Supply Regulation in the Nursing Home Industry*

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Abstract: In most states, firms in the nursing home industry must obtain a state license, which is known as a Certificate of Need (CON), prior to constructing or expanding a skilled nursing facility. There are two competing theoretical justifications in the economics literature for this regulation of the supply of nursing home beds. The public interest justification for CON regulation is based upon the belief that unregulated competition will result in the construction of unnecessary facilities and raise the cost of providing care for state-funded Medicaid patients. In addition, CON regulations that impose conditions on CONs may be used by states to ensure a supply of beds for poor elderly through the state-funded Medicaid program, despite relatively low Medicaid reimbursement rates. In contrast, proponents of the special interest theory of regulation suggest that CON construction controls provide a mechanism for barring new entry into a cartelized industry. Indeed, by controlling entry, the state provides nursing homes with a buffer from competition. As such, control of entry allows for the possibility of above normal economic profits as firms are able to charge higher prices to private-pay nursing home residents (i.e. residents paying out of pocket for nursing home care). The objective of this research is to consider the competing theoretical justifications for CON laws empirically, using nursing home facility-level data for nursing homes in Florida from 1986-1998, demographic data, and CON application data. The results indicate that firm-level CON activity in Florida during this period did not result in increases in the price markup to private-pay residents, and increasing the proportion of Medicaid residents decreases the price markup to private-pay residents. These results fail to support the hypothesis that bargaining is taking place between nursing homes and regulators, providing a lack of support for both the public interest and special interest theories of regulation.

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1 Introduction

In most states, firms in the nursing home industry must obtain a state license, which is known as a Certificate of Need, prior to constructing or expanding a skilled nursing facility, i.e. nursing home. The federal Certificate of Need (CON) program was implemented in 1974, with the passage of the National Health Planning and Resources Development Act, which mandated state CON approval on all new construction or expansion of healthcare facilities, including skilled nursing facilities (Harrington et al. 1997). In part, the legislation was intended to control the nursing home bed supply and the rapid growth in expenditures occurring in this segment of the healthcare market. Although the Federal requirements for CON programs were removed in 1986, Harrington et al. (1999) reported 44 states with a nursing home CON policy or moratorium on nursing home bed construction in 1998.

There are two competing theoretical justifications for the regulation of the supply of nursing home beds in the economics literature. The public interest justification for CON regulation is based upon the theory that unregulated competition will result in the construction of unnecessary facilities and raise the cost of providing care for state-funded Medicaid patients. In addition, CON regulations that impose conditions on CONs may be used by states to ensure a supply of beds for poor elderly through the state-funded Medicaid program, in spite of relatively low Medicaid reimbursement rates. As such, the public interest theory of regulation would assert that CON regulation may increase social welfare. In contrast, proponents of the special interest theory of regulation suggest that CON construction controls provide a mechanism for barring new entry into a cartelized industry. By controlling entry, the state provides nursing homes with a buffer from competition. This control of entry allows for the possibility of above normal economic profits as firms are able to charge higher prices to private-pay nursing home residents

(i.e. residents paying out of pocket for nursing home care). The objective of this research is to examine the competing theoretical justifications for CON laws using empirical methods.

While several authors have considered the effects of Certificate of Need regulation on nursing home behavior, all previous studies face at least one of the following limitations. First, most studies are national in scope, using state-level measures to estimate the effect of CON programs. In these studies, a variable is used to indicate the presence or absence of a CON program in the state or to indicate the number of years that a state has had a CON program. These studies do not account for the potential endogeneity of CON laws or examine the issue at the level of the firm or market. Other authors use market-level data, but they also use more indirect measures of the effect of CONs on firm behavior. By considering a single state's CON program and by using both facility-level and market-level data, this paper avoids such problems and adds to the literature on supply regulation in the U.S. nursing home industry.

2 Background and Literature on CON Regulation

In the case of nursing home CONs, the primary goal is clearly to restrict the number of nursing home beds in the state. Why? There are several possible explanations.

2.1 Public Interest Justification versus Special Interest Justification

The belief that unregulated competition will result in the construction of unnecessary facilities (or unnecessarily small facilities) is the primary stated public interest justification for CON regulation. In addition, CON regulation may be used to ensure a supply of beds for Medicaid funded residents in the face of relatively low Medicaid reimbursement rates through the explicit linking of CON awards and commitments to provide beds to Medicaid residents. In contrast, special interest theory argues that, "An even more important anti-competitive consequence of construction controls is that they provide a means of barring new entry into the

cartelized industry"(Posner 1974, p. 115). Indeed, the linking of CON awards to commitments to provide beds to Medicaid residents may be the "price" to nursing homes of limiting competition in a market.

2.1.1 Public Interest Theory: CONs to Limit State Expenditures on Nursing Home Care or to Ensure Beds for Medicaid Residents

A state may have an incentive to use the CON process to control the number of nursing home beds to limit the number of nursing home beds available to Medicaid funded nursing home residents. In an attempt at cost containment, states may limit nursing home expenditures by limiting reimbursement rates, by limiting the bed supply for Medicaid patients explicitly, or by limiting the overall bed supply through a CON program. Of the three options, CON regulation to limit the bed supply is a more subtle, less visible form of expenditure limitation than explicitly setting spending caps or limits on the number of Medicaid funded beds (Feder and Scanlon 1980). There is some evidence that CON policies have been effective in reducing Medicaid nursing home expenditures (Harrington and Swan 1987), but more recent work on the effects of repeal of nursing home CON has found no statistically significant effect of the repeal of CON legislation on Medicaid nursing home expenditures (Grabowski, Ohsfeldt, and Morrisey 2003). The CON process may also be used to award capacity to firms that commit to providing care to low-paying Medicaid residents when Medicaid reimbursement rates are low. This mechanism allows regulators to limit reimbursement rates for Medicaid residents without dramatically reducing the bed supply for these residents. If firms receiving CON approvals provide care to Medicaid residents without increasing the price markup to private-pay residents, CON programs are more likely to increase public welfare.

2.1.2 Special Interest Theory: CONs to Preserve Market Power and Regulatory Favors

In contrast, regulators may choose to restrict the number of nursing home beds, allowing incumbent nursing homes to face limited competition as a result of the CON process. Arguing that this may be the case for hospitals, Joskow (1981) notes that hospital associations were among the supporters of federal CON legislation. In his essay, Posner (1974, p. 114) argues that CON laws that result in controls on construction in an industry, "...often serve to reinforce cartelization among the regulated firms....Control of construction can be used to limit expansion of output. If the cartel dominates the regulatory agency, as is unfortunately often the case, construction will not be permitted where the result would be over capacity from the standpoint of maximizing cartel profits." As such, CON regulation may create a barrier to entry that could limit both the number of firms in the market and eliminate the contestability of the market by potential firms (Nyman 1994). As Vogel (1983) argues, "The monopoly power CON restrictions create is apparently far more valuable to those operators than [the expected value of] any new investment they might forgo." This assertion is supported by interviews conducted by Feder and Scanlon (1980), who find that nursing home operators recognize the advantages to the nursing home industry of restricting entry through CONs.

Nursing homes may agree to accept Medicaid residents as a means of "buying" favors from regulators: Certificate-of-Need approvals. Under Florida statute, regulators are given that authority to impose a condition on a CON for nursing home beds, requiring a specified number or percentage of new beds be set aside for use by Medicaid recipients. If a nursing home agrees to such a condition, the condition may act as an explicit contract with regulators, allowing the firm the ability to raise the price to private-pay residents above the competitive level.

2.3 Empirical Studies on the Effects of CONs

Most previous studies of nursing home regulation have been based upon Scanlon's (1980) model of a monopolistically competitive nursing home that provides a common level of quality to both Medicaid and private-pay nursing home residents. Scanlon hypothesizes that CON and other moratoria policy impose a binding bed constraint on the market for nursing home care under which Medicaid-funded patients may be unable to gain access to care. Whether CON and moratoria policy actually produce a binding bed constraint has been an important empirical issue given that a bed constraint is likely to influence the effectiveness of increases in Medicaid reimbursement rates in improving nursing home quality. Gertler (1989, 1992), Nyman (1985, 1988a, 1988b, 1989), Cohen and Spector (1996) and Grabowski (2001a) examine the empirical relationship between Medicaid reimbursement rates and nursing home quality under CON policies. Using 1980 data from New York, both Nyman and Gertler's results support the hypothesis that changes in reimbursement rates may decrease quality in nursing homes. However, more recent work by Cohen and Spector (1996) and Grabowski (2001a,b) found the opposite, that an increase in reimbursement has a positive effect on measured quality. Grabowski (2001b) suggests that a decline in nursing home utilization over the two decades in which these studies were conducted has shifted the market, to one where the characterizations of high occupancy rates and extended waiting times for Medicaid recipients are less pervasive, i.e. a non-binding bed constraint.

Other research has examined the effect of CON and moratoria policy on the change in bed growth and the number of residents in nursing home facilities throughout the United States. Using state-level data, Harrington et al. (1997) found that the presence of CON or moratoria policy effectively reduced the growth in nursing home beds in states. In contrast, using county-

level data and the number of years that a state has had a CON program as the measure of CON restrictiveness, Gulley and Santerre (2003) found the same number of nursing home beds and residents in otherwise comparable counties with and without CON policies.

However, there may be an endogeneity problem associated with including a state-level CON policy measure or a county-level measure based on state laws. States with low levels of nursing home services resulting from the relative unprofitability of nursing home service provision in the state may not develop a program to control the bed supply. In addition, this a binary variable indicating the presence or absence of a program or a measure of the number of years that a CON program has been in effect does not allow for differences in the degree of CON restrictiveness across states and does not allow for differences across markets within states.

2.4 CON Regulation in Florida

2.4.1 CON History

In mid-2001, Florida implemented a moratorium that prohibits CON approval of any additional nursing home beds not already in the CON approved pipeline. Prior to the implementation of the moratorium, Florida exercised strong controls on nursing homes (AHCA 2002). This study considers the pre-moratorium period of 1986-1998. In Florida, during the period from which data for this study are derived, before bed capacity could be added to an existing nursing home or before new nursing home construction could begin, a Certificate-of-Need had to be obtained from the state's Agency for Health Care Administration (AHCA). The agency awarded such a certificate to applicants if the agency determined that there is a "need" for nursing home beds in the market area. Fees were required for processing applications, based on a $5,000 minimum plus $0.015 for each dollar of proposed capital expenditure, with the total fee not to exceed $22,000. Thus, firms had an incentive not to apply for a CON unless there is a

reasonable chance of being awarded the CON. An examination of CON application data reveals that approximately half of all nursing home related CONs were approved from 1986-1998.

Florida's CON program has three stated policy goals: cost containment of overall health care expenditures, ensuring a minimum level of quality of health care, and ensuring access to health care goods and services. Local health councils in Florida provide the CON Office with data on local Medicaid utilization and provide the CON Office with preference statements for the award of CONs. Under Florida statute, AHCA is given that authority to impose a condition on a CON for nursing home beds, where the condition requires the facility to certify a specified number or percentage of beds for use by Medicaid recipients. Preference statements by local health councils vary. For example, preference may be given to an applicant who commits to providing beds for Medicaid patients. From 1987-1997, the CON Office had not awarded a nursing home CON that did not impose a condition that the applicant certify a portion of its beds for Medicaid residents.[1] However, some nursing homes in Florida have used litigation to remove CON conditions related to the proportion of Medicaid residents in the home.

3 Objective, Data, and Estimation Methods

3.1 Objective

Using nursing home facility-level data for nursing homes in Florida from 1986-1998, market demographic data, and CON application data, five measures of the influence of Certificate of Need regulation will be considered. These include the number of beds per elderly capita in the market, the approval/denial of a CON application in a year, the change in a facility's bed supply over a year, the proportion of CON applications approved in a year, and the proportion of requested beds approved in a year. The number of beds per elderly (age 65 and

over) individual in the county reveals the extent to which CON regulations have restricted the bed supply in a particular market. This is the only market-level measure of CON activity used in this study. For a subset of nursing homes that apply for a CON, approvals and denials can be examined explicitly, where both the probability of approval and the proportion of applications approved in a given year are considered. The final measures of CON regulation considered will be the change in a facility's bed supply over a year and the number of CON requested beds approved relative to the number requested. If CON applications are approved, but beds are not subsequently added, the change in the bed supply measure may provide different results from the application results. Each of these measures will be discussed in detail below.

Given the CON measures discussed above, the following questions will be addressed in this paper:

1. Does the markup to private-pay residents in year *(t)* depend on either CON activity in year *(t-1)* or a the proportion of Medicaid patients in the nursing home in year *(t)*? If firms engaged in CON Activity have higher price markups for private-pay residents, but markups do <u>not</u> depend on the proportion of Medicaid residents in the home, the special interest theory of regulation is supported. In other words, favorable CON activity for a firm reinforces the firm's ability to raise the private-pay price above the competitive level, benefiting the firm, without also providing the public benefit associated with accepting low-paying Medicaid residents. In contrast, a finding that the markups are increasing in both CON activity and the proportion of Medicaid residents in a home, is consistent with both the special interest theory and the public interest theory. This is due to the fact that both theories provide a mechanism for

[1] Florida Senate, Committee on Health Care, <u>Certificate-of-Need Program Medicaid Conditions on Nursing Home</u>

exchange between regulators and firms: nursing homes in which taking more Medicaid residents increases price markups may simultaneously serve both the public and special interests. Such a finding would be consistent with private-pay residents paying higher prices in firms that take on a higher proportion of Medicaid residents.

2. Does the CON activity in year *(t+1)* depend on the markup to private-pay residents and the proportion of Medicaid residents in the nursing home in year *(t)*? This question considers factors that firms may use to signal to regulators a willingness to take on Medicaid residents: price markups to private-pay residents and the proportion of Medicaid-funded residents in the nursing home's population. If both the proportion of Medicaid residents and the price markup to private-pay residents help to explain subsequent CON activity, support is lended to the idea of implicit bargaining between regulators and firms. However, if higher price markups are negatively related to favorable CON activity, regulators may be penalizing firms with higher price markups to private-pay residents, a finding that is inconsistent with the special interest theory of regulation.

3. How do other factors, such as market concentration, substitutes for nursing home care in the market, and nursing home ownership type affect both the price markup for private-pay residents and CON activity? Other factors that may affect markups and CON activity will be considered.

The first step in the empirical examination is the estimation of the price markup for private-pay patients at each facility. Toward this end, two cost functions are estimated: a translog cost function and a Cobb-Douglas cost function. Then, the estimates are used to

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Beds, Interim Project Report 97-P-28, August 1997, p.4.

compute the marginal cost of care for a private-pay resident day in each facility in each year. Next, facility-level and market-level data are used to analyze the impact of CON activity on the price markup to private-pay patients. Finally, factors that influence measures of CON activity are considered.

3.2 Data

Data on nursing home resident patient days, nursing home financial data (including costs and private-pay rates), and CON application and approval data was obtained from Florida's Agency for Health Care Administration. In addition, inspection violation and resident census data were obtained from the Online Survey Certification and Reporting (OSCAR) System, provided by the Centers for Medicare & Medicaid Services (CMS) (formerly the Health Care Financing Administration). Hospital Wage Index data was also obtained from CMS. Data on home health agencies at the county level was taken from the Area Resource File. The Florida Statistical Abstracts provided county level data on the population of individuals age 65 and over, the Florida Price Level Index, and the Florida Housing Price Level Index. The data period 1986-1998 is used to compute lagged and lead values for the CON activity measures.

3.3 Cost Function Estimates

For the cost function estimates, two functional forms are used. First, a multi-product translog cost function is used to avoid placing undue restrictions on the form of the production function.[2] The translog is based on the neoclassical cost function, where costs are a function of

[2] Vita (1990) and Caves, Christensen, and Tretheway (1980) provide an excellent discussion of the properties of the translog cost function.

outputs and input prices. By using the translog function, as opposed to functional forms such as Cobb-Douglas, the restrictions placed on the structure of production are reduced.[3]

The total costs of an individual nursing home in a given year are a function of outputs (measured by resident days), of relative input prices, and of a vector of control variables. The model contains three outputs: Medicaid patient days, Medicare patient days, and private-pay patient days. The choice of three outputs is driven by general differences across patients that cause them to qualify (or fail to qualify) for a specific type of reimbursement program. For example, Medicare coverage requires that the patient be hospitalized for at least three days prior to entering the nursing home, that the patient be admitted to the nursing home within thirty days of the hospital discharge, and that a medical doctor certify that skilled nursing is required. Thus, Medicare pays primarily for rehabilitative nursing home care. In contract, Medicaid residents must meet certain asset and income tests.

The model contains four input prices: labor (including nursing services), property, patient care services (less nursing services), and other inputs. The relative prices of the first three inputs are measured as by the following price indices: a hospital wage index for the MSA, a housing price index by county, and a general price index by county. Because of unavailability of data on the price of "other inputs," the conventional assumption that these prices are uniform across the nursing homes in the sample is employed. Through this assumption, the price of other inputs serves as a numeraire in imposing the input homogeneity restrictions.

[3] The generalized translog was not used, as the estimates are very sensitive to the choice of λ, the Box-Cox parameter. As such, the sample of nursing homes is restricted to firms with non-zero levels of each of the three outputs.

The translog cost function is as follows:

$$\ln C = \alpha_0 + \Sigma_i \alpha_i \ln Y_i + 1/2\, \Sigma_i \Sigma_j \delta_{ij} \ln Y_i \ln Y_i + \Sigma_k \beta_k \ln W_k + 1/2\, \Sigma_k \Sigma_l \gamma_{kl} \ln W_k \ln W_l$$

$$+ \Sigma_k \Sigma_l \rho_{ik} \ln Y_i \ln W_k + \phi \ln K + \eta Z + \varepsilon \qquad (1)$$

where ln C is the natural log of total nursing home costs,

Y_i is the output indexed by i=1, 2, 3,

W_k is the input price index indexed by k=1, 2, 3,

K is the number of beds in the nursing home, a measure of fixed inputs, and

Z is a vector of control variables.

Given linear homogeneity and other restrictions, the model is estimated along with the factor share equations using seemingly unrelated regression.

One recognized property of the translog cost function is that it does not perform well when evaluated at values that are far from the mean values for the explanatory variables (Vita 1990; Caves, Christensen, and Tretheway 1980). Due to concerns about sensitivity of facility-level marginal cost estimates to this property, a second cost function is used: the Cobb-Douglas with facility fixed effects. In this model, the natural log of total nursing home costs, ln C, is a function of outputs and a vector of control variables, where facility fixed effects control for facility-specific factors that do not change over the period considered.

As with the translog, three outputs are used. The Cobb-Douglas cost function is a follows:

$$\ln C = a_n + \Sigma_i \alpha_i \ln Y_i + 1/2\, \Sigma_i \Sigma_j \delta_{ij} \ln Y_i \ln Y_i + \phi \ln K + \eta Z + \mu \qquad (2)$$

where Y_i is the output indexed by i=1, 2, 3,

K is the number of beds in the nursing home, a measure of fixed inputs, and

Z is a vector of control variables.

The single equation model is estimated using facility fixed effects for each of the *n* facilities in the sample.

A description of the variables used in the cost function estimates and descriptive statistics are presented in Table 1. While many of the control variables are standard elements of nursing home cost function estimates, several warrant further explanation. A nursing home's costs are likely to be influenced by the disability level of the patient population (i.e. case-mix) and the quality of care provided. Given the available data, a measure very similar to the Katz index of Activities of Daily Living (ADL) is constructed to measure case-mix.[4] The slightly altered formulation involves summing the total number of residents needing either partial or total assistance in each of seven categories (bathing, dressing, going to the toilet, transferring, two categories involving continence, and feeding) and dividing the sum by the total number of residents in the home. The smaller the number, the more healthy the nursing home's population.

To control for quality driven differences in nursing home costs, one measure of quality is used: the number of cited inspection violations, i.e. inspection deficiencies, per patient per day. Clearly, quality of health related services is both difficult to define and difficult to measure. In the industrial organization literature, Leffler (1982) provides a general discussion of product quality and firm behavior. He defines quality as the amount of the unpriced attributes contained in each unit of the priced attribute, where higher quality involves a higher level of the unpriced attribute per unit. In the case of a nursing home, the priced attribute is resident days. In this analysis, the unpriced attribute is the degree of compliance with nursing home inspection-related guidelines. Thus, a "higher quality" nursing home has fewer inspection violations per patient day. In addition to quality and case-mix, nursing home costs may be influenced by the bed

[4] See Katz, Ford, Moskowitz, Jackson, and Jaffe (1963).

supply per elderly capita in the market, nursing home ownership type, whether the home is part of a chain of nursing homes, firm size, and location of the nursing home within an MSA. Given data limitations, the county is used as the market area.

3.4 Private-pay Price Markup Estimates

The cost function estimates are used to compute the marginal cost of care for private-pay residents in each nursing home in the sample. The price markup to private-pay residents is calculated for each nursing home, *i*:

$$PrivatePayPriceMarkup_{it} = \frac{(Price_{itP} - MC_{itP})}{Price_{itP}} \quad (3)$$

where $Price_{itP}$ is the private-pay daily rate for nursing home residents in home *i* in year *t* and MC_{itP} is the estimated marginal cost of care for private-pay patients in nursing home *i* in year *t*. If the price markup is large and positive, then the firm is clearly setting the price for private-pay residents above the marginal cost of care for those residents.[5]

If CON activities influence price markups to private-pay residents, CON regulation in the preceding period *(t-1)* should result in higher price markups for private-pay patients in the current period *(t)*. The empirical model of the private-pay price markup is shown below:

$$\begin{aligned} PrivatePayPriceMarkup_{it} = {} & b_i + b_1 CONActivity_{i(t-1)} + b_2 \%Medicaid_{it} + b_3 HHI_{it} \\ & + b_4 HomeHealth_{it} + b_5 NonProfit_{it} + e \end{aligned} \quad (4)$$

This model is estimated using facility fixed effects.

3.4.1 CON Regulation Activity Measures

As discussed above, five measures of CON activity are considered: the number of beds per elderly capita in the market in the previous year, the change in the nursing home's bed supply

from the previous year to the current year, a binary variable indicating whether the nursing home had any CON application approved or denied in the previous year, the proportion of CON applications approved in the previous year, and the proportion of requested beds approved in the previous year. Increasing the number of beds per elderly capita will increase competition in the market. If market level competition decreases, firms in that market will be more able to markup prices to private-pay patients without risking the loss of those patients to a competitor. This suggests that the coefficient on this CON activity measure should be negative, if the number of beds per elderly capita represents protection from competition by regulators.[6] Note that such protection is consistent with both the public interest and special interest theories of regulation.

The second measure of CON regulatory activity, the change in each nursing home's bed stock over the past year indicates a recent CON approval and gives a sense of the magnitude of the change brought about by the approval. An increase in the nursing home's bed stock over the year should be associated with higher private-pay markups if the nursing home has entered into an implicit agreement with regulators. An increase in the bed stock may, in contrast, may increase competition in the market, as the number of beds available for private-pay residents is increased. If this is the case, the sign on this term will be negative.

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[5] If the capacity constraint on nursing homes is binding, firms would choose to take no Medicaid residents, the price markup to private-pay residents would be overestimated, and elasticities would be underestimated. As noted, this analysis is restricted to firms with non-zero levels of all three outputs.

[6] The beds per elderly capita measure of CON policy is limited by the fact that there may not be uniform excess demand across markets. In other words, some rural, low-income areas may have few beds per elderly capita even though the CON regulatory board has uniformly accepted all applications to add new nursing home beds in the market. Clearly, if nursing home construction is not sufficiently lucrative in rural, low-income areas, the less restrictive CON policies will not drive construction. However, the correlation between the CON application approval rate for the county and a binary variable for being in an urban area is .09, implying that there is a positive relationship between being in an MSA and the CON approval rate. In addition, the correlation between the CON approval rate and per capita income in the county is .07, implying that there is a positive relationship between the CON approval rate and per capita income. Both of these correlations would tend to negate the hypothesis that, in rural, low income areas, the CON regulatory authority is likely to be largely ineffective in its efforts to restrict the beds per elderly capita.

The remaining three measures of CON regulation are based on CON application data for a subset of nursing homes who participate in the CON application process. First, a binary variable equal to one if at least one CON application for the facility was approved in the previous year and zero if the application was denied is used to consider the affect of a CON approval. A CON approval in period *(t-1)* that limits competition may increase the private-pay markup in period *t*. If, in contrast, a firm level CON approval signals increased bed supply and increased market competition, the coefficient on this variable will be negative. Second, the proportion of CON applications approved in a given year is considered. Finally, the ratio of the number of approved beds relative to the number of requested beds is considered. The signs on the coefficients on these final two measures have the same interpretation as the sign on the coefficient on the CON approval measure.

3.4.2 Other Variables in Private-pay Markup Estimates

As discussed above, the price markup to private-pay patients may be increasing in CON awards by regulators and the proportion of Medicaid patients in the home, if firms agree to accept less profitable Medicaid residents in exchange for regulatory favors. However, if firms are attempting to attract more private-pay residents by keeping private-pay prices relatively low, increasing the proportion of Medicaid patients may have negative effect on the price markup if firms. As noted above, dual findings of a positive effect of favorable CON Activity on price markups and no effect of the proportion of Medicaid residents on price markups would lend support to the special interest theory of regulation.

The markup may also be influenced measures of the firm's market power: market concentration and the number of substitutes available for nursing home care. Nursing homes in more concentrated markets, as measured by the Herfindahl-Hirschman Index for each county,

may be able to charge private-pay residents a higher daily rate.[7] In turn, substitutes for nursing home care, such as more home health agencies per elderly capita, may decrease the ability of nursing homes to raise the price of care to private-pay patients without losing those patients.

Some authors, such as Scanlon (1980), have argued that non-profit homes may be more inclined to provide patients with lower than profit-maximizing prices. However, it may be shown that utility maximizing non-profit nursing homes, which wish to provide charity care, have an incentive to act like profit maximizing nursing homes by charging the profit maximizing price and using the returns to fund charity care (Morrisey 1994). This study considers whether the price markup is affected by the nursing home's ownership type.[8]

3.5 CON Regulation Estimates

Just as private-pay price markups are influenced by the previous period's CON activity, next period's CON activity may be influenced by current markups to private-pay residents within a nursing home. Regulators have access to both cost data and price data for nursing homes. Higher price markups to private-pay patients may signal the firm's willingness to take on more Medicaid patients, increasing the likelihood of favorable CON regulatory action if regulators set reimbursement rates at a low level and award CONs to firms agreeing to set aside beds for Medicaid-funded residents. In addition, CON activity may be affected by the proportion of Medicaid patients in the nursing home during the previous period, market concentration, the ownership type of the nursing home, and whether or not the nursing home is part of a chain.

[7] Gertler (1989, 1992) uses the HHI to measure the effectiveness of a CON program. However, using only the HHI as a measure of CON policy may be problematic is that it is constructed using the squared market shares for each firm in the industry and market. While CON policy may affect the number of firms in the industry and the distribution of the bed supply among firms, a casual examination of the CON application data reveals that the CON policy in Florida has been very active in regulating the total number of bed additions in a market. If firms are awarded bed additions (or denied such additions) in a uniform manner, the market shares of the firms may not change when CON policy becomes more or less restrictive. For a description of the properties of the HHI and other measures of market concentration, see Scherer (1980).

Firms with larger Medicaid populations may be viewed more favorably by regulators interested in increasing access for such patients. Increasing the number of substitutes for nursing homes (home health agencies) in a market would tend to decrease the "need" for nursing homes and the likelihood of approval, ultimately decreasing the number of nursing home beds per elderly capita and failing to increase the bed supply for a given nursing home in the market. The effect of ownership type and being part of a chain of nursing homes depends on whether regulators favor particular types of owners or chain-owned firms. The empirical model of CON Activity is as follows:

$$CONActivity_{i(t+1)} = a_i + a_1 PrivatePayPriceMarkup_{it} + a_2 \%Medicaid_{it} + a_3 HHI_{it} + a_4 NonProfit_{it} + a_5 Chain_{it} + a_6 HomeHealth_{it} + e \quad (5)$$

The model is estimated using facility fixed effects for the models where beds per elderly capita and the change in the bed stock are the measures of CON activity. A random effects model is used for the measures of the proportion of CONs approved and the proportion of beds approved. The CON approval dependent variable is modeled using a fixed effects logit model.[9]

4 Empirical Results

4.1 Cost Function Estimates

The cost function estimates, which are used to compute the marginal cost of care for private-pay residents, are contained in Table 3. At the bottom of Table 3, the marginal cost of a private-pay resident day, the price markup for a private-pay resident day, and the price elasticity of demand for private-pay residents are given for each cost function. When the marginal cost estimate from the translog cost function is used to compute the price markup to private-pay residents, the translog produces negative price markups for approximately twenty percent of the

[8] Government owned nursing homes were excluded from the analysis.

observations. When examining differences in mean characteristics for those with negative and non-negative markups, it is apparent that the negative markups are driven largely by differences in the estimated marginal cost of care for private-pay residents.[10] In contrast, only 15 of the observations used in the markup estimates using the marginal cost from the Cobb-Douglas model with fixed effects have negative price markups. Given this result, the subsequent analysis focuses on firms with positive price markups, where the results are given for estimates based on both cost functions.

4.2 Private-pay Price Markup Estimates

The private-pay price markup estimates are contained in Tables 4 and 5. Each of the five specifications uses a different measure of CON activity. In nine of the ten specifications, CON activity in the previous period has no statistically significant (at the 5 percent level) impact on the price markup to private-pay residents. In the model using beds per elderly capita in the county as a measure of market-level CON activity, in Table 4, more beds per elderly capita is associated with lower price markups. This finding is consistent with lower markups (and more competition for private-pay residents) in firms located in markets with a higher bed supply. Only one firm-level measure of CON activity has a significant effect at the six percent level on markups to private-pay residents, where the effect is very small. In sum, there is a lack of support for the assertion that CON Activity has a negative effect at the firm-level on private-pay nursing home residents in the form of higher prices.

In contrast, increasing the proportion of Medicaid residents in the nursing home decreases the markup to private-pay residents in the seven specifications in which the effect is

[9] P-values for a Hausman test for the appropriateness of random effects vs. fixed effects are given in tables four through seven.
[10] The means are available from the author upon request.

statistically significant. This finding is the opposite of what one would expect if there were implicit bargaining between firms and regulators: taking on a higher proportion of Medicaid-funded residents reduces a firms ability (or inclination) to raise the price to private-pay nursing home residents. Where significant, the effects of market concentration and the number of home health agencies per capita on the price markup are mixed. The effect of non-profit ownership on the private-pay price markup is positive, where statistically significant, suggesting that non-profits have higher price markups to private-pay residents.

4.3 CON Regulation Estimates

Tables 6 and 7 contain the CON activity estimates. The results reveal that price markups are not significant predictors of firm-level CON activity, at the five percent significance level. In the first column of results in each table, market-level CON activity is measured by the number of beds per elderly capita in the market. Both sets of results indicate a significant effect of firm-level private-pay price markups on this measure on CON Activity, but the estimated coefficients are of the opposite sign. In the specifications using firm-level measures of CON activity, the estimated coefficients on nearly all of the explanatory variables are insignificant. Indeed, the models of firm-level CON activity do not appear to include factors that are important in explaining variation in CON activity across firms.

5 Discussion

No significant relationship between firm-level measures of CON activity and price markups to private-pay residents was found, and a higher proportion of Medicaid residents in the facility was associated with smaller price markups to private-pay residents. If the results had revealed that favorable CON activity increased markups while the Medicaid population of a home had no effect on markups, the special interest theory of regulation would have been

supported. In contrast, if firms were marking up prices in the face of favorable CON activity and, at the same time, markups were increasing in the proportion of Medicaid residents in the home, the results would support the idea of exchange between regulators and firms, which could be consistent with either the special interest or public interest theories. Instead, the results show that firm-level CON activity measures has no effect on price markups to private-pay residents and that increasing the proportion of Medicaid residents decreases the price markup to private-pay residents. When considering a market-level measure of CON activity, the model based on the translog cost function shows a negative effect of the number of beds per elderly capita in a market on price markups at the firm level. This suggests that CON activity may be having an influence on firm behavior by limiting the bed supply in a market, which allows firms to raise price above the competitive level.

It is important to note that most of the results are based upon fixed effects models, where facility characteristics that do not change over time are captured in the facility fixed effects. The lack of significant relationships found between private-pay price markups and firm-level CON activity measures would be found if characteristics about a facility that remain constant over time, such as geographic location, are important in explaining markups and CON activity. In addition, the effect of CON activity was modeled as influencing firm behavior one year after the activity. Future work should examine the sensitivity of the results to changes in the lag length of the lagged variables in both the price markup and CON activity models.

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Table 1: Description of Variables Used in Cost Function Estimates

Variable	Definition	Source	Mean	Standard Deviation
Total Cost $_t$	Total nursing home costs in year (t).	Florida's AHCA	3,940,298	2,429,271
Outputs				
Private-Pay (X1) $_t$	Annual number of private-pay resident patient days.	Florida's AHCA	8859.60	7943.1860
Medicaid (X2) $_t$	Annual number of Medicaid resident patient days.	Florida's AHCA	24676.11	16458.3300
Medicare (X3) $_t$	Annual number of Medicare resident patient days.	Florida's AHCA	3402.44	3172.2090
Input Prices				
Wage Index (W1) $_t$	Annual price index for hospital wages by MSA, a proxy for relative nursing home wages.	CMS	92.7900	6.5515
Housing Price Index (W2) $_t$	Annual price index by county for housing.	FL Stat. Abstract	96.8761	12.0394
General Price Index (W3) $_t$	Annual composite price index by county.	FL Stat. Abstract	99.3178	5.3112
Fixed Input				
Number of Beds $_t$	The number of beds in the nursing home in year (t).	Florida's AHCA	121.8487	51.1405
Control Variables				
Case-mix $_t$	The Katz index of activities of daily living.	CMS	478.2601	220.2479
Non-profit $_t$	Binary variable equal to one if the nursing home is non-profit in year (t).	Florida's AHCA	0.1920	0.3938
Chain $_t$	Binary variable indicated whether the nursing home is part of a chain of nursing homes in year (t).	Florida's AHCA	0.7716	0.4193
Quality (Deficiencies) $_t$	The number of inspection violations per patient day.	CMS	0.0779	0.0773
Urban $_t$	Binary variable indicating whether the home is in an MSA.	Florida's AHCA	0.8836	0.3207
Beds per elderly capita $_t$	The number of beds per person age 65+ in the county.	Florida's AHCA	0.0350	0.0215

Note: The mean and standard deviation is for all observations with complete data for that variable. Florida's AHCA is Florida's Agency for Health Care Administration. CMS is the Centers for Medicare & Medicaid Services. FL Stat. Abstract is the Florida Statistical Abstract.

Table 2: Descriptive Statistics for Variables Used in Price Markup and CON Activity Estimates

Variable	Definition	Source	Mean	Standard Deviation
Private-Pay Daily Rate $_t$	Daily rate charged to private-pay residents in each nursing home in a year.	Florida's AHCA	105.9098	47.8199
CON Activity Measures				
Beds per elderly capita $_{t-1}$	The number of beds per person age 65+ in the county in year (t-1).	Florida's AHCA	0.0349935	0.0214028
Change in bed stock $_{t-1}$	The change in the nursing home's bed stock from year (t-1) to year (t).	Florida's AHCA	-0.074768	10.71381
CON Approval $_{t-1}$	Binary variable indicating whether the nursing home had a CON application approved in in year (t-1).	Florida's AHCA	0.5090812	0.4844928
Pct. CONs Approved $_{t-1}$	The ratio of CON applications to approvals in year (t-1).	Florida's AHCA	0.5090812	0.4844928
Beds Approved $_{t-1}$	The number of beds approved from a CON application in year (t-1).	Florida's AHCA	0.5097215	0.4863569
Beds per elderly capita $_{t+1}$	The number of beds per person age 65+ in the county in in year (t+1).	Florida's AHCA	0.0349407	0.0213736
Change in bed stock $_{t+1}$	The change in the nursing home's bed stock from year (t) to year (t+1).	Florida's AHCA	-0.074768	10.71381
CON Approval $_{t+1}$	Binary variable indicating whether the nursing home had a CON application approved in year (t+1).	Florida's AHCA	0.5101317	0.4852834
Pct. CONs Approved $_{t+1}$	The ratio of CON applications to approvals in year (t+1).	Florida's AHCA	0.5101317	0.4852834
Beds Approved $_{t+1}$	Ratio of beds requested to bed approvals from a CON application in year (t+1).	Florida's AHCA	0.5107421	0.4870491
Percent Medicaid $_t$	The proportion of beds filled by Medicaid residents annually relative to all filled beds in year (t).	Florida's AHCA	0.6230	0.2392
Herfindahl-Hirschman Index $_t$	The Herfindahl-Hirschman Index, a measure of market concentration, based on resident days for all nursing homes within the county in year (t). The index ranges from 0 to 1.	Florida's AHCA	0.1255	0.1846
Home Health $_t$	The number of home health agencies in the market per 1000 elderly capita, using 1994 number of home health agencies and population 65 and over in the county in each year.	Area Resource File and FL Statistical Abstract	0.1441	0.1335
Non-profit $_t$	Binary variable equal to one if the nursing home is non-profit in year (t).	Florida's AHCA	0.1920	0.3938
Chain $_t$	Binary variable indicated whether the nursing home is part of a chain of nursing homes in year (t).	Florida's AHCA	0.7716	0.4193

Note: The mean and standard deviation is for all observations with complete data for that variable. Florida's AHCA is Florida's Agency for Health Care Administration. FL Statistical Abstract is the Florida Statistical Abstract.

Table 3: Cost Function Estimates

Method	Translog Seemingly Unrelated Regression		Cobb-Douglas Facility Fixed Effects	
	Coefficient Estimate	p-value	Coefficient Estimate	p-value
Private Pay (X1)	0.2447	(.000)	0.0792	(.370)
Medicaid (X2)	0.1927	(.035)	0.0100	(.304)
Medicare (X3)	0.7933	(.000)	0.8079	(.000)
(X1)(X1)	0.0216	(.000)	0.0122	(.000)
X2X2	0.0758	(.000)	0.0934	(.000)
X3X3	0.0778	(.000)	0.0538	(.000)
X1X2	-0.0296	(.000)	-0.0166	(.064)
X1X2	-0.0287	(.000)	-0.0110	(.073)
X2X3	-0.1399	(.000)	-0.1257	(.000)
Wage Index (W1)	0.3846	(.000)		
Housing Price Index (W2)	0.2866	(.000)		
General Price Index (W3)	0.1305	(.005)		
W1W1	0.0669	(.000)		
W1W2	-0.0420	(.000)		
W1W3	-0.0318	(.001)		
W2W2	0.0047	(.457)		
W2W3	-0.0009	(.847)		
W3W3	0.0356	(.001)		
X1W1	-0.0027	(.038)		
X1W2	0.0037	(.003)		
X1W3	0.0046	(.000)		
X2W1	0.0007	(.713)		
X2W2	-0.0007	(.706)		
X2W3	0.0096	(.000)		
X3W1	0.0183	(.000)		
X3W2	-0.0034	(.030)		
X3W3	-0.0200	(.000)		
Case-mix (Katz)	0.0000	(.706)	-0.0003	(.000)
Non-profit	0.0806	(.000)	-0.0023	(.921)
Chain	-0.0193	(.131)	0.0504	(.009)
Number of beds	0.0639	(.008)	0.2475	(.000)
Quality (Deficiencies)	0.0644	(.299)	0.1321	(.013)
Beds per elderly	0.4034	(.043)	2.1831	(.002)
Urban	0.0761	(.000)		
Constant	1.1542	(.079)	6.3143	(.000)
R^2	0.8817		0.8969	

Table 3: Cost Function Estimates

Method	Translog Seemingly Unrelated Regression	Cobb-Douglas Facility Fixed Effects
Mean Marginal Cost Private-Pay	$64.09	$18.19
Marginal Cost Private-Pay - 10% Decile	$33.08	$10.68
Marginal Cost Private-Pay - 90% Decile	$128.73	$30.17
Mean Price Markup for Private-Pay, All	0.2275 n=4390	0.8016 n=4390
Mean Price Markup for Private-Pay, where Markup>0	0.4379 n=3525	0.8186 n=4375
Price Markup for Private-Pay - 10% Decile	0.1286	0.7203
Price Markup for Private-Pay - 90% Decile	0.6734	0.8833
Mean Price Elasticity for Private-Pay, where Markup>0	-2.2836	-1.2215
Price Elasticity for Private-Pay - 10% Decile	-7.7951	-1.3883
Price Elasticity for Private-Pay - 90% Decile	-1.4851	-1.1321

Table 4: Price Markup Estimates Based on Translog SUR Marginal Cost Estimate

Independent Variable	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
Beds per elderly capita $_{t-1}$	-5.5177	(.000)								
Change in bed stock $_{t-1}$			-0.0003	(.387)						
CON Approval $_{t-1}$					0.0095	(.627)				
Pct. CONs Approved $_{t-1}$							0.0095	(.627)		
Beds Approved $_{t-1}$									0.0094	(.631)
Percent Medicaid $_{t}$	-0.7201	(.000)	-0.6451	(.000)	-0.8306	(.000)	-0.8306	(.000)	-0.8300	(.000)
Herfindahl-Hirschman Index $_{t}$	0.1287	(.140)	0.4959	(.000)	0.0054	(.995)	0.0054	(.995)	0.0087	(.992)
Home Health $_{t}$	0.1032	(.027)	0.1949	(.016)	2.9499	(.006)	2.9499	(.006)	2.9481	(.006)
Non-profit $_{t}$	-0.0155	(.457)	-0.0068	(.752)	0.2000	(.018)	0.2000	(.018)	0.2012	(.017)
Constant	0.9974	(.000)	0.7251	(.000)	0.4907	(.009)	0.4907	(.009)	0.4888	(.009)
R^2	0.2604		0.1785		0.3238		0.3238		0.3238	
Fixed Effects or Random Effects?	Fixed		Fixed		Fixed		Fixed		Fixed	
P-value for Hausman Test: H_0=Random Effects	0.0000		0.0226		0.0226		0.0226		0.0245	
Number of Observations	3227		3523		199		199		198	
Number of Facilities	488		493		126		126		125	
Number of Years (Average)	6.6		7.1		1.6		1.6		1.6	

Note: SUR is the abbreviation for Seemingly Unrelated Regression.

Table 5: Price Markup Estimates Based on Cobb-Douglas Single Equation Marginal Cost Estimate

Independent Variable	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value	Estimate	p-value
Beds per elderly capita $_{t-1}$	0.1529	(.836)								
Change in bed stock $_{t-1}$			-0.0003	(.063)						
CON Approval $_{t-1}$					0.0023	(.798)				
Pct. CONs Approved $_{t-1}$							0.0023	(.798)		
Beds Approved $_{t-1}$									0.0021	(.815)
Percent Medicaid $_{t}$	-0.1311	(.000)	-0.0731	(.000)	0.0580	(.440)	0.0580	(.440)	0.0584	(.436)
Herfindahl-Hirschman Index $_{t}$	-0.0558	(.079)	-0.0989	(.002)	-0.3274	(.016)	-0.3274	(.016)	-0.3273	(.016)
Home Health $_{t}$	-0.1582	(.000)	-0.1881	(.000)	0.6732	(.024)	0.6732	(.024)	0.6733	(.024)
Non-profit $_{t}$	0.0179	(.035)	0.0268	(.003)	0.0364	(.367)	0.0364	(.367)	0.0367	(.363)
Constant	0.9224	(.000)	0.8889	(.000)	0.7349	(.000)	0.7349	(.000)	0.7348	(.000)
R^2	0.0369		0.034		0.1425		0.1425		0.1424	
Fixed Effects or Random Effects?	Fixed		Fixed		Fixed		Fixed		Fixed	
P-value for Hausman Test: H_0=Random Effects	0.0008		0.0000		0.0002		0.0002		0.0001	
Number of Observations	3747		4118		228		228		227	
Number of Facilities	531		540		145		145		144	
Number of Years (Average)	7.1		7.6		1.6		1.6		1.6	

Table 6: CON Activity Estimates Based on Translog SUR Marginal Cost Estimate

Dependent Variable	Beds per elderly capita $_{t+1}$		Change in bed stock $_{t+1}$		CON Approval $_{t+1}$		Pct. CONs Approved $_{t+1}$		Beds Approved $_{t+1}$	
Independent Variable	**Estimate**	**p-value**	**Estimate**	**p-value**	**Estimate**	**p-value**	**Estimate**	**p-value**	**Estimate**	**p-value**
Price Markup $_t$	-0.0056	(.000)	-0.9238	(.402)	0.6569	(.069)	-0.1736	(.453)	-0.1596	(.491)
Percent Medicaid $_t$	0.0036	(.000)	-2.1704	(.220)	-0.2915	(.721)	-0.2334	(.352)	-0.2440	(.335)
Herfindahl-Hirschman Index $_t$	-0.1134	(.000)	17.2791	(.000)	0.5676	(.376)	0.1205	(.522)	0.1309	(.489)
Non-profit $_t$	-0.0023	(.000)	-0.1447	(.747)	0.4151	(.235)	0.1563	(.075)	0.1575	(.074)
Chain $_t$	0.0020	(.000)	0.3197	(.659)	-0.1002	(.771)	0.0881	(.345)	0.0920	(.326)
Constant	0.0438	(.000)	0.3915	(.796)	-0.0470	(.941)	0.5824	(.010)	0.5737	(.012)
R^2	0.3771		0.0046		NA		0.0272		0.0283	
Fixed Effects or Random Effects?	Fixed		Fixed		No		Random		Random	
P-value for Hausman Test: H_0=Random Effects	0.0000		0.0664		NA		0.5420		0.5106	
Number of Observations	3171		3523		226		183		182	
Number of Facilities	476		493		125		115		114	
Number of Years (Average)	6.7		7.1		1.5		1.6		1.6	

Note: SUR is the abbreviation for Seemingly Unrelated Regression.

Table 7: CON Activity Estimates Based on Cobb-Douglas Single Equation Marginal Cost Estimate

Dependent Variable	Beds per elderly capita $_{t+1}$		Change in bed stock $_{t+1}$		CON Approval $_{t+1}$		Pct. CONs Approved $_{t+1}$		Beds Approved $_{t+1}$	
Independent Variable	**Estimate**	**p-value**	**Estimate**	**p-value**	**Estimate**	**p-value**	**Estimate**	**p-value**	**Estimate**	**p-value**
Price Markup $_t$	0.0028	(.047)	-3.7653	(.053)	1.8097	(.208)	0.2755	(.494)	0.2755	(.494)
Percent Medicaid $_t$	0.0063	(.000)	-1.7243	(.244)	-0.5499	(.499)	-0.0794	(.686)	-0.0794	(.686)
Herfindahl-Hirschman Index $_t$	-0.0982	(.000)	12.2426	(.001)	0.3650	(.573)	0.1101	(.481)	0.1101	(.481)
Non-profit $_t$	-0.0029	(.000)	-0.0054	(.990)	0.4644	(.192)	0.1320	(.118)	0.1320	(.118)
Chain $_t$	0.0028	(.000)	0.4761	(.448)	-0.0853	(.808)	0.0486	(.568)	0.0486	(.568)
Constant	0.0393	(.000)	3.0422	(.132)	-1.1268	(.368)	0.2282	(.509)	0.2282	(.509)
R^2	0.2946		0.0049		NA		0.0168		0.018	
Fixed Effects or Random Effects?	Fixed		Fixed		No		Random		Random	
P-value for Hausman Test: H_0=Random Effects	0.0000		0.0099		NA		0.4729		0.4479	
Number of Observations	3661		4008		214		212		212	
Number of Facilities	523		540		110		133		133	
Number of Years (Average)	7		7.6		1.5		1.6		1.6	