The Effect of Chain Ownership on Nursing Home Costs

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Although it is commonly assumed that chain ownership will result in lower costs due to economies of scale, the empirical evidence with respect to the effect of chain ownership on nursing home costs is mixed. Chain for-profit nursing homes will have a cost advantage over independent for-profit homes only if there are firm-level (multiple-home) economies of scale. For the study population of Texas nursing homes in 1983, cost structures differed sufficiently across ownership types to warrant estimating separate cost functions by ownership type. The results indicate that, when other factors affecting cost are held constant, chain homes have lower average costs than independent homes at intermediate and high levels of output, but higher average costs at low and very high levels of output. The results highlight the importance of considering whether or not to pool data across ownership categories when estimating nursing home cost functions.

The cost of nursing home care is an important policy issue because government programs pay for almost half of total expenditures on nursing home care. In 1986, for example, public funding accounted for 48 percent of the $38.1 billion spent on nursing home care (*Health Care Financing Review* 1987). An understanding of the determinants of nursing home costs and of the effects of different types of ownership on these costs can aid policymakers in the search for reimbursement methods that will control costs and provide an acceptable level of quality for publicly funded nursing home care.

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Several studies have examined the effect of ownership type on nursing home costs. These studies have consistently shown that average costs are higher for nonprofit and government providers than for for-profit homes.[1] The evidence with respect to the effect of chain ownership on nursing home costs, on the other hand, is not nearly as clear-cut.

The public perception seems to be that chain providers automatically have an advantage over independently owned homes. An article in the *Wall Street Journal*, for example, observed that "the long-term need for nursing homes seems to favor big operators . . ." (February 4, 1988). It is commonly assumed that chain ownership will result in lower costs due to economies of scale from centralized purchasing and administration. The empirical evidence on this question is rather mixed, however. One recent study (Arling, Nordquist, and Capitman 1987) concluded that average costs were lower for chain homes than for other providers, while three other studies (Birnbaum et al. 1981; Meiners 1982; Schlenker and Shaughnessy 1984) found that chain ownership did not significantly affect cost.

This study provides a new and more detailed analysis of the effect of chain ownership on nursing home costs. After reviewing previous research, the article begins by discussing the conceptual framework for assessing how chain ownership affects cost. The empirical portion of the study uses 1983 data for nursing homes in Texas to estimate both a common regression with a dummy variable for ownership type (that is, using pooled data) and separate cost functions by ownership type. The results from the separate regressions (the appropriate estimation procedure for this data set) indicate that cost differences between chain and independent for-profit homes depend on the level of output (i.e., the number of patient days). More specifically, average cost is lower for chain homes than for independent homes at intermediate and high levels of output, but higher at low and very high levels of output. The final section of the article compares the results to those of other studies and discusses the policy implications of the findings.

PREVIOUS RESEARCH

Only a few previous studies have investigated the effect of chain ownership on nursing home costs. Three studies examined the effects of chain ownership tangentially in the course of analyzing the various determinants of nursing home costs. Birnbaum et al. (1981) and

Meiners (1982) both used the 1973/1974 National Nursing Home Survey to estimate a general nursing home cost function; both found that the coefficient of a dummy variable for chain ownership was not statistically significant. Schlenker and Shaughnessy (1984) reached the same conclusion using data for Colorado nursing homes in 1980.

Arling, Nordquist, and Capitman (1987), the previous study that looked most closely at chain ownership, used three ownership categories—public/nonprofit, individual for-profit, and chain—to examine costs for Virginia nursing homes in 1985. Regression analysis using pooled data (that is, including dummy variables for chain and individual for-profit ownership) indicated that chain homes in the sample had significantly lower costs than public/nonprofit providers, as did individual for-profit homes. (The article did not report whether or not there was a statistically significant difference between the costs of chain and individual for-profit homes.)

The study also estimated separate regression equations for each ownership category and concluded that, in general, chain homes "appear to provide a standard, relatively low-cost level of care that is concentrated on the Medicaid market" (p. 265). Unfortunately, the authors did not use statistical techniques to determine whether it was more appropriate to estimate a common regression equation or separate equations by ownership category, nor did they compare the results of the two estimation techniques.

CONCEPTUAL FRAMEWORK

Economic theory provides a framework for analyzing nursing home costs (see Scanlon 1980, and Palmer and Vogel 1985). For-profit nursing homes are assumed to make choices that will minimize cost and maximize profit, subject to various regulatory constraints. Nonprofit providers, on the other hand, by definition have objectives other than profit. A common assumption, for example, is that nonprofit nursing homes desire to maximize their size, subject to quality and break-even constraints (Scanlon 1980). All else equal, one would thus expect nonprofit providers to have higher average costs than for-profit homes, a prediction confirmed by numerous empirical cost studies.[2]

In the for-profit sector, both chain and independent homes seek to minimize cost, and therefore economies of scale are the key to assessing the effect of chain ownership on nursing home costs. Economies of scale, which exist when long-run average cost declines as output increases,[3] can result from pecuniary or real savings. Pecuniary sav-

ings are due to a decrease in input prices as output increases, usually resulting from greater bargaining power on the part of a larger firm. Real savings are due to the increased productivity of inputs at larger levels of output. Real savings, generally the result of specialization or indivisibilities, mean that each unit of output can be produced using fewer inputs as output increases.

Economic theory would suggest that whether or not chain ownership will affect nursing home costs will depend on whether or not there are economies of scale at the firm level, as opposed to the plant level. Plant-level economies of scale refer to decreases in long-run average cost as output at a given plant (nursing home) increases; both chain and nonchain providers would benefit from plant-level economies of scale.[4] Multiple-plant (chain) ownership will confer a cost advantage only if there are firm-level cost savings, that is, only if average cost is lower for chain homes than for nonchain homes at any given level of output.

Multiple-plant economies of scale could result from real savings due to a more specialized central staff, or from pecuniary savings due to lower input prices. Capital costs, in particular, could be lower if multiple-plant firms could obtain funds at a lower cost. Capital-raising economies of scale could be a combination of real savings, due to spreading the nearly fixed transactions costs of issuing common stock or borrowing funds over larger levels of output, and pecuniary savings, stemming from the ability of larger firms to negotiate lower interest rates.

In the case of nursing homes, multiple-home economies of scale could result from joint purchasing arrangements that lead to lower prices for inputs such as food, medical and household supplies, and furnishings. Or, chains might lower labor costs by sharing various types of consultants (e.g., for nursing, physical therapy, or social work) among homes. Other possible sources of multiple-home economies of scale are capital savings, due to lower interest expenditures on building and equipment, or lower average costs of centralized management.

The effect of chain ownership on average cost is an empirical question, because there is no theoretical basis for assuming that chain ownership leads to firm-level economies of scale. If firm-level economies of scale do *not* exist, either firm size does not affect average cost or average cost increases as firm size increases. The latter case, firm-level diseconomies of scale, is usually attributable to coordination problems and limits to management.

Table 1: Descriptive Statistics: Texas Nursing Homes in 1983 (N = 826)

Variable	*Mean or Percent (Standard Deviation)*	
Average cost	$29.09	($6.89)
Total patient days	30,018.4	(15,115.3)
Beds	100.5	(48.6)
Occupancy rate	82.8%	(13.9%)
Private patient days as percent of total patient days	28.0%	(15.1%)
Ownership		
For-profit (N = 722)	87.4%	
Chain (N = 469)	56.8%	
Independent (N = 253)	30.6%	
Nonprofit (N = 88)	10.7%	
Government (N = 16)	1.9%	
Certification		
Skilled nursing facility (SNF) only (N = 48)	5.8%	
Intermediate care facility (ICF) only (N = 666)	80.6%	
Both SNF and ICF (N = 112)	13.6%	

DATA

The Texas Department of Human Resources requires an annual cost report from all nursing homes receiving Medicaid reimbursement. This study used data obtained from the 1983 cost reports, which covered 955 of the 1,001 nursing homes in Texas. Of the 955 homes that received at least some payment from the Medicaid program, 129 operated for less than 12 months in 1983. Because nursing home costs may be unusually high in a year of entry into or exit from the market, the final data set included only the 826 nursing homes that operated for the entire year.[5]

The Texas Department of Human Resources cost report provided detailed information on facility characteristics, revenues, and costs. Table 1 presents descriptive statistics for Texas nursing homes in 1983. The average nursing home had about 100 beds and provided approximately 30,000 patient days of care per year, with private patients accounting for 28 percent of total patient days. The Texas nursing home market is dominated by for-profit providers: 87 percent of all homes were for-profit operations, 11 percent were nonprofit, and 2 percent were operated by a government agency. And chain ownership

is widespread—57 percent of all providers were chain-owned for-profit nursing homes.

Because Medicaid patients account for such a large proportion of total payments for nursing home care, the Medicaid reimbursement method has a great influence on a nursing home's incentive to control (minimize) costs. Although there are a variety of rate-setting methods, most states use average cost either to determine a fixed reimbursement rate or to set ceilings for rates based on each home's cost (Bishop 1980). In 1983, Texas used a prospective, fixed-rate reimbursement method in which the costs of all nursing homes participating in the Medicaid program were used to calculate the median cost of a given level of care (i.e., skilled nursing facility—SNF—or intermediate care facility—ICF). The median cost, adjusted for projected inflation, then determined the reimbursement rate for a given level of care, and all homes received the same reimbursement rate (Texas Department of Human Resources). Because nursing homes in Texas were allowed to retain any difference between the fixed reimbursement rate and actual cost, the reimbursement method should not have altered cost-minimizing behavior by the for-profit homes in the study population.

RESULTS

The first step in assessing the effect of chain ownership on nursing home costs was to examine whether or not average cost varied with type of ownership. Nursing homes were classified into three groups on the basis of ownership: chain for-profit (N = 469), independent for-profit (N = 253), and nonprofit/government (N = 104). Two-sample t-tests were used to test the null hypothesis that the mean average costs (i.e., the mean costs per patient day) were equal between any two ownership groups.

As shown in Table 2, the mean cost per patient day for nonprofit/government providers was significantly greater than that for chain and independent for-profit homes. As noted, numerous nursing home cost studies have come to the same conclusion (see Palmer 1985 for a survey). The surprising result was that the mean cost per patient day for chain-owned homes was statistically greater than for independent for-profit homes (t = 2.15). This result is inconsistent with the conventional wisdom that chain ownership leads to a lower average cost for nursing home care.

The above results are interesting, but preliminary. Average cost did vary by type of ownership, but other factors affecting cost also

Table 2: Two-Sample *t*-Tests by Ownership Type

Variable	*Mean Values*		
	Chain For-Profit (N = *469*)	*Independent For-Profit* (N = *253*)	*Nonprofit/ Government* (N = *104*)
Average Cost	$28.11*†	$27.53*‡	$37.28†‡
As percent of total patient days			
SNF days	3.3%*†	4.5%*	5.8%†
ICF days	71.7%*†	68.0%*‡	51.6%†‡
Private days	25.0%*†	27.6%*‡	42.7%†‡
Beds	106.9*	88.3*‡	101.4‡
Total patient days	30,307	28,247‡	33,027‡
Occupancy rate	78.5%*†	87.9%*	90.0%†

*Difference between chain and independent group means is statistically significant at the .05 confidence level.

†Difference between chain and nonprofit/government group means is statistically significant at the .05 confidence level.

‡Difference between independent and nonprofit/government group means is statistically significant at the .05 confidence level.

varied among homes. Regression analysis was used to examine the effect of chain ownership on nursing home average cost, holding constant other important determinants of nursing home costs.

In order to be consistent with previous work, this study first estimated a typical nursing home cost function using the data set for all Texas nursing homes in 1983 (see Palmer 1985 for a survey of nursing home cost studies):

$$AC = f(Y, YSQ, OCCR, PRIV, OWN, CERTIF, HSA)$$

The dependent variable is average cost (*AC*). The continuous independent variables are the total number of patient days (*Y*), the square of the total number of patient days (YSQ),[6] the occupancy rate (*OCCR*), and the percent of total patient days accounted for by private patients (*PRIV*). The remaining independent variables, ownership (*OWN*), certification (*CERTIF*), and region (*HSA*), are categorical variables. Ownership categories are chain for-profit (*CHAIN*) and nonprofit/government (*NONPGOVT*), with independent for-profit as the base. Certification categories are SNF only (*SNF*) and both SNF and ICF (*BOTH*), with ICF only being the reference group. Regional differences were taken into account by assigning a dummy variable to

each of the 12 health service areas in Texas (HSA1, Amarillo, is the reference area).

Direct measures of two important determinants of nursing home costs—case mix and quality—were not available. The cost function does, however, include the certification variable, a crude proxy for case-mix differences, and the proportion of private patients, a measure found to be associated with quality differences (see Walsh 1979, and Ruchlin and Levey 1972). Moreover, other nursing home cost studies found that cost differences among ownership types persisted even after controlling for case mix and quality (see, for example, Birnbaum et al. 1981, and Arling, Nordquist, and Capitman 1987). Nonetheless, the analysis is limited by the absence of more accurate measures of case mix and quality.

Table 3 presents the estimation results both for a common regression with a dummy variable for ownership type (the usual specification in nursing home cost studies) and for separate regressions by ownership type. Estimating a common regression presumes that the intercept varies but the slope coefficients are the same across ownership categories. The *F*-statistic for a test of the null hypothesis that the slope coefficients are equal across ownership categories is 155.4, more than sufficient to reject the null hypothesis at the 1 percent confidence level.[7] (Using for-profit homes only, the conclusion is also to estimate separate regressions for chain and independent homes.)[8] For this data set, the appropriate technique thus is to estimate a separate regression for each ownership category.[9]

Although the magnitudes of the coefficients vary, the different specifications give similar results for the effects of the occupancy rate, the percentage of private patients, and the type of certification on average cost. As was true in other cost studies, average cost decreased as the occupancy rate increased and increased as the percentage of private patients increased. Homes certified as SNF-only had higher average costs than ICF-only homes, as did homes with both SNF and ICF patients.

It is with regard to scale effects that the choice of specification will influence conclusions about the effect of ownership on nursing home costs. The coefficients of the number of patient days (Y) and patient days squared (YSQ) are statistically different from zero at the 1 percent confidence level in the separate regression results for chain homes and in the common regression equation. In the initial separate regression equations for independent and nonprofit/government providers, however, the coefficients of patient days and patient days squared were not statistically distinguishable from zero. The cost functions for indepen-

Table 3: Parameter Estimates of Nursing Home Cost Functions

	Separate Regressions			
Variable	*Chain For-Profit (N = 469)*	*Independent For-Profit (N = 253)*	*Nonprofit/ Government (N = 104)*	*Common Regression (N = 826)*
INTERCEPT	37.89**	32.83**	80.95**	41.02**
Y	-.00016**	—	—	-.0002**
YSQ	$1.37X10^{-9}$**	—	—	$2.33X10^{-9}$**
OCCR	-9.60**	-8.07**	-55.70**	-13.40**
PRIV	6.08**	6.82**	17.61**	11.52**
SNF	4.25**	4.07**	14.62**	6.65**
BOTH	4.43**	3.05**	6.56*	3.92**
CHAIN	—	—	—	-0.17
NONPGOVT	—	—	—	7.33**
REGION†				
HSA 2	-0.79	-1.34	-8.53	-3.82**
HSA 3	1.21	-3.03	-4.06	-1.06
HSA 4	-1.81*	0.40	0.31	-1.91
HSA 5	-0.62	-1.20	-4.97	-1.53
HSA 6	-1.63*	-0.94	-6.14	-2.62*
HSA 7	-1.00	-0.15	-4.48	-1.03
HSA 8	-1.43	-0.22	-7.64	-2.36*
HSA 9	-1.68	-1.14	-11.65*	-3.55**
HSA10	-2.17*	-1.21	-8.31	-2.83*
HSA11	-1.03	0.03	2.25	-0.97
HSA12	-0.29	-0.15	26.46*	1.62
F-ratio	18.79	8.42	5.83	32.73
Adjusted R^2	.39	.31	.41	.42

*Statistically significant at the .05 confidence level.

**Statistically significant at the .01 confidence level.

†HSA2 = Lubbock; HSA3 = El Paso; HSA4 = Abilene; HSA5 = Dallas-Fort Worth; HSA6 = Austin; HSA7 = Paris; HSA8 = Edinburg; HSA9 = San Antonio; HSA10 = Beaumont; HSA11 = Houston; HSA12 = Midland.

dent and nonprofit/government providers were therefore reestimated without the patient-day variables, and those results are reported in Table 3.[10] The estimation results based on the common regression show that all homes appear to have U-shaped average cost curves, but, when estimated separately, average cost is U-shaped only for chain homes.

The choice of specification becomes especially important when examining how chain ownership affects nursing home costs. In the common regression, the dummy variable for chain ownership is not statistically different from zero, suggesting that, all else equal, average

cost was approximately the same for chain and independent for-profit homes.

A different picture emerges from the separate regressions, however. Because the slope coefficients are unequal, a comparison of average cost between chain and independent homes depends on the level of output (that is, the number of patient days). Graphs of chain and independent homes' average cost functions were prepared for each of the 36 certification/region categories. The graphs show how chain and independent average costs change over the relevant range of output (5,000 to 100,000 patient days), based on the parameter estimates from the separate regressions by ownership type and evaluated at the mean occupancy rate and percentage-of-private-patients values for all for-profit homes. In other words, the graphs compare chain and independent homes' average cost curves, holding constant all other factors affecting cost.

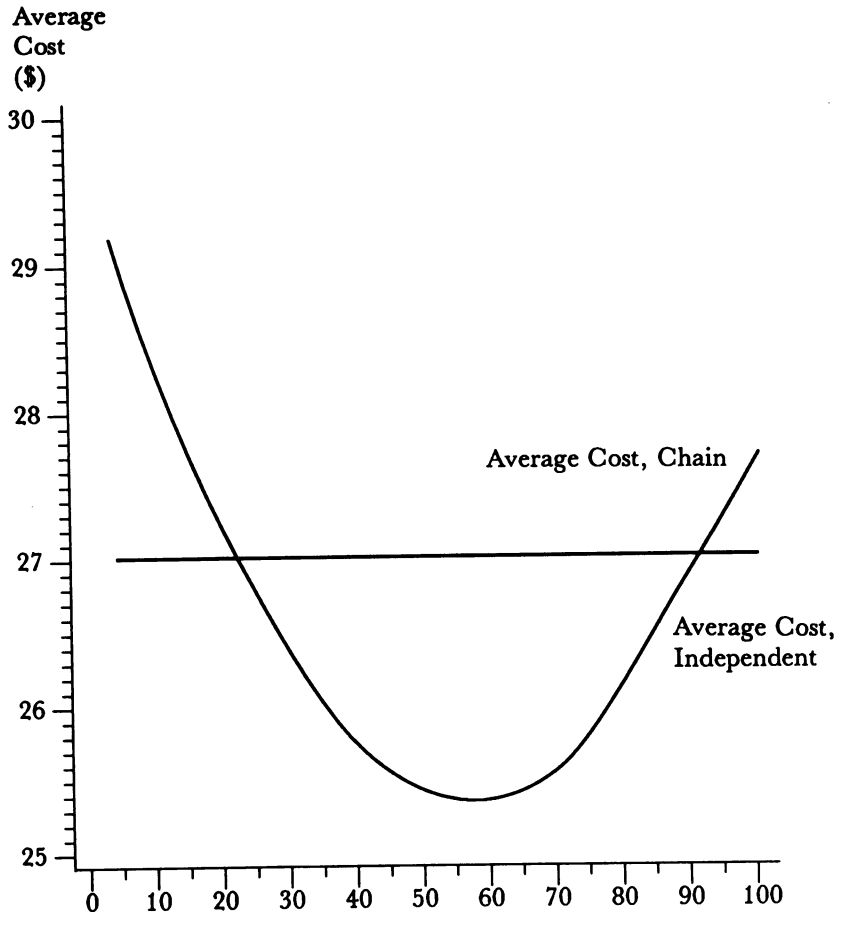
Figure 1 presents the average cost curves for chain and independent for-profit homes in the Austin health service area (HSA6) that provide only ICF care. In this certification/region category, accounting for about 12 percent of all Texas for-profit homes, chain average cost was higher than independent average cost at low and very high levels of output, but lower at intermediate and high levels of output. This pattern was typical: 95 percent of the for-profit homes were in a certification/region category that exhibited a similar set of average cost curves.[11]

The range of output over which chain homes had lower average costs than independent homes varied, depending on the certification/region category. Calculating the intersections of the chain and independent homes' average cost functions for each certification/region category and then weighting the intersections by the proportion of homes in that category, the weighted average range over which chain homes had lower average costs than independent homes was approximately 26,000–90,000 patient days.

In the common regression, with only the intercept varying, cost differences at low, intermediate, and high levels of output cancelled out, resulting in an insignificant coefficient on the dummy variable for chain ownership. The separate regressions, which allow both intercept and slope coefficients to vary, indicate that, although there are cost differences between chain and independent homes, those differences depend on the scale of operation. In most cases, chain homes do have a cost advantage over independent homes, but only at intermediate and high levels of output.

A final issue to be considered in this investigation of nursing home

Figure 1: Average Cost Curves for Chain and Independent For-Profit Nursing Homes in HSA6 That Provide Only Intermediate Care*



*Average cost is evaluated at the mean occupancy rate and percent of private patients for all for-profit homes.

costs is the role of occupancy rates in explaining ownership cost differences. For Texas nursing homes in 1983, the average occupancy rate for chain homes was significantly less than for independent homes (see Table 2, t = 9.03). And this difference in average occupancy rates

appears to have been an important determinant of the actual cost differences between the two types of homes.

Although regression analysis holds the occupancy rate constant when measuring ownership cost differences, it is possible that chain homes with unusually low occupancy rates could be responsible for the reported cost differences between chain and independent for-profit homes. To examine this possibility, chain homes with occupancy rates below the minimum occupancy rate for the group of independent homes (52.5 percent) were excluded, and the chain regression equation reestimated (N = 440). The resulting parameter estimates differ only slightly from those reported in Table 3, suggesting that the regression results showing cost differences between chain and independent homes are not due to chain homes with unusually low occupancy rates.

CONCLUSIONS AND POLICY IMPLICATIONS

Chain providers are often assumed to have lower costs than independent nursing homes. The regression results for the study population of Texas nursing homes did provide evidence to support this assumption, but only at intermediate and high levels of output. Thus, at those levels of output, there was evidence of firm-level economies of scale in the production of nursing home care. At low and very high levels of output, chain homes had higher average costs than independent homes, that is, there were firm-level diseconomies of scale. Any advantages of chain ownership—lower costs due to centralized purchasing and administration or capital savings—thus appeared to operate only in the intermediate and high ranges of output.

The results of this article differ from those of previous studies of the effect of chain ownership on nursing home costs. The differing results could be due to differences between Texas nursing homes and nursing homes in other states. For example, the mean occupancy rate of Texas nursing homes is well below the national average occupancy rate.[12] Or the differing results could stem from the fact that case mix was not thoroughly considered in this study. Another possibility is that differing methods of analysis were responsible for the differing results.

In the case of the three studies that found no effect of chain ownership on nursing home cost (Birnbaum et al. 1981; Meiners 1982; Schlenker and Shaughnessy 1984), the differences could be due to the fact that this study estimates separate regressions by ownership type rather than a common regression with a dummy variable for chain

ownership. Estimating a common regression using the data for Texas nursing homes yielded the same result as the previous studies: the dummy variable for chain ownership was not statistically significant. But a test of whether or not to pool the data concluded that the appropriate technique was to estimate separate regressions for each ownership category. And that approach resulted in a different conclusion, namely, that chain ownership does affect nursing home cost, with the nature of the effect depending on the level of output.

Although the study by Arling, Nordquist, and Capitman (1987) did present results both for a common regression and for separate regressions by ownership category, the authors did not report the results of a pooling test to determine which was the appropriate estimation technique. Furthermore, the separate regressions in that study did not include a measure of output (utilization or capacity) as one of the independent variables, and thus it was not possible to compare average costs at a given level of output across ownership categories.

Reporting the results of a test of whether or not it is appropriate to pool nursing homes across ownership types when estimating a cost function therefore distinguishes this work from previous studies in this area. It is notable that the choice of estimation technique also influences conclusions about the extent of *plant-level* economies of scale. That is, in the common regression, all homes appear to have U-shaped average cost curves, while the separate regressions indicate that only chain homes exhibit plant-level economies of scale.

These results are important because they suggest that the pooling decision must be explicitly considered in attempts to describe and predict changes in nursing home costs. Researchers must determine whether or not pooling is appropriate in order to characterize accurately the nature and extent of nursing home cost differences across ownership types.

The question of whether or not to pool can also affect public reimbursement policy. Cost analysis is an important tool available to policymakers who set reimbursement rates for public patients. As Birnbaum et al. (1981) suggest, cost analysis can aid "regulatory agencies [that] wish to negotiate the lowest possible prices for nursing home services consistent with agency goals" (p. 5). This policy prescription assumes, however, that the cost analyses available for regulatory purposes accurately represent nursing home costs. Using cost estimations based on pooled data when it is not appropriate to pool could lead to reimbursement rates that have unintended, and perhaps undesirable, consequences.

When nursing home cost structures do differ significantly across

ownership categories, one approach is to set different reimbursement rates for different ownership categories. In general, regulatory agencies want to obtain a given amount and quality of nursing home services for public patients at the lowest possible cost. Because nursing homes of different ownership types have different objectives and face different incentives, policymakers may set reimbursement rates according to ownership type in their effort to control costs while maintaining quality. Cost analysis can provide an accurate and systematic basis for setting differential reimbursement rates.

A different regulatory approach is to argue that reimbursement rates should not take into account differences in ownership type. For example, Birnbaum et al. (1981) found that nonprofit homes had higher costs than for-profit homes. But they argued that setting different reimbursement rates on the basis of ownership "creates incentives for either inefficiency or increased production of amenities" (p. 167). Even in this case, however, policymakers need accurate information about costs in order to predict the effects of changes in reimbursement policy on nursing homes.

For the study population of Texas nursing homes, the fact that the extent of differences in costs depends on the level of output means that the choice of Medicaid reimbursement method probably will not greatly affect the overall relative performance of chain and independent for-profit nursing homes. That is, gains for chain homes of a given size will tend to be counterbalanced by losses for chain homes of other sizes, and the net effect most likely will be no change in the overall extent of chain ownership.

The cost function parameter estimates presented in this article must be viewed in the context of a data set that covers one state in one year. A consensus about the effect of chain ownership on nursing home costs must await further research using data for other states in other years. In addition to the empirical results, however, this study has demonstrated the importance of explicitly considering whether or not to pool the data when examining the effect of ownership type on nursing home costs. Although estimating a common regression may well be appropriate for other data sets, testing for pooling before estimating a nursing home cost function would appear to be well worth the small amount of effort involved, especially given the possibility that conclusions about nursing home cost structures may depend on the choice of estimation technique.

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NOTES

1. See Arling, Nordquist, and Capitman (1987); Birnbaum et al. (1981); Bishop (1980); Meiners (1982); Palmer (1985); Ruchlin and Levey (1972); and Schlenker and Shaughnessy (1984).
2. See Note 1.
3. Changes in long-run average cost as capacity changes do not measure true economies of scale. In the case of nursing homes, therefore, economies of scale should be measured with respect to changes in output (patient days) rather than with respect to changes in capacity (beds).
4. The empirical evidence on plant-level economies of scale is somewhat mixed. The consensus, however, is that the extent of scale economies, measured with respect to changes in the number of beds, is small (see Palmer 1985).
5. Using the data set with all 955 observations would not have altered the study's conclusions.
6. Both the total number of patient days and the square of the total number of patient days are included in order to allow the average cost curve to be U-shaped with respect to output (patient days). The results change very little if the number of beds and the square of the number of beds are used instead.
7. The calculated F is $F = [(S2 - S1)/(N - 1)]/[S1/(T - 2N)]$, where $S1$ = unrestricted sum of squares (from separate regressions by ownership type); $S2$ = restricted sum of squares (from common regression with dummy variable for ownership type); N = number of ownership categories; and T = number of nursing homes (see Maddala 1977). The critical value of F (degrees of freedom are 2,820) is 4.61 at the 1 percent confidence level.
8. Using for-profit homes only, the calculated F is 29.24, and the critical value of F (degrees of freedom are 1,718) is 6.63 at the 1 percent confidence level.
9. Estimation of a common regression with ownership interaction terms for all variables, which allows both intercept and slope coefficients to vary across ownership types, yields coefficients identical to the results of the separate regressions by ownership category. The statistical significance of the coefficients varies between the common regression with interaction terms and the separate regressions, however, due to differences in degrees of freedom and, more importantly for this data set, due to high correlations among the interaction terms. The separate regressions sidestep the multicollinearity problem associated with the numerous interaction terms and thus give a clearer picture of how cost behavior varies by ownership type.
10. The results of the separate regression equations including patient days and

patient days squared for independent and nonprofit/government providers are quite similar to the results presented in Table 3.

11. The other 5 percent of for-profit homes were in certification/region categories for which chain homes had higher average costs than independent homes at all levels of output.
12. The mean occupancy rate for the study population of Texas nursing homes in 1983 was 83 percent (see Table 1). In 1982, the national average occupancy rate was 91 percent (*Vital and Health Statistics* 1986).

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