists the nine variables in the analysis that measure quality and their type. Although registered nurses (RN) per bed, licensed practical nurses (LPN) per bed, and nurse aids per bed are all measures of staffing levels, they should not be regarded as perfect substitutes. RNs usually have more medical skills and can provide more intensive and skilled services to a resident. LPNs focus more on daily medical routines that help preserve a resident's well being. The all-day-round care provided by nurse aids can possibly affect a resident's satisfaction and his/her mood. To acknowledge these differences in roles, all three are used as quality indicators in the analysis. Measurements of catheter and pressure sores are adjusted for pre-existing conditions where the prevalence is recorded as percentage of residents who did not have but acquired catheter or pressure sore during the stay in nursing home facilities.

2.4.2 *Case Mix Measures*

The analysis controls for the case mix of residents in order to ensure that the quality indicators for each nursing home facility are not biased by case-mix differences. A case-mix index was created to measure the level of sickness among residents in each facility, and it was included in all nursing home quality regressions. The nursing home case-mix index was built based on the "Management Minutes System" designed by Bill Thoms (1975). It is expressed in minutes of staff time where different prevalence of disability is given a different weight based on the level of sickness. The indicators of disabilities are mutually exclusive and expressed in term of percentage of residents. In

order to avoid multicollinearity in the statistical analysis, any quality indicator that is embodied in the case-mix system was abandoned as dependant variables. The formula for case-mix index calculation is shown in Appendix A.

2.4.3 *Definition of the Market*

Before local market competition can be measured, the relevant market needs to be defined. The market should be a place where competition actually happens. In most previous studies of nursing homes the county has been used to represent the local market. Although not ideal, it has proven to be reasonable. For example, by looking at resident characteristics in different regions, Nyman (1994), Gertler (1989), and Banaszak-Holl et al (1996) all found that more than 75% of nursing home residents were from the same county where the home they were in was located. Therefore, following Zinn(1994), Cohen and Spector (1996), and Grabowski (2001), this study used the county to approximate the relevant geographic market.

2.4.4 *Excess Demand*

States control the supply of nursing home beds through their certificate-of-need and moratorium regulations. Limits on nursing home bed supply can lead to unfulfilled demand in some markets, a phenomenon economists call "excess demand". When excess demand exists, a facility may be able to strategically select residents based on its own preferences. Because potential patients differ in terms of their payment rates and sometimes health conditions, more profitable private-pay patients are usually admitted first. When this happens individuals on Medicaid typically wait in line until an empty bed becomes available. In effect, they lose the right to choose a nursing home based on its quality, which in turn may reduce the willingness of local nursing homes to provide

better quality and to compete with each other based on quality. Different studies have reached different conclusions about the effects of excess demand on the quality of nursing home care, and about how Medicaid reimbursement affects quality in the presence of excess demand (Grabowski 2001, Gertler 1992, Nyman 1989). In this analysis, excess demand was measured as the county-wide average percentage of empty nursing home beds.

2.5 Econometric Framework

Using the 2010 data on nursing homes and their markets described above, we examined the effects of market competition on nursing home quality by estimating a series of linear regression models for the quality measures. In each model estimated, we allowed for the possibility that nursing home beds and the structure of the market might be endogenous to the facility. Specifically, Hausman tests were first conducted to check the endogeneity of nursing home beds, per capita home care agencies, and per capita assisted living beds. The results from these tests ruled out the endogeneity of nursing home beds and home care agencies per capita, but they failed to reject the endogeneity of assisted living beds per capita. To address this issue, two-stage least squares regression model were adopted, explicitely treating assisted living beds per capita as endogenous.

The instrument variables should be correlated with assisted living facility bed number but not correlated with nursing home quality indicators. State regulatory factors that affect the assisted living industry, such as regulation of facility scope of care, reimbursement methods, and whether the state had a Medicaid waiver covering assisted living care, are good candidates for instrument variables. However, some other policy

variables such as assisted living private-pay price level and assisted living certificate-of-need regulation might be correlated with the nursing home quality indicators as well as the variables measuring assisted living facilities. Thus, these variables were left out of the first-stage regression and were used as independent variables in the second stage regression only.

2.5.1 ***Statistical Models***

The basic linear regression model is built as equation (1), where Q_{im} is the dependant variable for nursing home quality of nursing home i in market m. Series of facility characteristics for nursing home i in market m is are included in X_{im}. S_m, which is the key set of variables in this paper, is composed of market competition from nursing homes, assisted living facilities, and home care agencies in market m. Z_m represents county level demographic characteristics. R_{mNH} are variables for nursing home state regulations.

$$Q_{im}=\beta_1 X_{im}+\beta_2 S_{mNH}+ \beta_3 S_{mHC}+ \beta_4 S_{mAL}+\beta_5 Z_m+\beta_6 R_{mNH}+\varepsilon_{im} \quad (1)$$

Because of the endogeneity of the assisted living beds per capita, the actual regression model is regressed in two stages with instrument variables dealing with the endogenous variable. Thus, for the first stage, we have:

$$S_{mAL} = \beta_1 X_{im}+ \beta_2 S_{mNH}+ \beta_3 S_{mHC}+ \beta_4 Z_m+ \beta_5 R_{mNH}+\beta_6 R_{mAL}+\varepsilon_m \quad (2)$$

where S_{mAL} is endogenous, and R_{mAL} is a vector of state regulation instruments to identify the model. Upon estimating equation (2), the following second stage equation was estimated for each quality measure:

$$Q_{im}=\beta_1 X_{im}+\beta_2 S_{mNH}+ \beta_3 S_{mHC}+ \beta_4 \hat{S}_{mAL}+\beta_5 Z_m+\beta_6 R_{mNH}+\varepsilon_{im} \quad (3)$$

where $\hat{S}_{mAL}$ was the estimated value from equation (2).

In order to further examine the possible effects of market competition on variables other than quality, two more linear regressions were also estimated. Equation (4) below describes the price per day received by the nursing home, and equation (5) below describes the case-mix of its residents:

$$P_{mNH}=\beta_1 X_{im}+\beta_2 S_{mNH}+ \beta_3 S_{mHC}+ \beta_4 S_{mAL}+\beta_5 Z_m+\beta_6 R_{mNH}+\varepsilon_{im} \quad (4)$$

$$CM_{imNH}=\beta_1 X_{im}+\beta_2 S_{mNH}+ \beta_3 S_{mHC}+ \beta_4 S_{mAL}+\beta_5 Z_m+\beta_6 R_{mNH}+\varepsilon_{im} \quad (5)$$

where P_{mNH} measures the nursing home's daily private-pay price level for market m, and CM_{imNH} is the case-mix index for nursing home i in market m. In estimating equations (4) and (5) we allowed for possible heteroscedasticity in the standard errors.

2.6 Results

Table 2.3 reports the mean and standard deviations for all variables used in the analysis.

2.6.1 *Effects of Competition on Nursing Home Quality*

Table 2.4 summarizes the key results from the two-stage least squares regressions for the nine quality indicators. It reports on the coefficients in these models for variables that measure local market competition from nursing homes, home care agencies, and assisted living facilities. Although not reported in the table, each of the models estimated also controlled for all the variables shown in the data summary, and the full regressions are available from the author upon request. Each column of the table describes a different quality measure.

The first three quality indicators measure staffing per bed, and were computed as the number of nursing home professionals per 1000 nursing home beds. The measures

were rescaled for the purpose of reporting coefficients. Staffing levels are believed to be positively correlated with nursing home quality, i.e., the higher the staffing level per bed, the better the nursing home's quality. The remaining six quality indicators measure deficiencies in health care services, care procedures, and health outcomes, and they are believed to be negatively related to the quality level of a nursing home. For example, the higher the percentage of residents who have facility-acquired pressure sores, the lower the nursing home's quality. Thus, a positive relationship of an independent variable with a positive quality indicator suggests an increase in that variable increases quality, whereas a positive relationship with a negative quality indicator suggests an increase in that independent variable decreases quality.

Each quality model included four measures of local market competition. Competition from assisted living facilities was measured by the number of assisted living facility beds per capita in the county. Competition from home care agencies was measured by the number of home care agencies per capita in the county. Competition from other nursing homes in the area was measured by the Herfindahl index (HHI) of nursing home bed share in each county. The index used in the regression is adjusted by 1 minus the actual index in order to better ally with the magnitude of competition. After the alternation, a higher adjusted HHI value indicates more intense competition among nursing homes. Finally, the county-wide average percent of empty nursing home beds is a proxy for the presence of excess bed demand in the market.

The results in Table 2.4 strongly suggest that nursing home quality was affected by local competition from home health agencies, assisted living facilities, as well as other nursing homes. The coefficients of home care agencies per capita are statistically

significant for eight of the quality indicators. Competition from home health agencies, however, had mixed effects on quality, tending to reduce nursing staffing levels, while it had mostly positive effects on other structure, process and outcome quality measurements. Judging from the regression results, competition from home care agencies was mainly focused in the labor market where both home care agencies and nursing homes are trying to get more professional nursing staff. The marginal effect of one unit increase in the home care agency per capita would lead to a decrease of 2.45 RN per bed in nursing homes and a 10.33 decrease of nurse aides per nursing home bed. However, the competition from home care agencies doesn't bring down nursing home quality measured by number of health deficiencies, percentage physically restrained resident, percentage with facility acquired catheters and drug error rate.

In contrast, Table 2.4 also reveals that competition from assisted living facility mainly improves staffing levels in nursing homes, but reduces quality indicated by process measurements. This is likely the result of differences in residents' characteristics between these two types of long-term care providers. Residents in assisted living facilities tend to be "low-care" patients (Mor et al.2007) who generally have less severe medical needs than residents in nursing homes. Morand colleagues found that about 5 to 12 percent of nursing home residents fall into the category, "low-care". The proportion of these residents is higher in states with lower investment in assisted living facilities. This suggests that where there is a greater presence of assisted living facilities there will be fewer "low-care" patients in nursing homes, leaving nursing homes with residents who have higher levels of disabilities. In this case, nursing homes will need higher levels of

nursing staff, and the health conditions will be lower for the nursing home residents as well.

The latter part of this explanation is supported by the regression results for the process and outcome quality indicators. The number of health deficiencies, the percentage of residents physically restrained, the percentage with catheters, and the drug error rate are all higher in markets with a high number of assisted living beds per capita. These results suggest that when assisted living beds per capita increases by 1, this increases the number of health deficiencies in the nursing home by 89.39, the drug error rate by 3.72, the percentage of residents who are physically restrained by 7.46, and the percentage with catheters by 2.25. However, the health outcome measured by percentage of residents with facility acquired pressure sore improves in the presence of greater competition from assisted living facilities, e.g., a 1 unit increase in assisted living beds per capita decreases the percentage of residents with pressure sores by 4.22.

This finding of negative competition effects on health deficiencies is consistent with recent findings from Bowblis (2012), who studied markets for long-term care in Ohio. He found that a one-unit increase in assisted living beds per 100 population could increase regulatory deficiencies by 4.60. Coefficients on factors, such as percentage physically restrained and percentage with facility acquired catheters that are not significant in his analysis using Ohio state data are significant using the national sample in this study.

The coefficients on the HHI measure the effects of competition from other nearby nursing homes. Competition from other nursing homes appears to have positive effect on staffing levels, while the effects on resident health outcome are mixed. The results

suggest that greater competition from nearby nursing homes decreases the percentage of resident with facility-acquired catheters, but at the same time, it increases the percentage of patients taking antipsychotic medication or who have pressure sores.

Bowblis (2012) used nursing home facility per capita as a proxy for nursing homes' within sector competition. Despite the difference in competition proxy, the findings about the effects on nursing home resident outcomes are consistent. The drug error rate will also increase with nursing home competition, which the study done by Bowblis failed to measure.

Zinn (1994) also includes a HHI to indicate market concentration in his analysis of nursing home quality. He finds a higher concentration of nursing homes will decrease prevalence of physically restrained, catheterized, and not toileted residents in nursing homes. Although percentage not toileted is not included in this study and percentage physically restrained is not significant in the result, the conclusion with catheterized residents in this study is completely opposite from the one by Zinn. This discrepancy might be caused by difference in measuring prevalence of catheter as facility acquired or as overall level. It also might be affected by the market changes through time. Zinn's study was based on data from 1987 when home and community based services have not thrived, while this study used 2010 data that fully encompasses the effects from assisted living and home care sectors. The study done by Grabowski in 2004 using data from 1991 to 1998 also has some consistent as well as opposite conclusion with our results. These differences in the conclusions further support the argument that more recent and more comprehensive analyses are needed following the huge change in the long-term care market.

The county average percentage of empty beds serves as a statistically significant and negative explanatory variable for all nine nursing home quality measurements. Although it might seem intuitive to think that with higher level of empty beds, nursing homes using the same amount of staffing and resource can concentrate on smaller number of resident, thus the quality should increase. However, this hypothesis is not supported by the empirical results. Actually, based on the excess demand theory, when the bed constraint is in effect, nursing homes have the power to choose residents. In this case, the homes will most likely choose private payers over Medicaid residents because of the higher price. When there is lower demand than supply, nursing homes lose the power to discriminate on the payer type. Therefore, there will be higher proportion of Medicaid residents in the facilities. Furthermore, as is proven by pervious literature and the regression on case-mix in Table 2.6, the disability level for Medicaid residents are significantly higher. Research done by Nyman (1988) also shows that the low-quality-high-Medicaid relationship not only exists, but is much stronger with excess demand. Under the influences of both worse health conditions and lower payment rate, higher percentage of Medicaid payers will more likely bring down the overall nursing home quality measurements.

2.6.2 *Effects of Competition on Nursing Home Private-Pay Price*

Table 2.5 shows how the nursing home private daily average price is influenced by market competition. As shown in Table 2.5, competition from home care agencies decreases the nursing home private daily price significantly. This result indicates that the competition effect from home care agencies to nursing homes is mainly presented in the form of price. A study done by Li and Jensen (2011), which analyzes the long-term care

usage pattern of long-term care insurance (LTCI) policy holders, shows that LTCI holders who have moderate disabilities would prefer to stay at home than entering a nursing facility to receive care. This result illustrates that competition from home care agencies reduces the demand of nursing home residents who have LTCI. With the price difference of a private insurer and a Medicaid patient, this competition reduces the price level for nursing homes.

On the other hand, competition from assisted living facilities and other nursing homes both affect nursing home private price positively. However, the magnitudes of these effects on price are very small. For example, a 1 unit increase in the per capita assisted living bed increases the nursing home price by 5.9, and a 1 point change in the nursing home HHI increases the price by 0.93. A positive price effect of competition from assisted living facility might stem from a higher disability rate in nursing homes when there is higher penetration of assisted living facilities. It might also be a result of reverse causality where assisted living facilities grow faster in areas where the price level of nursing home services is higher. The positive competition effect on price from other nursing homes seems counter-intuitive. However, with some limitations in the data sets, nursing homes which are from the same multi-site firm cannot be distinguished from others. Although these nursing homes might be considered as independent small firms that help intensify competition, they are actually operating under the same regime which could reduce competition and increase price.

The association between the average percentage of empty beds in the county and the private-pay price is consistent with economic theory. When demand is lower, price will be lower too. Although only the private-pay price of nursing home service is shown

in Table 2.5, the competition effects on Medicaid reimbursement rate are similar as the private price because of a high correlation (0.6011) between the two price levels.

2.6.3 *Effects of Competition on Nursing Home Case Mix*

Table 2.6 reports how nursing home case-mix index is affected by market competition. The more home care agencies per capita in a county, the lower the case-mix index of nursing home residents in that county. In other words, competition from home care agencies help reduce the case-mix of nursing home residents, leaving nursing homes with a healthier group that further lower the burden of providing more services. This may be caused by the proportion of post hospital care patients who use home care agency mostly for recovery. These patients whose case-mix indexes are much higher are generally in need of more nursing care. However, strictly speaking, they should not be counted as long-term care patients because they typically need just a relatively short period time of health services. Drawing this part of resident out of nursing homes might be the reason why number of home care agencies is negatively associated with residents' case-mix in nursing homes.

Assisted living facilities, on the other hand, provide services to individuals who are in less need of care. Competition from assisted living facilities will attract residents with better health conditions moving out of nursing homes, thus increases nursing home case-mix index. Furthermore, as the study done by Spillman et al (2002), the annual use of assisted living residents are much longer than before that about 45 percent of resident stayed throughout the year in 1998. This usage pattern implies that the "low-care" users stay longer in the assisted living facilities than before. This longer stay will delay the timing of entering nursing homes. In that case, when they are actually moved out of

assisted livings into nursing homes, their health conditions would be much worse than before. With the effects from both resident characteristics and usage patterns, competition from assisted living facility increases case-mix index of residents in nursing homes. This assumption is supported by the empirical results here.

Competition from other nursing home shown by the HHI index is positively associated with nursing home case-mix. In other words, case-mix in nursing homes increases with higher level of competition among nursing homes. For a nursing home that operates as a monopoly in a market, it has the full power to choose residents and to set price discrimination. Under this circumstance, healthier and better-paying patients tend to be admitted, and the ones with worse health conditions are left out. When competition becomes more and more severe, however, nursing homes compete for residents by broadening their scopes in admitting patients. In this way, patients with more complications and who need more resources are more likely to be admitted, thus the case-mix in nursing homes is higher with more market competition.

2.7 Conclusion

With the rapid growth in home care agencies and assisted living facilities across the U.S., nursing homes face new sources of competition for provision of long-term care services. This paper is the first to study how local competition from home care agencies and assisted living facilities affects care quality in nursing homes, the private-pay prices they charge, and the case-mix complexity of their residents. From this nationwide analysis of nursing home care quality in 2010, five broad findings emerge.

First, nursing home quality is affected by local competition from assisted living facilities, home care agencies, and other nursing homes. Overall, these effects are mostly statistically significant and intuitive. At the same time, different types of competitors have different effects on nursing homes.

Second, increased competition from home care agencies has mixed effects on nursing home quality. Its effects on staff-to-bed ratios were mostly negative, whereas its effects on other structure, process, and outcome quality measures were mostly positive. We also found evidence that increased competition from home care agencies affects the private-pay prices that nursing homes charge. As the supply of local home care providers increases, the private-pay price in nursing homes declines. One interpretation is that nursing homes are competing with home care providers on the basis of price.

Third, increased competition from assisted living facilities also has mixed effects. Despite some positive effects on staff-to-bed ratios, competition from assisted living facility overall tends to lower nursing home quality. This is because having more assisted living beds in an area significantly raises the case-mix complexity in the nursing home. Since "low-care" residents prefer assisted living facilities, the nursing home's case-mix shifts to a more-disabled, sicker mix of residents. We also presented evidence that the private-pay price in the nursing home also rose in order to cover the higher cost of caring for this more disabled patient mix. But given a more severe case-mix, care quality tends to suffer.

Fourth, increased competition from other nursing homes had positive effects on staff-to-bed ratios, while the effects on resident health outcomes were mixed. Competition from other nursing homes decreased the percentage of residents with a

facility-acquired catheter, but increased the percentage of patients taking antipsychotics, the percentage with pressure sores, and the drug error rate in the facility.

Fifth, excess demand for nursing home beds in an area has significant negative effects on all measures of nursing home quality. A high empty bed rate may be caused by lower overall demand, and it might also be the result of competition from home and community based services. Under both causes, nursing homes have less power to choose their residents. More Medicaid patients and more "high-care" patients may be admitted, causing the decrease in nursing home quality.

Overall, the findings in this paper are broadly consistent with previous research on the effects of competition in the market for nursing home care. We found that competition from assisted living facilities has mixed effects on care quality in nursing homes. Although staff-to-bed ratios rise, other measures of care quality tend to fall, in part because of the worsening case-mix of the nursing home's residents. The effects of competition from home care agencies reported here are presented for the first time, and so cannot be compared to prior studies. Yet, our findings for this source of competition seem reasonable. The effects of competition from other nursing homes reported here are differ in some ways from what previous researchers have found. This may be due to differences in the time frame across different studies. With the exception of Bowblis (2012), most previous work on this issue was based on much older data, when nursing homes were the dominant suppliers in markets for long-term care.

In summary, long-term care provided by nursing homes appears to be evolving in response to growing market competition from assisted living facilities and home care agencies. Faced with greater competition from assisted living facilities, nursing homes

are left to care for the more disabled and less healthy patients. Although a facility's staffing levels rise in response, other measures of care quality decline, such as more process- and outcome-based measures. There are strong indications that the transformation of nursing homes and the market for long-term care will continue.

Tables for Chapter 2:

Table 2.1 Variable Descriptions

Variable	Definition	Source
Quality Measures		
RN/Beds	Total number of registered nurses per beds in each nursing facility	CASPER
LPN/Beds	Total number of licensed practical nurses per beds in each nursing facility	CASPER
Nurse Aides/Beds	Total number of Nurse Aides per beds in each nursing facility	CASPER
Health Deficiencies	Number of regulatory health deficiencies in each nursing facility	NHC
Drug Error Rate	Percentage of drug error in each facility	CASPER
Percentage Physically Restrained	Percentage of resident in each facility who are physically restrained	CASPER
Percentage Antipsychotic	Percentage of resident in each facility who use antipsychotic medication	CASPER
Percentage Acquired Catheters	Percentage of resident in each facility who acquired catheter during the stay	CASPER
Percentage Acquired Pressure Sores	Percentage of resident in each facility who are acquired pressure sore during the stay	CASPER
Nursing Home Facility Characteristics		
NH Beds Per Capita	Nursing home total beds per capita for each facility	CASPER
NH Ownership	Dummy variable if Government owned=1; 0=otherwise	CASPER
For/Non- Profit	Dummy variable For-profit=1; Non-profit=0	CASPER
Provider Based Facility	Dummy variable =1 if provider based; 0=otherwise	CASPER
Percentage Medicaid Residents	Percentage of Medicaid residents in each facility	CASPER
Special Care Beds	Percentage of nursing home beds for Alzheimer patients	CASPER
Case-Mix Index	Case mix measurement for each facility	CASPER
Market Structure		

NH Avg Empty Beds	Average percentage of nursing home empty beds in county	CASPER
HC Agency Per Capita	Number of home care agencies per capita in county	POS
AL Beds Per Capita	Number of assisted living beds per capita in county	Stevensen 2010
NH Herfindahl Index	Nursing home Herfindahl Index in each county	CASPER
County Demographic Characteristics		
Census Region Code	1=Northeast 2=Midwest 3=South 4=West	ARF
County Per Capita Income	Per capita income in each county	ARF
Population 65+	Percentage of population age 65 and over in county	ARF
Adult Female	Percentage of population adult female in county	ARF
Medicaid Eligible	Percentage of Medicaid eligible older adults in 65 and over age group in each county	ARF
Mortality Rate	County mortality rate	ARF
Poverty Rate	County poverty rate	ARF
Percentage White	Percentage white population in county	ARF
Percentage Black	Percentage black population in county	ARF
Population Density	Population density per square mile in county	ARF
Low Education Type	Dummy variable for low educational region	ARF
State Policy Factors		
NH daily Avg Price	Nursing home private-pay daily average price	MetLife Market Survey
NH Price Ratio	Nursing home Medicaid reimbursement rate over nursing home private pay price	MetLife Market Survey
AL Daily Avg Price	Assisted living facility private-pay daily average price	MetLife Market Survey
HC hourly Avg Price	Home health care agency private-pay hourly average price	MetLife Market Survey
Adult Day Care Daily Avg Price	Adult day care facility private-pay daily average price	MetLife Market Survey
NH CON	Dummy variable for state nursing home Certificates of Need regulation	State Data Book

NH Prospective Reimbursement	Dummy variable for prospective reimbursement system	State Data Book
NH Combination Reimbursement	Dummy variable for combination reimbursement system	State Data Book
NH Case-Mix Adjusters	Dummy variable of whether the reimbursement rate is adjusted for case-mix	State Data Book
AL CON	Dummy variable for state assisted living Certificates of Need regulation	AL Regulatory Review
AL Facility Scope of Care	Dummy variable of whether the assisted living facility could provide nursing services	AL Regulatory Review
AL Medicaid Waiver	Dummy variable of whether the state Medicaid waiver could cover assisted living costs	AL Regulatory Review
AL State Plan	Dummy variable of whether there is a state plan to cover assisted living costs	AL Regulatory Review
AL Flat Rate Reimbursement	Dummy variable for flat rate reimbursement system	AL Regulatory Review
AL Tiered Rate Reimbursement	Dummy variable for tiered rate reimbursement system	AL Regulatory Review
AL Case-Mix Reimbursement	Dummy variable for case-mix reimbursement system	AL Regulatory Review
AL FFS Reimbursement	Dummy variable for fee-for-service reimbursement system	AL Regulatory Review
AL Negotiated Reimbursement	Dummy variable for negotiated reimbursement system	AL Regulatory Review

Table 2.2 Type of Quality Indicators

Quality Indicator	**Type of Indicator**
RN/Bed	Structure
LPN/Bed	Structure
Nurse Aids/Bed	Structure
Health Deficiency	Structure
Drug Error Rate	Process
Percentage Physically Restrained	Process
Percentage Antipsychotic	Process
Percentage Acquire Catheters	Process
Percentage Acquire Pressure Sores	Outcome

Table 2.3 Descriptive Statistics of All Variables

Total observation number: 13426

Variables	**Mean**	**Std. Dev.**
RN/Beds	0.07169	0.08586
LPN/Beds	0.135396	0.126905
Nurse Aides/Beds	0.378815	0.185241
Health Deficiencies	14.98494	11.32956
Drug Error Rate	1.504207	4.067297
Percentage Physically Restrained	3.11389	5.58665
Percentage Antipsychotic	25.19481	14.81464
Percentage Acquire Catheters	1.623429	2.80799
Percentage Acquire Pressure Sores	2.941331	3.245092
NH Beds Per Capita	0.165465	0.148378
NH Ownership	0.761367	0.426264
For/Non- Profit	0.705123	0.456005
Provider Based Facility	0.048494	0.214816
Percentage Medicaid Residents	62.89192	19.74553
Special Care Beds	4.987203	13.21166
Case-Mix Index	141.9866	43.93583
NH Avg Empty Beds	17.34904	10.53505
HC Agency Per Capita	0.036434	0.057068
AL Beds Per Capita	0.311181	0.221559
Herfindahl Index (1-HHI)	0.7740254	0.2565023
Census Region Code	2.461169	0.946563
County Per Capita Income (in 1000s)	1.722276	0.721113
Population 65+	14.08715	3.631144
Adult Female	30.0873	2.268431

Variables	Mean	Std. Dev.
Medicaid eligible	15.28146	7.763679
Mortality Rate	0.904158	0.23473
Poverty Rate	15.58205	5.318782
Percentage White	77.39127	16.67342
Percentage Black	11.00004	12.85455
Population Density (in1000s)	1.244913	4.045115
Low Education Type	0.121789	0.327054
NH daily Avg Price	192.0493	58.36996
NH Price Ratio	132.4298	68.02018
AL Daily Avg Price	107.2017	19.53959
HC hourly Avg Price	20.66501	2.799751
Adult Day Care Daily Avg Price	60.38816	17.47155
NH CON	0.773915	0.41831
NH Prospective Reimbursement	0.849497	0.357577
NH Combination Reimbursement	0.136091	0.342898
NH Case-Mix Adjusters	0.677738	0.46736
AL CON	0.156333	0.363184
AL Facility Scope of Care	0.749871	0.434623
AL Medicaid Waiver	0.716859	0.450541
AL State Plan	0.244645	0.487086
AL Flat Rate Reimbursement	0.312043	0.463347
AL Tiered Rate Reimbursement	0.432814	0.495487
AL Case-Mix Reimbursement	0.14892	0.356025
AL FFS Reimbursement	0.070242	0.255565
AL Negotiated Reimbursement	0.035982	0.186253

Table 2.4 Two-stage Least Square Model on Nine Quality Indicators:

	RN/1000 Beds	LPN/1000 Beds	Nurse Aides/1000 Beds	Health Deficiencies	Drug error rate	Percentage Physically Restrained	Percentage Antipsychotic	Percentage Acquired Catheters	Percentage Acquired Pressure Sores
HC Agencies Per Capita	-2452.974***	2837.384**	-10334.380***	-1864.227***	-79.649*	-155.393***	209.907	-47.680*	85.877***
	(845.217)	(1300.359)	(2011.762)	(222.236)	(41.784)	(56.738)	(135.333)	(28.264)	(33.474)
AL Beds Per Capita	116.248***	-131.222**	494.285***	89.390***	3.716*	7.455***	-8.685	2.250*	-4.220***
	(40.068)	(61.645)	(95.369)	(10.535)	(1.981)	(2.690)	(6.416)	(1.340)	(1.587)
Herfindahl Index	-1.040	7.732	17.701*	-1.295	0.418**	0.376	2.027***	-0.279**	0.316**
	(4.011)	(6.174)	(9.556)	(1.055)	(0.202)	(0.279)	(0.641)	(0.131)	(0.160)
NH Avg Empty Beds	-0.401***	-1.285***	-3.394***	0.065***	0.018***	0.018***	0.060***	0.014***	0.014***
	(0.090)	(0.139)	(0.214)	(0.024)	(0.004)	(0.006)	(0.014)	(0.003)	(0.004)

The dependant variables are listed on the top. Number of assisted living facility per capita is the endogenous variable. The instrument variables are assisted living facility policy factors. Regressions are all controlled for nursing home facility characteristics, county demographic variables, and policy factors. Estimated coefficients are reported for each variable and standard errors are in parentheses.

* significant at the 90% confidence level ** significant at the 95% confidence level *** significant at the 99% confidence level

Table 2.5 Linear Regression on Nursing Home Daily Average Price

Nursing Home Daily Average Price	Coef.	Std. Err.
HC Agency Per Capita	-282.378***	(104.318)
AL Beds Per Capita	5.943***	(2.538)
NH Herfindahl Index	0.925***	(0.202)
NH Avg Empty Beds	-0.986***	(0.038)
NH Beds Per Capita	296.548***	(46.124)
NH Ownership	5.610***	(1.711)
For/Non- Profit	-2.613*	(1.583)
Provider Based Facility	3.914*	(2.217)
Medicaid Residents	0.163***	(0.017)
Special Care Beds	-0.007	(0.021)
Case-Mix Index	0.064***	(0.019)
Census Region Code	-13.840***	(0.570)
County Per Capita Income (in1000s)	-2.847***	(0.645)
Population 65+	2.553***	(0.190)
Adult Female	2.056***	(0.181)
Medicaid eligible	-0.204***	(0.056)
Mortality Rate	-33.054***	(3.007)
Poverty Rate	0.428***	(0.094)
Percentage White	-0.510***	(0.078)
Percentage Black	-0.746***	(0.076)
Population Density (in1000s)	0.803***	(0.081)
Low Education Type	4.510***	(1.071)
AL Daily Avg Price	1.576***	(0.027)
HC Hourly Avg Price	-0.817***	(0.141)
Adult Day Care Daily Avg Price	0.185***	(0.023)
NH CON	23.485***	(1.126)
AL CON	-14.997***	(0.852)
NH Prospective Reimbursement	-47.474***	(1.438)
NH Combination Reimbursement	-50.976***	(1.497)
NH Case-Mix Adjusters	-7.254***	(0.735)
_cons	64.876***	(10.876)

Estimated coefficients are reported for each variable and standard errors are in parentheses.
* significant at the 90% confidence level ** significant at the 95% confidence level *** significant at the 99% confidence level

Table 2.6 Linear Regression on Nursing Home Case-mix Index

NH Case-Mix Index	Coef.	Std. Err.
HC Agency Per Capita	-67.600*	(38.170)
AL Beds Per Capita	2.493*	(1.510)
NH Herfindahl Index	0.525***	(0.135)
NH Avg Empty Beds	-0.285***	(0.036)
NH Beds Per Capita	-28.751	(41.364)
NH Ownership	2.775	(2.106)
For/Non- Profit	-6.475***	(2.204)
Provider Based Facility	-2.477	(2.157)
Medicaid Residents	0.091*	(0.052)
Special Care Beds	-0.001	(0.020)
Census Region Code	4.728***	(0.609)
County Per Capita Income (in1000s)	-2.989***	(0.851)
Population 65+	-0.144	(0.238)
Adult Female	0.261	(0.240)
Medicaid eligible	0.254***	(0.076)
Mortality Rate	-7.410**	(3.225)
Poverty Rate	-0.295*	(0.169)
Percentage White	0.308***	(0.047)
Percentage Black	0.418***	(0.053)
Population Density (in1000s)	-0.735***	(0.108)
Low Education Type	0.100	(1.384)
Nursing Home Daily Average Price	0.113***	(0.013)
AL Daily Avg Price	-0.007	(0.025)
HC Hourly Avg Price	-1.122***	(0.112)
Adult Day Care Daily Avg Price	-0.086***	(0.020)
NH CON	-4.726***	(0.869)
AL CON	5.308***	(2.144)
NH Prospective Reimbursement	4.834***	(1.561)
NH Combination Reimbursement	5.948***	(2.248)
NH Case-Mix Adjusters	3.541***	(1.067)
_cons	110.307***	(10.620)

Estimated coefficients are reported for each variable and standard errors are in parentheses.
* significant at the 90% confidence level ** significant at the 95% confidence level *** significant at the 99% confidence level

Chapter 3

State Regulation of Long-Term Care Providers and the Quality of Care in Nursing Homes

3.1 Introduction

The rising number of elderly, disabled, and chronically ill individuals in the US has brought increased attention to the utilization, cost, and quality of long-term care services. Long-term care encompasses a broad range of services, including both medical and non-medical care provided to individuals who need assistance performing activities of daily living. It has been estimated as many as 70 percent of older adults over age 65 will require long-term care services at some point during their remaining lives (CMS 2012). As the major payer for long-term care, state Medicaid programs face the daunting challenge of trying to balance the growing needs of an aging population with the unwillingness of many state legislators to expand their Medicaid budgets to pay for needed services. This situation has led to growing concerns about the quality of care provided to Medicaid residents in nursing homes, as well as a desire among many state legislators to cut back on Medicaid reimbursement rates, program eligibility, and the use of publically-financed long-term care, more generally. Consumers, the media, and the Institute of Medicine are particularly concerned with care quality in nursing homes.

Nursing homes are the major providers of long-term care in the US. They have also been the main focus of government regulation pertaining to long-term care services.

Policies such as certificate-of-need (CON) legislation, which are used by a majority of states, set barriers to the addition of new beds in this industry, in order to control the overall supply of nursing home services. Medicaid reimbursement policies, which have the most direct and significant effect on nursing home revenue, set the amount and method of payment for Medicaid-covered stays in nursing home facilities. These policies not only control the amount of services available, they can also affect the quality of care provided by a nursing home. Under law every nursing home is required to provide the same quality of care to all its residents, regardless of their payer source. Thus, if a nursing home reduces its cost of producing care in response to lower Medicaid payment rates, erosion in the quality of care for all patients may occur.

Under the assumption of a binding bed constraint created by CON regulation, economic theory suggests that the market for nursing home care will be characterized by excess demand among Medicaid-eligible individuals (Scanlon 1980). In effect, a binding bed constraint gives nursing homes the power to choose patients based on the generosity of their payment source, leaving lower-paying (and often sicker) Medicaid patients with less access to care. Furthermore, in the presence of excess demand, the effects of Medicaid reimbursement rates on care quality are actually ambiguous (Nyman 1985, Gertler 1989). On one hand, an increase in the rate gives a nursing home more resources that it could use to produce more quality, as suggested by a basic theory of economic production. If it produces more quality, it could likely attract more private pay patients, since quality matters to them. However, the economic reward of having another private-pay patient (as opposed to a Medicaid patient) is simply the difference in the prices they come with, which will now be lower if the Medicaid rate increases. In effect, as long as

excess demand is present, a nursing home's return to raising quality can decline with an increase in the Medicaid rate. Thus, it may actually choose to lower quality rather than increase it. This possibility has motivated a number of researchers to empirically investigate the relationship between nursing home quality and Medicaid reimbursement rates, with particular attention to whether the findings depend on the presence of excess demand in the market (Nyman (1985, 1988, 1989), Gertler 1992, Cohen and Spector 1996, Grabowski (1999, 2001, 2007)). Findings from these studies have been mixed.

In recent decades, alternatives have emerged to receiving long-term care in a nursing home setting. In most areas of the US two other types of providers of long-term care services are now available, assisted living facilities and home health care agencies. Assisted living facilities are community-based, residential long-term care centers, which provide housing and supportive services to older adults. Since 1990 the total number of beds in assisted living facilities has grown rapidly. For example, in 2010 there were a total of 1,233,690 beds in licensed assisted living facilities across the US, up from 519,905 in 1990 (AARP 2010). For all but the most disabled and severely ill patients, an assisted living facility may be a feasible substitute for a nursing home. Such facilities can provide both professional medical care and services to assist with activities of daily living. Furthermore, assisted living facilities are preferred to nursing homes for older adults who seek for more independence and dignity (Perkins et al 2012). There are now 1.8 million individuals who live in the nation's 16,000 nursing homes (Kaye 2010) and more than 735,000 individuals who live in assisted living facilities (NCAL 2012).

Home health care agencies, which deliver services in a patient's home, are another important substitute for some types of nursing home care. More and more

seniors have shifted from receiving services in nursing homes to receiving services at home from home care agencies. This trend is perhaps not surprising, as most older adults strongly prefer staying at home and living independently to being institutionalized (Gibson et al. 2003).

With these significant changes in the structure of the market for long-term care, the demand for nursing home care, and the quality of nursing home services may also have changed. In addition, new state regulations have emerged governing Medicaid policy and standards of care in assisted living facilities, and these too may be influencing equilibrium quality levels in nursing homes.

Despite the potentially important role of home care agencies and assisted living facilities in the long-term care market, no studies to date have considered the effects of local competition from these two sectors when looking at the relationship between Medicaid regulation and nursing home quality. Nor has any study considered the possible spillover effects of state regulation of businesses in these two other sectors. Yet, analyzing the determinants of nursing home quality in isolation from the rest of the long-term care market could lead to biased estimates and false conclusions if, in fact, competition and state regulations matter in decision-making.

This study examines the effects of Medicaid regulation on nursing home quality, controlling for local market competition from home care agencies and assisted living facilities, as well as state regulation of assisted living facilities. State regulation of assisted living facilities can affect nursing home quality by affecting the supply of assisted living facilities, which in turn competes with nursing homes.

The paper is organized as follows. Section 1 provides background information on the long-term market and briefly reviews existing literature on the determinants of nursing home quality. Section 2 describes data sources and variable specifications used in the empirical analysis, while Section 3 describes statistical methods. Results are presented in Section 4. Section 5 summarizes conclusion from this study, their policy implications, and describes possible future work.

3.2 Background

Several previous studies have examined the effects of Medicaid reimbursement rates on nursing home quality. The earliest studies were based on data from single states. Using data on nursing homes in Wisconsin, Nyman (1988, 1989) examined the effects of a facility's Medicaid reimbursement rate on its total number of violations of quality standards for nursing homes. Analyzing data from two different years, 1979 and 1983, he found no evidence to suggest quality was higher with higher reimbursement. In fact, he found the opposite: quality was lower in homes receiving a higher Medicaid reimbursement rate. His explanation for these finding was that most nursing homes in Wisconsin had excess Medicaid demand in these years due to stringent certificate-of-need (CON) regulation. In the presence of excess Medicaid demand, a higher Medicaid rate is associated with a lower return to raising quality to attract more private pay patients along with no return to raising quality to attract more Medicaid patients.

Using data on nursing homes in New York State and a different measure of quality, Gertler (1992) likewise found an inverse relationship between the Medicaid reimbursement rate and quality of care. He found that a 10% increase in Medicaid

expenditures decreased a nursing home's expenditures on patient services by 3.4%, but yet was positively related to the number of Medicaid residents receiving care. A 10% increase in Medicaid expenditures increased the latter by 4.1%. He too attributed these findings to the presence of excess Medicaid demand in most New York markets because of the state's stringent CON regulation.

More recent studies, however, based mostly on nationwide samples of nursing homes (as opposed to single state samples), have found a positive relationship between Medicaid reimbursement levels and care quality. For example, Spector (1996) found a positive relationship between the Medicaid reimbursement rate and LPN staffing intensity, an input-based measure of quality. Grabowski (2001a) found that the Medicaid reimbursement rate had a positive effect on the percentage of residents without facility-acquired pressure ulcers, which is an important outcomes-based quality indicator. His analysis was based on a nationwide sample of nursing homes observed in 1995 and 1996. With the same data Grabowski (2001b) looked at several other measures of care quality, as well. He found a significant positive relationship between the Medicaid reimbursement rate and nurse staffing levels per resident. For example, he found that a $40 increase in the reimbursement rate raised the number of registered nurses by 1.42 per 100 residents. Yet the same increase had insignificant (but still positive) effects on more process-based quality indicators, such as the medication error rate in a facility, the prevalence of feeding tubes, the prevalence of catheters, and the prevalence of physical restraints. More recently Grabowski (2004) analyzed longitudinal data on nursing homes spanning 1991 through 1998, and found that nearly all quality indicators improved as the Medicaid reimbursement rate increased. For example, a 10 percent increase in the

Medicaid rate was associated with a 1.8 decrease in the percentage of nursing home resident with bedsores.

In all of the above-mentioned studies the effect of excess Medicaid demand on the relationship between nursing home quality and the Medicaid reimbursement rate was emphasized. Several of these studies also suggest that in markets where there are severe CON construction moratorium policies on nursing home beds together with excess Medicaid demand, the counterintuitive result of an inverse relationship between Medicaid reimbursement and quality has resulted.

The problem of constraints on available beds in long term care facilities appears to have lessened since the 1980s, according to a couple of different measures. One is the occupancy rate in nursing homes, which has declined slowly but steadily over time. For example, it was 91.8% in 1985, 87.4% in 1995, and 86% in 2004 (Strahan 1997 and CDC 2014). Another indicator is the increasing supply of substitutes for nursing home care, such as other home care and community based facilities. Between 1990 and 2002, for example, the number of beds in assisted living facilities nearly doubled, rising from 519,905 to 1,026,397 nationwide (Harrington et al. 2005). Home care agencies have also become more common.

It is important to take account of these alternatives to nursing homes, i.e., home care agencies and the assisted living facilities, when analyzing the relationship between Medicaid policies and nursing home quality. Yet, surprisingly few previous studies have done so. Bowblis (2012) is an exception. He examined how the growth of assisted living facilities and market structure has affected nursing home quality in Ohio-based nursing homes. Yet, because his sample was limited to a single state, his study was unable to

simultaneously address the policy effects of Medicaid. It is worthwhile to take a close look at how market structure and the existence of home and community based services can affect the influential power of government regulation on nursing home quality.

Using data from a nationwide census of nursing homes observed in 2010, this study examines the effects of state regulatory policies towards both the nursing home sector and the assisted living facilities sector on the quality of care in U.S. nursing homes. It addresses two questions. First, how is nursing home quality affected by a state's Medicaid reimbursement rate and the methods a state uses to control competition from other long-term care sectors? Second, is nursing home quality affected by how a state regulates assisted living facilities, and if so, how?

3.3 Data

Data from several sources were assembled to conduct the analysis. The primary source of data on nursing homes was the on-line 2010 Certification and Survey Provider Enhanced Reporting System (CASPER), maintained by the Center for Medicare and Medicaid Services (CMS). In addition, other data were drawn from the 2010 Nursing Home Compare (NHC) data set maintained by CMS, the Provider of Services File (POS) maintained by CMS, the Area Resource File (ARF), the MetLife Market Survey of Nursing Homes data, the Assisted Living, Adult Day Services, and Home Care Costs (MetLife Market Survey) data, the State Data Book on Long Term Care (State Data Book), the Assisted Living State Regulatory Review (AL Regulatory Review), and assisted living facility supply data collected by Stevenson and Grawboski (2010).

The facility-level nursing home data are from the CASPER and NHC data sets. The CASPER data set replaces the Online Survey, Certification, and Reporting (OSCAR) System, which was also maintained by CMS. CASPER provides comprehensive information for every Medicare- or Medicaid-certified nursing home facility in the U.S. It provides information on the operational characteristics of each facility along with aggregate statistics on its residents. The CASPER data were merged at the facility-level with the NHC data, which provides information on the quality of care at the nursing home, as reported by CMS.

Because our interest centers on the effects of competition between nursing homes, home care agencies, and assisted living facilities, nursing homes that were only certified as a skilled nursing facility (SNF) were dropped from the sample of facilities to be analyzed. The care provided by SNF-only facilities is much more intense nursing care, and arguably is not a substitute for the intermediate-level care provided by home care agencies and assisted living facilities.

Several variables such as the staffing level per bed, the total number of health deficiencies, the percentage of empty beds in the county, a Herfindahl index, and case-mix measurement were all calculated for each facility using the data sets listed above. The staffing level was calculated as full-time-equivalent staff per bed, defined as the sum of full-time staff, part-time staff (upon conversion into full-time-equivalent persons), and contract staff (upon conversion into full-time-equivalent persons). The percentage of empty beds was derived from the difference between the total number of resident and total number of certified nursing home beds for each facility as a percentage of the total number of beds, and then averaged at the county level where the nursing home was

located. The Herfindahl index was calculated at the county-level and is based on each facility's share of beds, defined as the number of beds in that nursing home divided by the total number of beds in that facility's county.

Data from the Provider of Service file, which provides information on all certified health care institutional providers across the U.S., and the assisted living facility supply data collected by Stevenson and Grabowski were merged with the nursing home facility file based on each nursing home's zip code. The assisted living data collected by Stevenson and Grabowski describes assisted living facilities across the entire U.S., as of 2007. Before merging their data with the 2010 nursing home file, their variables were each adjusted to reflect 2010 levels, based on the aggregate growth rate in assisted living facilities, as reported by the AARP report on Assisted Living and Residential Care in the States in 2010. Data from the ARF were likewise merged to the nursing home file based on the county. Variables merged from the ARF were county-specific demographic characteristics, including per capita income, race, gender, the poverty rate, the mortality rate, and a region identifier.

The MetLife Market Survey was collected by the MetLife Mature Market Institute. It contains daily private-pay price levels for nursing homes, monthly rates for assisted living facilities, hourly rates for home health care agencies, and daily prices for adult day services. The private rates are mainly state-level average rates, with some metropolitan areas reported as well. Using state-level price information instead of recording it at facility level could help avoid the endogeneity problem between price and quality, thus the state average private price levels were merged with the other previous mentioned data sets to provide private-pay rates for each long-term care facility.

Data on state regulations covering long-term care facilities were also added to the nursing home file. Most of the variables describing nursing home and assisted living facility regulation take the form of (0,1) indicators. These variables were derived from information reported in the State Data Book on Long Term Care (2007) Program and Market Characteristics (funded by the U.S Department of Housing and Urban Development) and the Assisted Living State Regulatory Review (2007) (prepared by the National Center for Assisted Living).

According to the State Date Book on Long Term Care, there are four types of rate-setting systems for nursing homes, including prospectively set, flat rate, case-mix based, and combination-type systems. The strictest is a flat rate system because it sets a uniform level of reimbursement for the same class of homes, regardless of their variation in costs. In contrast, a case-mix based system adjusts a nursing home's rate based on its residents' case-mix, which reflects differences in need. Under a prospective rate system a nursing home's reimbursement rate is set in advance, based on the previous costs level of each facility, but it doesn't account for the actual costs. A combination system has both prospective and retrospective elements to how rates are set, so that interim rates eventually align closer to actual costs. Since only one state has a flat rate system and one state has a case-mix based system, this analysis could control for only the prospective and combination systems in the regression models estimated.

State rate-setting systems for assisted living facilities can likewise be categorized according to the type of system. In 2010 there were five different approaches seen across the different states: a flat rate system, a tiered rate system, a case-mix based rate, a fee-for-service (FFS) based rate, and a negotiated rate system. A flat rate system for assisted

living facilities, just like a flat rate system for nursing homes, does not allow any adjustments for conditional differences across assisted living facilities. Rather, each facility receives the same flat rate. A case-mix based system has the same basic logic as a case-mix reimbursement system for nursing homes. A tiered rate system is quite similar to a case-mix based system, except it typically has fewer rate categories than a case-mix based system. Under a fee-for-service rate setting scheme, instead of receiving a monthly payment, the assisted living facility has to send bill to the payment agency based on the services delivered to the resident. Finally, a negotiated rate system is a method that combines some or all features of the other four systems.

In addition to their rate-setting system, the analysis controls for several other aspects of state regulation of assisted living facilities. "Assisted living CON" measures whether the state has a CON program in effect for assisted living facilities. "AL scope of care" indicates whether the facility could provide skilled nursing services to residents. "AL Medicaid Waiver" and "state plan" measure whether the state allows Medicaid to cover the costs of assisted living services through a Medicaid Waiver program or state plan.

Table 3.1 describes all of the variables used in the analysis and their sources.

3.4 Econometric Framework

3.4.1 Market Definition

Following previous studies I define the local market as the county where the nursing home is located (Nyman 1985, Gertler 1992, Cohen and Spector 1996, Grabowski and Hirth 2003). Thus, we presume that competition among long term care

providers takes place mainly in the facility's county and not outside it. Nyman (1994) found 80% of residents in Wisconsin facilities chose a nursing home located in the county in which they resided before entering the home, and Gertler (1989) found 75% of nursing home residents in New York state were likewise from the same county where their facility was located. Thus, although not perfect, the county may be a reasonable proxy for the relevant market.

3.4.2 Explanatory Variables in the Models

The presence of local excess demand for nursing home placement can affect competition among suppliers. When there is a bed constraint in the supply of nursing home care, theory suggests that private-pay consumer will be satisfied first because of their higher pay rates. Remaining beds will then be filled with Medicaid eligibles. Thus, "excess-demanders" are typically Medicaid eligibles. Excess demand in a market can affect care quality. As long as quality is higher than the minimum required level, nursing home beds will be filled by Medicaid eligibles. In effect, individuals on Medicaid lose their right to choose a nursing home based on its quality; instead they are simply wait-listed for the first facility where an available bed opens up. This reduces the willingness of nursing homes to provide better quality and to compete based on quality. An increase in the Medicaid rate may even have the reverse effect on nursing home quality. The present analysis will control for local excess demand in analyzing the determinants of nursing home quality. The county-wide average percentage of empty beds in nursing homes is used as a proxy for excess demand.

Nursing home care quality is multidimensional. Measures fall into three categories: structural or input-based measures, process-of-care measures, and outcome-

related measures. Structural measures are organizational characteristics of the nursing home, and include staffing levels as well as the scope of the nursing home's health-related deficiencies, such as the number of federal minimum quality standards the facility fails to fulfill. Process measures include the prevalence of indwelling catheters among the facility's residents, the prevalence of tube feeding, the prevalence of physical restraints, and the facility's drug error rate. In general, process measures depend on and reflect the interactions occurring between the nursing home's staff and its residents. Outcome measures, such as the prevalence of pressure sores in the nursing home, are widely regarded as the most straightforward measures of care quality. Outcome measures represent changes in resident characteristics directly attributable to the practice and environment of the nursing home.

In this analysis measures from all three categories are used. Table 3.2 lists the nine variables in the analysis that measure care quality and their type. Although registered nurses (RN) per bed, licensed practical nurses (LPN) per bed, and nurse aids per bed are all measures of staffing levels, these different types of nursing staff should not be regarded as perfect substitutes. RNs have the broadest scope-of-practice under state licensure regulations, have more medical training, and in any nursing home they provide the more intensive and skilled nursing services. LPNs focus more on daily medical routines that help preserve a resident's well being. The all-day-round care provided by nurse aids can possibly affect a resident's satisfaction and his/her mood. To acknowledge these differences in roles, all three are used as quality indicators in the analysis. Measurements of catheter and pressure sores are adjusted for pre-existing

conditions where the prevalence is recorded as percentage of residents who did not have but acquired catheter or pressure sore during the stay in nursing home facilities.

The models to be estimated also control for the case mix of residents because this too may affect quality. Residents who are more disabled generally require higher levels of care, and they tend to preform worse on outcome-based measures of quality. The Management Minutes system designed by Bill Thoms (1975) is used to adjust this bias. It is expressed in minutes of staffs' time where different prevalence of disability is given different weight based on the level of sickness. The indicators of disabilities are mutually exclusive and expressed in term of percentage of residents. In order to avoid multicolinearity in the statistical analysis, any quality indicator that is embodied in the case-mix system is abandoned from the group of dependant variables.

The case mix index was calculated as follows:

Case-Mix Index = A(20) + B(18) + C(30) + D(30) + E(20) + F(48) + G(90) + H(90) + I(45) + J(32) + K(20) + L(50) + M(36)

where A through M are: (A) the percentage of residents needing full assistance bathing, (B) the percentage needing partial assistance bathing, (C) the percentage needing full assistance dressing, (D) the percentage needing partial assistance dressing, (E) the percentage who are catheterized, (F) the percentage who are incontinent, (G) the percentage needing parenteral feeding, (H) the percentage needing tube feeding, (I) the percentage needing assistance eating, (J) the percentage who are nonambulatory, (K) the percentage with pressure sores, (L) the percentage receiving bowel/bladder retraining, and (M) the percentage receiving special skin care.

3.4.3 Model Specification

Linear regression models are adopted, one for each measure of nursing home quality. Because of the possible correlation between long-term care regulation policies and the market supply of nursing home, home care, and assisted living facility, a Hausman test is used to check for the endogenous of nursing home beds, per capita home care agencies, and per capita assisted living beds. The results ruled out the possible endogeneity of nursing home beds and home care agency, but failed to reject the possibility of endogeneity of per capita assisted living beds in the county. To address this issue, all of the quality models were estimated via two-stage least squares (2SLS). State regulations specific to assisted living facilities are good candidates for instrumental variables, as they are expected to influence assisted living facilities but should not affect nursing home outcomes. In this study state regulations regarding assisted living facility's allowed scope of care, reimbursement methods, and whether there was a Medicaid waiver in place allowing for coverage in such facilities were used as instruments in the first stage of estimation.

However, some other policy variables such as assisted living private-pay price level and assisted living Certificate of Need regulation might be correlated with the nursing home quality indicators as well. These variables are left out of the first-stage regression and are instead used as additional independent variables in the second stage regression.

Equation (1) below describes the basic linear regression model for care quality. Q_{im} measures the care quality of nursing home i in market m. X_{im} is a vector of facility characteristics for nursing home i in market m. S_m is a vector of measures of competition and private price from nursing homes, assisted living facilities, and home care agencies in

market m. Z_m is a vector of the demographics of the local population, measured at the county-level. Finally, R_{mNHAL} is a vector of variables measuring nursing home state regulations and AL CON.

$$Q_{im} = \beta_1 X_{im} + \beta_2 S_{mNH} + \beta_3 S_{mHC} + \beta_4 S_{mAL} + \beta_5 Z_m + \beta_6 R_{mNHAL} + \varepsilon_{im} \quad (1)$$

Because of the endogeneity of the assisted living beds per capita, the actual regression model is estimated using 2SLS, with instrument variables to address the endogeneity of assisted living beds per capita. In the first stage, the equation estimated is:

$$S_{mAL} = \beta_1 X_{im} + \beta_2 S_{mNH} + \beta_3 S_{mHC} + \beta_4 Z_m + \beta_5 R_{mNH} + \beta_6 R_{mAL} + \varepsilon_m \quad (2)$$

where S_{mAL} is endogenous, and the vector, R_{mAL} , is a set of instrumental variables describing state regulation of assisted living facilities other than AL CON. In the second stage, the equation estimated is:

$$Q_{im} = \beta_1 X_{im} + \beta_2 S_{mNH} + \beta_3 S_{mHC} + \beta_4 \hat{S}_{mAL} + \beta_5 Z_m + \beta_6 R_{mNHAL} + \varepsilon_{im} \quad (3)$$

where $\hat{S}_{mAL}$ is a vector of predicted values for S_{mAL} that are estimated from equation (2).

3.5 Results

Table 3.3 reports the mean and standard deviations for variables used in the analysis.

As noted earlier, the nine quality indicators examined all three types of quality measure, i.e., input-based, process-based, and outcome-based measures. The first three measure staffing levels, and are each computed as number of nursing staff per 1000 nursing home beds. This scale is used for the convenience of presenting coefficients. As an input factor for residents' health conditions, an increase in the staffing level per bed indicates a better nursing home quality. The other six quality indicators measure the

deficiencies in health service, care procedures, and health outcomes, and they are negative indicators of care quality. For example, the higher the percentage of residents who have facility-acquired pressure sores, the lower the quality of care in the nursing home. A positive relationship of an independent variable with a positive quality indicator means that an increase in that variable increases quality, whereas a positive relationship with a negative quality indicator means that an increase in that independent variable decreases quality.

County-level demographic characteristics include county per capita income, the percentage of females in the adult population, the percentage of the population ages 65 and older, the mortality rate, the poverty rate, and whether the county is urban or rural. County per capita income is included to measure ability to pay for long term care in the county. The percentage of adult females is a proxy for the availability of informal care provided by family members. Since women are the major caregivers in families this is likely a good proxy. Whether a certain county is located in a metropolitan area is included because previous studies have found this to be predictive of quality.

Four variables measure the market's structure and competition from outside and within the nursing home sector. Competition from assisted living is represented by the number of assisted living facility beds per capita in the county. This measure is preferable to the number of assisted living facilities per capita for two reasons. First, the size of assisted living facilities varies tremendously, e.g., a single facility may have 5 or 500 beds. Thus, simply using the number of facilities would fail to capture the true availability of beds outside of nursing homes. Second, compared to the number of assisted living facilities, the number of beds is more likely to affect the overall demand

for nursing home placements. With regard to the home health agencies, whose services are not generally counted in terms of beds, the number of home care agencies per capita in the county is used as a proxy for competition from the home health care sector. Competition from other nursing homes is measured by the Herfindahl index (HHI) of nursing home bed share in each county. The competition index used in this regression is adjusted by 1 minus the actual Herfindahl index. After the alternation, a higher adjusted HHI value indicates more competition within the nursing home sector.

Table 3.4 reports key findings from the 2SLS regressions estimated for all nine quality measures. The full regression models, which control for all of the variables shown in the data summary, are included in the appendix B.

Just as anticipated, nursing home quality is affected by local competition from assisted living facilities and home care agencies. As shown in Table 3.4, increased competition from home care agencies has significant effects on seven out of the nine quality indicators. Competition was mainly focused in the labor market where both home care agencies and nursing homes are trying to get more professional nursing staff. The marginal effect of one unit increase in the home care agency per capita would lead to a decrease of 6943.63 nurse aides for 1000 nursing home beds. However, the competition from home care agencies doesn't bring down nursing home quality measured by number of health deficiencies, percentage physically restrained resident, percentage with facility acquired catheters and drug error rate. Increased competition from assisted living facilities also has significant effects on nursing home quality. These effects will be analyzed with assisted living regulations coefficients in Table 3.5 in more detail.

These results show the importance of controlling for the long-term care market competition when analyzing the policy effects on nursing home quality. Estimation in an isolated market is biased and far from the reality.

After controlling for excess demand and local competition from all three types of long-term care providers, the Medicaid reimbursement rate is positively and significantly associated with nursing home quality. A one dollar increase in the reimbursement rate leads to an increase of 0.12 RNs per 1000 beds, 0.578 LPNs per 1000 beds, and 0.571 nurse aids per 1000 beds. An increase in the Medicaid reimbursement rate also has uniformly positive and significant effects on process-based and outcome-based measures of quality. Raising the Medicaid price by one dollar decreases the number of health-related deficiencies by 0.159, the drug error rate by 0.006 percent, the prevalence of antipsychotic medications by 0.017 percent, and the prevalence of catheters by 0.004 percent. Although these effects are small, they are all statistically significant.

These results imply that the excess demand hypothesis, which states that nursing home quality and Medicaid rate will change counter-intuitively, does not apply to the market conditions of 2010, for which these models are estimated. This may be due to the growth in other forms of long-term care services. Medicaid residents as well as the private residents become limited resources that all sectors are competing with each other in terms of quality. A higher price level will lead directly to higher quality as suggested by economics theories. Any factor that will decrease the Medicaid price level will reduce the nursing home quality.

The effects of CON regulation on nursing home quality are mixed. CON regulations significantly raise nurse staffing levels. One interpretation is that, to the

extent that CON regulations lower available nursing home beds, nursing homes compensate by staffing more intensely. However, their more-intense staffing does not bring up the quality in nursing homes. Instead, nursing homes located in states with CON have, on average, four more health deficiencies and 0.58% more residents who are physically restrained, compared to nursing homes in non-CON states. This finding suggests that CON may improve staffing inputs, but this improvement dose not lead to a further increase in nursing home quality, at least according to process-based and outcome-based measures. Regulatory agencies should try to protect the quality level of nursing homes first before reducing nursing home beds.

Studies that examined the effects of Medicaid reimbursement methods, not just the level of the Medicaid rate, such as Cohen and Dubay (1990) and Grabowski (2001), found that stricter, flat-rate methods tend to have more negative effects on staffing levels, and fewer positive effects on other measures of quality. Prospective rate-setting methods are the strictest compared to combination systems in this paper, and the regression results are consistent with the previous literature. Both systems have positive effects on staffing levels, as measured by LPNs per 1000 beds and nurses aids per 1000 beds. These two rate-setting methods also appear to significantly reduce the prevalence of health deficiencies and pressure sores. Regarding other process-based quality measures, such as the prevalence of physical restraints and antipsychotic medications, the prospective rate-setting methods cause a rise in the prevalence of both conditions. In contrast, the coefficients are not statistically significant for combination systems.

Rate-setting systems that adjust for a nursing home's case mix appear to have mixed effects on quality. They increase LPN staffing levels, while decreasing RN and

nurse aid staffing levels. They also appear to reduce the drug error rate and the prevalence of physical restraints, but increase the prevalence of antipsychotic medications and catheters. Their effect on the prevalence of pressure sores is negative as well.

The effects of state regulations regarding assisted living facilities on care quality in nursing homes are reported in Tables 3.5 and 3.6. The direct effect is from the AL CON regulation and AL beds per capita. The indirect effects are from the AL regulation factors onto the AL beds supply, which is a direct competition factor to nursing home quality, then further associated with quality level provided in nursing homes.

As far as its direct impact on quality, competition from assisted living facility, which is measured by number of beds per capita in each county, has mixed effects on nursing home quality. It improves the staffing level quality indicators, while it reduces quality indicated by process measurements.

The positive effects on the staffing level can be explained by the different in care level the two kinds of facilities provide. Residents in assisted living facility, referred to as “low-care” patients by Mor et al (2007), generally have better health conditions and require less services than the ones in nursing homes. As a result, there will be more staffs needed and hired in counties where competition from assisted living facilities have attracted the "low-care" residents and left nursing homes with "high-care" residents. Furthermore, this condition also helps explain the negative effects on resident outcome. Because the "high-care" residents generally have high level of disabilities, their measured health conditions will be lower as well. Overall, factors including number of health deficiencies, percentage physically restrained, percentage catheters, and drug error rate

are more severe in places with higher number of assisted living beds per capita. For example, when the assisted living beds per capita increases by 1, it will increase health deficiencies in nursing homes by 123.72, drug error rate by 4.24%, percentage physically restrained by 6.32%, and percentage acquired catheters by 3.68%.

Because of the negative effects of assisted living competition on nursing home quality, a factor that controls the competition from assisted living facilities, such as the assisted living CON, will generally increase nursing home quality. Nursing homes operate in state with assisted living CON will have 9 less health deficiencies than homes operate in states that do not control the growth speed of assisted living facilities. There will also be 0.49% less physically restrained, 0.58% less antipsychotic and 0.15% less catheters in those nursing facilities.

The effects of other AL regulation policies on AL beds from the first step regression are listed in Table 3.6. When states allow assisted living facilities to provide skilled nursing care, the AL bed supply in that state will be higher by 0.024 beds per capita. Although the bed supply is not significantly higher in states allowing Medicaid waiver to pay for the AL services, it is higher when there is state plan to cover the costs. The coefficient of the flat rate reimbursement method on AL beds per capita is -0.051, with similar effects from other methods of payments. All kinds of the AL reimbursement methods are associated with the bed supply negatively, except for the most generous FFS reimbursement. This might because of the fact that Medicaid generally pay lower than the private insurance. In states where Medicaid can be used to pay for assisted living costs, there will be more residents using Medicaid instead of private long-term care insurance in the facilities. According to Stevenson et al (2010) assisted living facilities distribute

disproportionally in areas where there are more private-paying residents. So no matter which kind of payment the Medicaid reimbursement system uses, the assisted living bed supply will be lower.

Using the chain rule (i.e., dy/dz = dy/dx*dx/dz) we see that the indirect effect of assisted living regulations on nursing home quality can be derived as the product of their marginal effect on AL beds and the marginal effect of AL beds on care quality. The cross products are shown only for the variables with significant coefficients at both steps.

Variables which have positive effects on the growth of assisted living facilities are now negatively associated with nursing home quality. Application of the chain rule implies that in states that allow nursing care to be provided in AL facilities and which also cover Medicaid services using state plans, there will be about 6 less LPNs per bed in nursing homes, 3 more health deficiencies occurring in nursing homes, a 0.10% increase in the drug error rate, a 0.15% increase in the prevalence of physical restraints, and a 0.09% increase in the prevalence of catheters.

On the other hand, the reimbursement methods have positive effects on nursing home process-based and outcome-based quality measures. For example, the total number of health deficiencies is reduced by about 4.08 to 8.78, the drug error rate is reduced by 0.14% to 0.30%, the prevalence of physical restraints is reduced by 0.21% to 0.45, and the prevalence of catheters is reduced by 0.12% to 0.26%. The AL case-mix reimbursement method has the highest magnitude in affecting the nursing home quality among all the other systems.

3.6 Conclusions

The market for long-term care and the nature of competition among suppliers has evolved over the last two decades. Assisted living facilities and home care agencies are far more prevalent nowadays compared to 1990, and these providers compete with nursing homes to provide services to individuals who are higher-functioning, e.g., who need assistance with a few activities of daily living but not continuous, 24-hour support. With the exception of Bowblis (2012), existing empirical studies of the determinants of nursing home quality have generally assumed that nursing homes only compete with other nursing homes and not with other types of firms providing substitutes for nursing home care, at least among higher-functioning, less disabled individuals. This paper has examined the effects of state regulation of long-term care providers on care quality in nursing home, controlling for the local competition effects from other long-term care providers. From this nationally representative analysis of data on 13,436 nursing homes, all observed in 2010, three key findings emerge.

First, a higher Medicaid reimbursement rate leads to definite improvements in care quality in nursing homes. This statement applies to nine different quality measures, including input-based, process-based, and outcome-based indicators. Given the widespread presence of assisted living facilities and home care agencies, which for some patients are feasible alternatives to nursing homes, a presumption that excess demand gives rise to a negative relationship between Medicaid reimbursement rates and nursing home quality just isn't plausible anymore. An increase in the Medicaid daily rate leads to significant increases in a nursing home's RNs, LPNs, and nurses aids per bed, and significant decreases in a home's total number of health deficiencies, the occurrence of medication errors, the prevalence of antipsychotic medications, and the prevalence of

catheters. The method used by a state for setting Medicaid rates also has quality repercusions. Prospective rate setting systems and combination systems raise some aspects of care quality in nursing homes, at least compared to flat-rate systems.

Second, the presence of nursing home CON regulations also has positive effects on nursing home staffing levels. However, other measures, such as process-based and outcome-based quality indicators respond negatively to the presence of CON. One interpretation is that, faced with a bed constraint, nursing homes are substituting labor for capital, but such substitution does not raise care quality when measured via any non-staffing measure.

Finally, care quality in nursing homes also responds significantly to local market competition from assisted living facilities and home care agencies, not just from other nearby nursing homes. Nursing homes are no longer an isolated long-term care sector, and their care quality reflects that. This study found that competition from home care agencies has mixed effects on nursing home quality. Its effects on staff-to-bed ratios were mostly negative, whereas its effects on other structure, process, and outcome quality measures were mostly positive. The presence of local competition from assisted living facilities has mixed but mostly negative effects on care quality. For example, more assisted living beds in a nursing home's market improves the home's staffing levels, but increases its number of health deficiencies, the prevalence of medication errors, physical restraints, and catheters among residents.

Related to this, state CON programs for assisted living facilities, which in effect constrain competition from assisted living facilities, generally raise care quality in nursing homes. In states with such programs nursing homes incur fewer health

deficiencies, and they have lower rates of physical restraints, antipsychotic medications, and catheter use among their residents. Additionally, when states allow assisted living facilities to provide skilled nursing care, nursing homes lower nurse staffing levels, but at the same time they incur more health deficiencies and have a higher prevalence of medication errors, physical restraints, and catheters among residents. Similar findings occurred in states that cover long-term care for Medicaid residents in assisted living facilities.

The main policy implication of this study is that Medicaid regulations have significant effects on nursing home quality. Like Grabowski (2001), this study finds strong evidence that lower Medicaid reimbursement rates decrease nursing home quality, regardless of how it is measured. Further, this fundamental result holds even when quality models control for competition from home care agencies and assisted living facilities. When a state reduces its payment rate, nursing homes sacrifice quality to make ends meet. State CON programs also tend to lower quality. Although CON programs save on Medicaid outlays, they end up hurting all nursing home residents, whose wellbeing is reduced by lower quality care. Governments need to weigh these costs against the benefits before implementing CON. The methods for setting Medicaid rates also matter. In particular, methods that adjust for actual costs, such as retrospective rate-setting systems, have an advantage over other approaches, in that they improve nursing home quality.

As far as the interaction between nursing home quality and assisted living regulation, policies that restraint the growth of assisted living facilities will raise nursing home quality. However, this does not mean states should impede the growth of the

assisted living sector. Policy makers need to take into account changes in residents' characteristic and quality of services of nursing homes after the rapid growth of home and community based services when they set the reimbursement level of nursing homes. Building a segmented market may be useful in establishing state regulations and improving efficiency.

However, based on the nature of the analyzing model, we cannot rule out the possibility of some third factor that is correlated with the policy factors and nursing home quality in longitudinal settings. Further research needs to be done using panel data of the whole long-term care market.

Tables for Chapter 3:

Table 3.1 Variable Descriptions

Variable	Definition	Source
Quality Measures		
RN/Beds	Total number of registered nurses per beds in each nursing facility	CASPER
LPN/Beds	Total number of licensed practical nurses per beds in each nursing facility	CASPER
Nurse Aides/Beds	Total number of Nurse Aides per beds in each nursing facility	CASPER
Health Deficiencies	Number of regulatory health deficiencies in each nursing facility	NHC
Drug Error Rate	Percentage of drug error in each facility	CASPER
Percentage Physically Restrained	Percentage of resident in each facility who are physically restrained	CASPER
Percentage Antipsychotic	Percentage of resident in each facility who use antipsychotic medication	CASPER
Percentage Acquired Catheters	Percentage of resident in each facility who acquired catheter during the stay	CASPER
Percentage Acquired Pressure Sores	Percentage of resident in each facility who are acquired pressure sore during the stay	CASPER
Nursing Home Facility Characteristics		
NH Beds Per Capita	Nursing home total beds per capita for each facility	CASPER
NH Ownership	Dummy variable if Government owned=1; 0=otherwise	CASPER
For/Non- Profit	Dummy variable For-profit=1; Non-profit=0	CASPER
Provider Based Facility	Dummy variable =1 if provider based; 0=otherwise	CASPER
Percentage Medicaid Residents	Percentage of Medicaid residents in each facility	CASPER
Special Care Beds	Percentage of nursing home beds for Alzheimer patients	CASPER
Case-Mix Index	Case mix measurement for each facility	CASPER
Market Structure		

NH Avg Empty Beds	Average percentage of nursing home empty beds in county	CASPER
HC Agency Per Capita	Number of home care agencies per capita in county	POS
AL Beds Per Capita	Number of assisted living beds per capita in county	Stevensen 2010
NH Herfindahl Index	Nursing home Herfindahl Index in each county	CASPER
County Demographic Characteristics		
Census Region Code	1=Northeast 2=Midwest 3=South 4=West	ARF
County Per Capita Income	Per capita income in each county	ARF
Population 65+	Percentage of population age 65 and over in county	ARF
Adult Female	Percentage of population adult female in county	ARF
Medicaid Eligible	Percentage of Medicaid eligible older adults in 65 and over age group in each county	ARF
Mortality Rate	County mortality rate	ARF
Poverty Rate	County poverty rate	ARF
Percentage White	Percentage white population in county	ARF
Percentage Black	Percentage black population in county	ARF
Population Density	Population density per square mile in county	ARF
Low Education Type	Dummy variable for low educational region	ARF
State Policy Factors		
NH Medicaid Price	Nursing home Medicaid per diem price	State Data Book
NH CON	Dummy variable for state nursing home CON regulation	State Data Book
NH Prospective Reimbursement	Dummy variable for prospective reimbursement system	State Data Book
NH Combination Reimbursement	Dummy variable for combination reimbursement system	State Data Book
NH Case-Mix Adjusters	Dummy variable of whether the reimbursement rate is adjusted for case-mix	State Data Book
NH Price Ratio	Nursing home Medicaid reimbursement rate over nursing home private pay price	MetLife Market Survey
AL Daily Avg Price	Assisted living facility private-pay daily average price	MetLife Market

		Survey
HC hourly Avg Price	Home health care agency private-pay hourly average price	MetLife Market Survey
Adult Day Care Daily Avg Price	Adult day care facility private-pay daily average price	MetLife Market Survey
AL CON	Dummy variable for state assisted living Certificates of Need regulation	AL Regulatory Review
AL Facility Scope of Care	Dummy variable of whether the assisted living facility could provide nursing services	AL Regulatory Review
AL Medicaid Waiver	Dummy variable of whether the state Medicaid waiver could cover assisted living costs	AL Regulatory Review
AL State Plan	Dummy variable of whether there is a state plan to cover assisted living costs	AL Regulatory Review
AL Flat Rate Reimbursement	Dummy variable for flat rate reimbursement system	AL Regulatory Review
AL Tiered Rate Reimbursement	Dummy variable for tiered rate reimbursement system	AL Regulatory Review
AL Case-Mix Reimbursement	Dummy variable for case-mix reimbursement system	AL Regulatory Review
AL FFS Reimbursement	Dummy variable for fee-for-service reimbursement system	AL Regulatory Review
AL Negotiated Reimbursement	Dummy variable for negotiated reimbursement system	AL Regulatory Review

Table 3.2 Type of Quality Indicators

Quality Indicator	**Type of Indicator**
RN/Bed	Structure
LPN/Bed	Structure
Nurse Aids/Bed	Structure
Health Deficiency	Structure
Drug Error Rate	Process
Percentage Physically Restrained	Process
Percentage Antipsychotic	Process
Percentage Acquire Catheters	Process
Percentage Acquire Pressure Sores	Outcome

Table 3.3 Descriptive Statistics of All Variables

Total observation number: 13426

Variables	**Mean**	**Std. Dev.**
RN/Beds	0.07169	0.08586
LPN/Beds	0.135396	0.126905
Nurse Aides/Beds	0.378815	0.185241
Health Deficiencies	14.98494	11.32956
Drug Error Rate	1.504207	4.067297
Percentage Physically Restrained	3.11389	5.58665
Percentage Antipsychotic	25.19481	14.81464
Percentage Acquire Catheters	1.623429	2.80799
Percentage Acquire Pressure Sores	2.941331	3.245092
NH Beds Per Capita	0.165465	0.148378
NH Ownership	0.761367	0.426264
For/Non- Profit	0.705123	0.456005
Provider Based Facility	0.048494	0.214816
Percentage Medicaid Residents	62.89192	19.74553
Special Care Beds	4.987203	13.21166
Case-Mix Index	141.9866	43.93583
NH Avg Empty Beds	17.34904	10.53505
HC Agency Per Capita	0.036434	0.057068
AL Beds Per Capita	0.311181	0.221559
Herfindahl Index (1-HHI)	0.7740254	0.2565023
Census Region Code	2.461169	0.946563
County Per Capita Income (in 1000s)	1.722276	0.721113
Population 65+	14.08715	3.631144
Adult Female	30.0873	2.268431

Variables	Mean	Std. Dev.
Medicaid eligible	15.28146	7.763679
Mortality Rate	0.904158	0.23473
Poverty Rate	15.58205	5.318782
Percentage White	77.39127	16.67342
Percentage Black	11.00004	12.85455
Population Density (in1000s)	1.244913	4.045115
Low Education Type	0.121789	0.327054
NH Medicaid Per Diem Price	142.3166	37.54888
NH CON	0.773915	0.41831
NH Prospective Reimbursement	0.849497	0.357577
NH Combination Reimbursement	0.136091	0.342898
NH Case-Mix Adjusters	0.677738	0.46736
NH Price Ratio	132.4298	68.02018
AL Daily Avg Price	107.2017	19.53959
HC hourly Avg Price	20.66501	2.799751
Adult Day Care Daily Avg Price	60.38816	17.47155
AL CON	0.156333	0.363184
AL Facility Scope of Care	0.749871	0.434623
AL Medicaid Waiver	0.716859	0.450541
AL State Plan	0.244645	0.487086
AL Flat Rate Reimbursement	0.312043	0.463347
AL Tiered Rate Reimbursement	0.432814	0.495487
AL Case-Mix Reimbursement	0.14892	0.356025
AL FFS Reimbursement	0.070242	0.255565
AL Negotiated Reimbursement	0.035982	0.186253

Table 3.4 Two-stage Least Square Regression Model on Nursing Home Quality Indicators:

	RN/1000 Beds	LPN/1000 Beds	Nurse Aides/1000 Beds	Health Deficiencies	Drug error rate	Percentage Physically Restrained	Percentage Antipsychotic	Percentage Acquired Catheters	Percentage Acquired Pressure Sores
HC Agencies Per Capita	-1493.377	5238.454***	-6943.626***	-2577.078***	-90.094*	-131.627**	260.119*	-77.662***	54.415
	(917.918)	(1555.042)	(2056.177)	(328.127)	(47.148)	(62.845)	(152.742)	(32.582)	(36.674)
AL Beds Per Capita	70.415	-247.131***	332.139***	123.724***	4.241*	6.315**	-11.009	3.678***	-2.727
	(43.605)	(73.871)	(97.678)	(15.587)	(2.240)	(2.985)	(7.256)	(1.548)	(1.742)
NH Medicaid Per Diem Price	0.120***	0.578***	0.571***	-0.159***	-0.006***	0.002	-0.017**	-0.004***	-0.002
	(0.045)	(0.076)	(0.100)	(0.016)	(0.002)	(0.003)	(0.007)	(0.002)	(0.002)
NH CON	12.299***	-25.325***	35.489***	4.116***	0.200	0.583***	0.078	0.087	-0.077
	(2.509)	(4.250)	(5.620)	(0.897)	(0.129)	(0.172)	(0.417)	(0.089)	(0.100)
NH Prospective Reimbursement	-9.381	61.866***	27.879*	-8.918***	0.737**	1.413***	2.740***	-0.269	-0.675***
	(6.827)	(11.566)	(15.293)	(2.441)	(0.351)	(0.467)	(1.136)	(0.242)	(0.273)
NH Combination Reimbursement	5.255	52.192***	9.511	-8.134***	0.799**	0.701	1.495	-0.115	-0.565**
	(7.080)	(11.994)	(15.860)	(2.531)	(0.364)	(0.485)	(1.178)	(0.251)	(0.283)
NH Case-Mix Adjusters	-10.049***	13.252***	-8.797**	0.194	-0.642***	-0.270**	1.750***	0.173***	0.453***
	(1.998)	(3.385)	(4.476)	(0.714)	(0.103)	(0.137)	(0.332)	(0.071)	(0.080)

The dependant variables are listed on the top. Number of assisted living facility per capita is the endogenous variable. The instrument variables are assisted living facility policy factors. Regressions are all controlled for nursing home facility characteristics, county demographic variables, and policy factors. Estimated coefficients are reported for each variable and standard errors are in parentheses.

* significant at the 90% confidence level ** significant at the 95% confidence level *** significant at the 99% confidence level

Table 3.5 Second-stage Regression and Cross-product Coefficients:

	RN/1000 Beds	LPN/1000 Beds	Nurse Aides/1000 Beds	Health Deficiencies	Drug error rate	Percentage Physically Restrained	Percentage Antipsychotic	Percentage Acquired Catheters	Percentage Acquired Pressure Sores
AL CON	-11.210***	13.901***	14.997***	-8.924***	0.005	-0.493***	-0.584	-0.148*	0.246***
	(2.501)	(4.237)	(5.603)	(0.894)	(0.128)	(0.171)	(0.416)	(0.089)	(0.100)
AL Beds	70.415	-247.131***	332.139***	123.724***	4.241*	6.315**	-11.009	3.678***	-2.727
	(43.605)	(73.871)	(97.678)	(15.587)	(2.240)	(2.985)	(7.256)	(1.548)	(1.742)
AL Facility Scope of Care	-5.931	7.971	2.969	0.102	0.152	0.090			
AL State Plan	-6.178	8.303	3.093	0.106	0.158	0.090			
AL Flat Rate Reimbursement	12.604	-16.939	-6.310	-0.216	-0.322	-0.188			
AL Tiered Rate Reimbursement	8.155	-10.961	-4.083	-0.140	-0.208	-0.121			
AL Case-Mix Reimbursement	17.546	-23.582	-8.784	-0.301	-0.448	-0.261			
AL Negotiated Reimbursement	15.569	-20.925	-7.795	-0.267	-0.398	-0.232			

Estimated coefficients are reported for each variable and standard errors are in parentheses.

* significant at the 90% confidence level ** significant at the 95% confidence level *** significant at the 99% confidence level

Table 3.6 First-stage Regression on Assisted Living Beds Per Capita:

AL Beds Per Capita	AL Facility Scope of Care	AL Medicaid Waiver	AL State Plan Reimbursement	AL Flat Rate Reimbursement	AL Tiered Rate Reimbursement	AL Case-Mix Reimbursement	AL FFS Reimbursement	AL Negotiated Reimbursement
Coef.	0.024***	0.008	0.025***	-0.051***	-0.033**	-0.071***	-0.014	-0.063***
S.E.	(0.008)	(0.007)	(0.008)	(0.014)	(0.015)	(0.016)	(0.018)	(0.019)

Estimated coefficients are reported for each independent variable and standard errors are in parentheses.

* significant at the 90% confidence level ** significant at the 95% confidence level *** significant at the 99% confidence level

APPENDIX A

APPENDIX FOR CHAPTER 2

Case-mix based on Grabowski (2001) is calculated as follows:

A(20) + B(18) + C(30) + D(30) + E(20) + F(48) + G(90) + H(90) + I(45) + J(32) + K(20) + L(50) + M(36)

A=% of residents need full assistance bathing

B=% of residents need partial assistance bathing

C=% of residents need full assistance dressing

D=% of residents need partial assistance dressing

E=% of residents catheterized

F=% of residents incontinent

G=% of residents need parenteral feeding

H=% of residents need tube feeding

I=% of residents need assistance eating

J=% of residents nonambulatory

K=% of residents with pressure sores

L=% of residents receive bowel/bladder retraining

M=% of residents receive special skin care

APPENDIX B

FULL REGRESSION FOR CHAPTER 2

1. 2SLS QUALITY REGRESSION:

	RN/1000 Beds	LPN/1000 Beds	Nurse Aides/1000 Beds	Health Deficiencies	Drug error rate	Percentage Physically Restrained	Percentage Antipsychotic	Percentage Acquired Catheters	Percentage Acquired Pressure Sores
HC Agencies Per Capita	-2452.974***	2837.384**	-10334.380***	-1864.227***	-79.649*	-155.393***	209.907	-47.680*	85.877***
	(845.217)	(1300.359)	(2011.762)	(222.236)	(41.784)	(56.738)	(135.333)	(28.264)	(33.474)
AL Beds Per Capita	116.248***	-131.222**	494.285***	89.390***	3.716*	7.455***	-8.685	2.250*	-4.220***
	(40.068)	(61.645)	(95.369)	(10.535)	(1.981)	(2.690)	(6.416)	(1.340)	(1.587)
Herfindahl Index	-1.040	7.732	17.701*	-1.295	0.418**	0.376	2.027***	-0.279**	0.316**
	(4.011)	(6.174)	(9.556)	(1.055)	(0.202)	(0.279)	(0.641)	(0.131)	(0.160)
NH Avg Empty Beds	-0.401***	-1.285***	-3.394***	0.065***	0.018***	0.018***	0.060***	0.014***	0.014***
	(0.090)	(0.139)	(0.214)	(0.024)	(0.004)	(0.006)	(0.014)	(0.003)	(0.004)
NH Beds	-1029.250***	578.161	-3569.721***	-500.977***	-3.471	-39.687**	43.921	-8.838	34.388***
	(277.833)	(427.443)	(661.290)	(73.052)	(13.735)	(18.650)	(44.486)	(9.291)	(11.003)
Ownership	3.954	3.670	48.830***	2.934***	0.033	0.825***	1.811***	0.279**	-0.358***
	(3.596)	(5.533)	(8.559)	(0.946)	(0.178)	(0.241)	(0.576)	(0.120)	(0.142)
For/Non-	-7.511**	-7.239	-94.806***	-0.827	0.243	-0.423*	1.366***	-0.466***	0.174

Profit	(3.432)	(5.280)	(8.169)	(0.902)	(0.170)	(0.230)	(0.550)	(0.115)	(0.136)
Provider Based Facility	72.405***	33.910***	17.510**	1.286	0.011	-0.288	-3.310***	0.752***	-0.127
	(3.701)	(5.694)	(8.810)	(0.973)	(0.183)	(0.248)	(0.593)	(0.124)	(0.147)
Percentage Medicaid Residents	-0.594***	-0.121*	-0.362***	0.088***	0.006***	0.031***	0.278***	0.008***	0.000
	(0.040)	(0.062)	(0.096)	(0.011)	(0.002)	(0.003)	(0.006)	(0.001)	(0.002)
Special Care Beds	-0.141***	-0.036	0.031	-0.015	-0.003	0.014***	0.106***	-0.006***	-0.004*
	(0.056)	(0.086)	(0.133)	(0.015)	(0.003)	(0.004)	(0.009)	(0.002)	(0.002)
Case Mix	0.091***	0.150***	0.221***	-0.007*	0.000	0.015***	-0.031***	0.006***	0.012***
	(0.017)	(0.026)	(0.040)	(0.004)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
Census Region Code	-1.472	9.807***	16.284***	-2.607***	-0.135*	0.459***	-0.260	-0.064	0.092
	(1.484)	(2.283)	(3.532)	(0.390)	(0.073)	(0.100)	(0.238)	(0.050)	(0.059)
County Per Capita Income	2.123	-8.489***	-1.666	0.001	0.138	-0.014	1.059***	0.104*	-0.086
	(1.716)	(2.641)	(4.085)	(0.451)	(0.085)	(0.115)	(0.275)	(0.057)	(0.068)
Population 65+	0.566	1.264*	5.893***	-0.284**	-0.033	-0.118***	-0.335***	-0.057***	-0.050***
	(0.499)	(0.768)	(1.188)	(0.131)	(0.025)	(0.034)	(0.080)	(0.017)	(0.020)
Adult Female	0.728	3.005***	-2.297*	-0.548***	-0.003	-0.060*	0.079	-0.027	0.001
	(0.515)	(0.793)	(1.227)	(0.135)	(0.025)	(0.035)	(0.083)	(0.017)	(0.020)

Percentage Medicaid eligible	0.031	-0.129	0.764*	-0.266***	-0.024***	0.016	0.109***	0.007	0.000
	(0.165)	(0.254)	(0.392)	(0.043)	(0.008)	(0.011)	(0.026)	(0.006)	(0.007)
Mortality Rate	-15.090**	-2.702	-129.148***	-1.455	0.095	1.534***	4.094***	0.465*	0.668**
	(7.589)	(11.676)	(18.063)	(1.995)	(0.375)	(0.509)	(1.215)	(0.254)	(0.301)
Poverty Rate	0.029	-1.356***	2.318***	0.437***	0.034***	0.046**	-0.066	0.029***	-0.003
	(0.297)	(0.456)	(0.706)	(0.078)	(0.015)	(0.020)	(0.048)	(0.010)	(0.012)
Percentage White	-0.343***	0.201	1.132***	0.078**	-0.012*	0.010	0.064***	0.021***	0.004
	(0.134)	(0.206)	(0.319)	(0.035)	(0.007)	(0.009)	(0.021)	(0.004)	(0.005)
Percentage Black	-0.290*	1.293***	1.296***	0.122***	-0.010	0.003	0.014	0.004	0.002
	(0.152)	(0.234)	(0.361)	(0.040)	(0.008)	(0.010)	(0.024)	(0.005)	(0.006)
Population Density	-0.092	-2.099***	-1.236**	0.188***	-0.013	-0.058***	0.016	-0.004	-0.020**
	(0.244)	(0.376)	(0.581)	(0.064)	(0.012)	(0.016)	(0.039)	(0.008)	(0.010)
Low Education Type	-9.439***	20.688***	-29.463***	-4.917***	-0.512***	-0.356	1.696***	-0.179	0.239
	(3.702)	(5.695)	(8.810)	(0.973)	(0.183)	(0.248)	(0.593)	(0.124)	(0.147)
NH daily Avg price	0.047	0.387***	0.255***	-0.099***	-0.006***	0.002	-0.015***	-0.001	0.000
	(0.031)	(0.047)	(0.073)	(0.008)	(0.002)	(0.002)	(0.005)	(0.001)	(0.001)
NH price	-0.128***	0.202***	-0.087*	-0.039***	-0.001	0.006***	0.014***	-0.001	0.000

ratio	(0.019)	(0.029)	(0.045)	(0.005)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
AL daily avg price	0.051	-0.100	-0.063	0.048***	0.003	0.031***	0.032***	-0.004	0.000
	(0.069)	(0.106)	(0.164)	(0.018)	(0.003)	(0.005)	(0.011)	(0.002)	(0.003)
HC hourly avg price	1.688***	-1.975***	-3.932***	-0.251***	-0.061***	-0.119***	-0.227***	0.021*	-0.036***
	(0.332)	(0.510)	(0.789)	(0.087)	(0.016)	(0.022)	(0.053)	(0.011)	(0.013)
Adult day care daily avg price	-0.099*	0.193**	-0.667***	0.001	-0.008***	-0.003	-0.012	0.002	0.007***
	(0.059)	(0.091)	(0.141)	(0.016)	(0.003)	(0.004)	(0.009)	(0.002)	(0.002)
NH CON	13.059***	-25.516***	38.825***	4.003***	0.246*	0.578***	0.195	0.045	-0.122
	(2.600)	(3.999)	(6.187)	(0.684)	(0.129)	(0.175)	(0.416)	(0.087)	(0.103)
AL CON	-11.970***	9.233***	8.597	-7.745***	0.035	-0.494***	-0.494	-0.103	0.265***
	(2.534)	(3.898)	(6.031)	(0.666)	(0.125)	(0.170)	(0.406)	(0.085)	(0.100)
NH Prospective	-16.408***	1.043	10.485*	1.667***	0.037	0.690***	1.613***	-0.095	-0.080
	(2.543)	(3.913)	(6.053)	(0.669)	(0.126)	(0.171)	(0.407)	(0.085)	(0.101)
NH Case-Mix	7.793	-64.765***	-14.983	6.350***	-0.518	-0.560	-1.535	-0.147	0.024
	(10.314)	(15.868)	(24.550)	(2.712)	(0.510)	(0.692)	(1.651)	(0.345)	(0.408)
NH Flat	-12.637	-53.011***	-0.693	11.313***	-0.713	-0.825	-0.582	0.184	0.778**
	(9.496)	(14.610)	(22.603)	(2.497)	(0.469)	(0.637)	(1.521)	(0.318)	(0.376)
NH Case-	-10.234***	12.964***	-9.458*	0.360	-0.643***	-0.261*	1.823***	0.184***	0.460***

Mix Adjusters	(2.065)	(3.177)	(4.915)	(0.543)	(0.102)	(0.139)	(0.331)	(0.069)	(0.082)
Cons_	103.480***	-33.294	420.439***	46.905***	4.607***	-5.269***	-1.382	-0.642	0.735
	(25.097)	(38.611)	(59.735)	(6.599)	(1.241)	(1.685)	(4.018)	(0.839)	(0.994)

APPENDIX C

FULL REGRESSION FOR CHAPTER 3

1. 2SLS QUALITY REGRESSION

	RN/1000 Beds	LPN/1000 Beds	Nurse Aides/1000 Beds	Health Deficiencies	Drug error rate	Percentage Physically Restrained	Percentage Antipsychotic	Percentage Acquired Catheters	Percentage Acquired Pressure Sores
AL Beds Per Capita	70.415	-247.131***	332.139***	123.724***	4.241*	6.315**	-11.009	3.678***	-2.727
	(43.605)	(73.871)	(97.678)	(15.587)	(2.240)	(2.985)	(7.256)	(1.548)	(1.742)
HC Agencies Per Capita	-1493.377	5238.454***	-6943.626***	-2577.078***	-90.094*	-131.627**	260.119*	-77.662***	54.415
	(917.918)	(1555.042)	(2056.177)	(328.127)	(47.148)	(62.845)	(152.742)	(32.582)	(36.674)
Avg Empty Beds in County	-0.398***	-1.285***	-3.314***	0.063**	0.019***	0.017***	0.058***	0.013***	0.014***
	(0.088)	(0.148)	(0.196)	(0.031)	(0.004)	(0.006)	(0.015)	(0.003)	(0.003)
NH HHI	-0.759	9.650	19.406***	-1.631	0.389*	0.398	2.159***	-0.276**	0.308**
	(3.884)	(6.580)	(8.701)	(1.388)	(0.200)	(0.266)	(0.646)	(0.138)	(0.155)
NH Beds	-715.460***	1450.000***	-2438.472***	-754.834***	-8.610	-31.777	54.417	-18.465*	24.708**

	(302.744)	(512.877)	(678.159)	(108.221)	(15.550)	(20.727)	(50.377)	(10.746)	(12.096)
Ownership	3.262	1.737	45.815***	3.481***	0.039	0.810***	1.769***	0.304***	-0.334***
	(3.497)	(5.925)	(7.834)	(1.250)	(0.180)	(0.239)	(0.582)	(0.124)	(0.140)
For/Non-Profit	-7.238**	-5.923	-93.104***	-1.147	0.235	-0.415*	1.380***	-0.478***	0.167
	(3.327)	(5.636)	(7.453)	(1.189)	(0.171)	(0.228)	(0.554)	(0.118)	(0.133)
Provider Based Facility	73.081***	34.701***	18.631**	0.919	0.009	-0.276	-3.319***	0.735***	-0.151
	(3.585)	(6.073)	(8.030)	(1.281)	(0.184)	(0.245)	(0.596)	(0.127)	(0.143)
Percentage Medicaid Residents	-0.604***	-0.135**	-0.397***	0.093***	0.006***	0.031***	0.277***	0.008***	0.000
	(0.039)	(0.066)	(0.088)	(0.014)	(0.002)	(0.003)	(0.007)	(0.001)	(0.002)
Special Care Beds	-0.131***	-0.026	0.050	-0.019	-0.003	0.014***	0.107***	-0.007***	-0.005**
	(0.054)	(0.092)	(0.121)	(0.019)	(0.003)	(0.004)	(0.009)	(0.002)	(0.002)
Case Mix	0.091***	0.160***	0.228***	-0.010	0.000	0.015***	-0.031***	0.006***	0.012***
	(0.016)	(0.028)	(0.037)	(0.006)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
Census Region Code	-0.728	10.422***	18.930***	-2.876***	-0.115	0.469***	-0.157	-0.094*	0.057
	(1.447)	(2.451)	(3.241)	(0.517)	(0.074)	(0.099)	(0.241)	(0.051)	(0.058)
County Per Capita Income	2.057	-9.012***	-1.874	0.132	0.148*	-0.018	1.076***	0.104*	-0.087
	(1.662)	(2.815)	(3.722)	(0.594)	(0.085)	(0.114)	(0.277)	(0.059)	(0.066)

Population 65+	0.684	1.809**	6.338***	-0.419***	-0.039	-0.112***	-0.329***	-0.059***	-0.052***
	(0.487)	(0.826)	(1.092)	(0.174)	(0.025)	(0.033)	(0.081)	(0.017)	(0.019)
Adult Female	0.885*	3.419***	-1.798	-0.661***	-0.005	-0.054	0.096	-0.031*	-0.003
	(0.504)	(0.854)	(1.129)	(0.180)	(0.026)	(0.035)	(0.084)	(0.018)	(0.020)
Percentage Medicaid eligible	0.092	0.024	0.990***	-0.311***	-0.024***	0.017	0.113***	0.005	-0.002
	(0.162)	(0.274)	(0.363)	(0.058)	(0.008)	(0.011)	(0.027)	(0.006)	(0.006)
Mortality Rate	-14.234*	-3.806	-126.831***	-1.452	0.149	1.524***	4.176***	0.422	0.618**
	(7.346)	(12.445)	(16.456)	(2.626)	(0.377)	(0.503)	(1.222)	(0.261)	(0.294)
Poverty Rate	-0.189	-1.936***	1.549**	0.612***	0.038***	0.041**	-0.069	0.036***	0.004
	(0.302)	(0.512)	(0.677)	(0.108)	(0.016)	(0.021)	(0.050)	(0.011)	(0.012)
Percentage White	-0.424***	-0.064	0.855***	0.155***	-0.009	0.008	0.066***	0.024***	0.006
	(0.134)	(0.227)	(0.300)	(0.048)	(0.007)	(0.009)	(0.022)	(0.005)	(0.005)
Percentage Black	-0.379***	0.997***	0.995***	0.206***	-0.008	0.000	0.015	0.007	0.005
	(0.152)	(0.257)	(0.340)	(0.054)	(0.008)	(0.010)	(0.025)	(0.005)	(0.006)
Population Density	-0.123	-1.902***	-1.203**	0.149*	-0.017	-0.059***	0.001	-0.003	-0.018*
	(0.234)	(0.396)	(0.523)	(0.084)	(0.012)	(0.016)	(0.039)	(0.008)	(0.009)
Low Education	-7.196*	27.554***	-21.060***	-6.845***	-0.559***	-0.293	1.779***	-0.246*	0.173
	(3.730)	(6.318)	(8.355)	(1.333)	(0.192)	(0.255)	(0.621)	(0.132)	(0.149)

Type									
NH Medicaid Price	0.120***	0.578***	0.571***	-0.159***	-0.006***	0.002	-0.017**	-0.004***	-0.002
	(0.045)	(0.076)	(0.100)	(0.016)	(0.002)	(0.003)	(0.007)	(0.002)	(0.002)
NH price ratio	-0.160***	0.006	-0.248***	0.013**	0.001	0.005***	0.021***	0.000	0.000
	(0.018)	(0.030)	(0.039)	(0.006)	(0.001)	(0.001)	(0.003)	(0.001)	(0.001)
AL daily avg price	0.038	-0.016	-0.120	0.031	0.001	0.032***	0.026***	-0.003	0.001
	(0.064)	(0.108)	(0.143)	(0.023)	(0.003)	(0.004)	(0.011)	(0.002)	(0.003)
HC hourly avg price	1.594***	-2.280***	-4.069***	-0.147	-0.056***	-0.121***	-0.205***	0.023**	-0.035***
	(0.314)	(0.532)	(0.704)	(0.112)	(0.016)	(0.022)	(0.052)	(0.011)	(0.013)
Adult day care daily avg price	-0.083	0.250***	-0.577***	-0.013	-0.008***	-0.003	-0.009	0.001	0.006***
	(0.058)	(0.098)	(0.129)	(0.021)	(0.003)	(0.004)	(0.010)	(0.002)	(0.002)
NH CON	12.299***	-25.325***	35.489***	4.116***	0.200	0.583***	0.078	0.087	-0.077
	(2.509)	(4.250)	(5.620)	(0.897)	(0.129)	(0.172)	(0.417)	(0.089)	(0.100)
AL CON	-11.210***	13.901***	14.997***	-8.924***	0.005	-0.493***	-0.584	-0.148*	0.246***
	(2.501)	(4.237)	(5.603)	(0.894)	(0.128)	(0.171)	(0.416)	(0.089)	(0.100)
NH Prospective	-9.381	61.866***	27.879*	-8.918***	0.737**	1.413***	2.740***	-0.269	-0.675***
	(6.827)	(11.566)	(15.293)	(2.441)	(0.351)	(0.467)	(1.136)	(0.242)	(0.273)

NH Combined	5.255	52.192***	9.511	-8.134***	0.799**	0.701	1.495	-0.115	-0.565**
	(7.080)	(11.994)	(15.860)	(2.531)	(0.364)	(0.485)	(1.178)	(0.251)	(0.283)
NH CaseMix Adjusters	-10.049***	13.252***	-8.797**	0.194	-0.642***	-0.270**	1.750***	0.173***	0.453***
	(1.998)	(3.385)	(4.476)	(0.714)	(0.103)	(0.137)	(0.332)	(0.071)	(0.080)
_cons	96.697***	-74.814*	399.992***	52.065***	3.426***	-6.003***	-4.781	-0.392	1.499
	(25.941)	(43.947)	(58.110)	(9.273)	(1.332)	(1.776)	(4.317)	(0.921)	(1.036)

2. FIRST STAGE REGRESSION

AL Beds Per Capita	Coef.	Std. Err.	
NH Beds Per Capita	6.59951	0.29603	***
Avg Empty Beds	-0.00033	0.00024	
Ownership	-0.01667	0.00952	*
For/Non- Profit	0.01100	0.00918	
Provider Based Facility	0.00564	0.00993	
Percentage Medicaid Residents	-0.00014	0.00011	
Special Care Beds	0.00013	0.00015	
Case Mix	0.00006	0.00005	
HC Agencies Per Capita	21.01664	0.15630	***
NH HHI	0.02557	0.01034	***
Census Region Code	0.01502	0.00382	***
County Per Capita Income	-0.00404	0.00466	
Population 65+	0.00392	0.00132	***
Adult Female	0.00533	0.00128	***
Percentage Medicaid eligible	0.00177	0.00045	***
Mortality Rate	-0.00481	0.02133	
Poverty Rate	-0.00444	0.00071	***
Percentage White	-0.00120	0.00035	***
Percentage Black	-0.00115	0.00039	***
Population Density	-0.00177	0.00065	***
Low Education Type	0.04904	0.00847	***
NH Medicaid Per Diem Price	0.00041	0.00012	***
NH price ratio	-0.00002	0.00006	

AL daily avg price	0.00014	0.00019	
HC hourly avg price	0.00209	0.00127	*
Adult day care daily avg price	0.00043	0.00016	***
NH CON	-0.00796	0.01006	
AL CON	-0.01893	0.00858	**
NH Prospective Reimbursement	0.02046	0.01977	
NH Combination Rimbursement	0.02655	0.02018	
NH Case-Mix Adjusters	-0.00759	0.00700	
AL Facility Scope of Care	0.02435	0.00816	***
AL Medicaid Waiver	0.00775	0.00724	
AL State Plan	0.02511	0.00787	***
AL Flat Rate Reimbursement	-0.05078	0.01415	***
AL Tiered Rate Reimbursement	-0.03278	0.01508	**
AL Case-Mix Reimbursement	-0.07073	0.01580	***
AL FFS Reimbursement	-0.01398	0.01818	
AL Negotiated Reimbursement	-0.06289	0.01939	***
Con_	-0.23682	0.07282	***

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ABSTRACT

ECONOMIC DETERMINANTS OF QUALITY OF CARE IN NURSING HOMES

by

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August 2014

Advisor: Dr. Gail Jensen Summers

Major: Economics

Degree: Doctor of Philosophy

This dissertation examines the factors that will affect nursing home quality of care using several national data sources on market regulation, county demographic characteristics, market structural and the characteristics of different types of long-term care providers in 2010.

The first study examines how nine different measures of nursing home care quality respond to the greater levels of local market competition from these alternative providers of long-term care, as well as other nursing homes. Findings reveal that faced with greater competition from assisted living facilities, nursing homes are left to care for more disabled, less healthy patients. Although the nursing home's staff-to-bed ratios rise in response, other measures of care quality decline, such as more process- and outcome-based measures. Competition from home health agencies likewise has mixed effects on nursing home care quality, and competition from other nursing homes in a market tends to decrease care quality. These finding suggest that care quality in nursing homes may

continue to erode as the market for alternative, community-based long-term care services expands.

The second study examines the Medicare regulation effects on nursing home quality controlling for the whole long-term care market competition structure. In many local markets nursing homes now compete with assisted living facilities for residents, yet most previous studies of the effects of Medicaid nursing home reimbursement policies on care quality have analyzed nursing homes in isolation, ignoring the presence of nearby competitor firms, and how state regulation of assisted living facilities might also affect care quality in nursing homes. This study uses a richer model specification that accounts for a much broader range of state long-term care regulations as well as the structure of a nursing home's local market. Findings reveal that a higher Medicaid reimbursement rate leads to significant improvements in nine different aspects of nursing home quality, while state certificate-of-need programs for nursing homes lead to a decline in several (but not all) dimensions of it. A large presence of assisted living beds in a local market also tends to reduce nursing home quality, and state regulations regarding assisted living facilities indirectly affect nursing home care quality by altering the nature of local market competition. Overall, these results suggest that state laws related to all long-term care providers, not just nursing homes, are important determinants of nursing home care quality.

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Teaching Assistant, Wayne State University, MI, U.S. 2009 – 2011

Conference/ Seminar Presentations:

Nov 2012 Presenter: Effects of Common Policy Restrictions in Long Term Care Insurance on the Likelihood of Ever Qualifying for Benefits. The Gerontological Society of America.

Fellowships/Awards/Honors/ Scholarships:

2013 Graduate Exhibition, First Prize, Wayne State University
2009 Teaching Certificate Graduate Employees' Organizing Committee, Wayne State University

Professional Affiliations:

American Economic Association, The Gerontological Society of America.