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Articles

An Empirical Study of Economies of Scope in Home Healthcare

Theresa I. Gonzales

Objective. To apply the economic theory of economies of scope to the home health-care industry.

Data Sources. Data on 488 observations obtained from the *Cost Report* (HCFA Form 1728-86) of all Connecticut state-licensed, Medicare-certified home health agencies.

Study Design. The *Cost Report* was the primary source of data for this study. Information on total cost, scope, and other related factors was collected. Logarithmic and nonlinear regression analyses were used to identify factors related to scope and also to test for economies of scope.

Data Collection Method. Data collected were both cross-sectional and time series (from 1988-1992). Data accuracy was verified using description of frequencies, measures of central tendency and variation, and a calculation package so that a computer calculation on the data could be compared with the agency's calculation.

Principal Findings. It was determined that initially as scope increases, costs go down, thus proving economies of scope. For larger values of scope, it was determined that costs go up, proving diseconomies of scope.

Conclusions. Many of the home health agencies included in this study provide more services than is cost effective given the economic theory of economies of scope.

Key Words. Economies of scope, home healthcare, healthcare

INTRODUCTION AND STATEMENT OF THE PROBLEM

The healthcare industry is currently undergoing fundamental changes concerning payment, accessibility, and service delivery. Recent literature has reflected an extraordinary number of mergers involving vertical and horizontal integration. The managerial response of healthcare providers to change has typically been to expand the numbers and types of services offered in an attempt to remain competitive and to better serve the needs of healthcare referral sources. This is best exemplified in the home healthcare setting. Home healthcare firms have responded to hospital reimbursement changes

by broadening the array of services the firms offer, so that they can service all of the needs of the hospitals' discharged patients.

In his book *Health Services in the United States: A Growth Enterprise Since 1875*, Odin Anderson points out that the growth of health services can be divided into three periods: the emergence of the basic services of the current system (1875–1930); the era of the third-party payment system (1930–1965); and the era of management and control (1965 to the present) (Anderson 1985: x). Anderson goes on to explain that in the current industry environment, with increasing amounts of competition, healthcare companies are either diversifying into other related areas or they are adding related services to their present line of business. Trends are also appearing as local health providers begin to realize that regional health systems may be a more appropriate and systematic method of administering complete health services (Ackerman 1992; U.S. Government, Office of the President 1993). The trend is toward vertical integration of healthcare firms with a focus on offering comprehensive services.

The focus on comprehensive service delivery needs to be examined in light of the economic concept of economies of scope. "Economies of scope imply that the cost of producing all outputs is strictly less than the cost of producing the same levels of output in separate production units, each unit specializing in a single output" (Cowing and Holtmann 1983: 647). There has been research relating to economies of scope in the hospital area. Findings suggest that with some types of services (pediatric care) economies may exist, but with other services (emergency room) diseconomies exist (Cowing and Holtmann 1983). With the increasing nature of healthcare competition and the emphasis on comprehensive service delivery, economies of scope become crucial to the efficient delivery of healthcare services as well as critical to a firm's profitability.

With increasing emphasis on home health as a less costly healthcare alternative, utilization of home health services has increased. But few attempts have been made to study the issues of economies of scope in home healthcare. Given recent business trends in this industry and the increasingly competitive nature of the environment, cost and efficiency are important considerations in management decisions.

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A study was conducted to determine whether or not economies of scope are present in the home healthcare setting. Home health agencies in the state of Connecticut were the foundation of this study. A home health agency is a public or private organization, whether for-profit or not-for-profit, that provides skilled nursing services and at least one additional home health service at a patient's residence according to a plan of treatment (Kass 1987). Other home health services might include (but are not limited to) physical and occupational therapy, home health aides and companions, intravenous therapy, baby care, and social work services.

The firms in this industry comprise local, regional, and national companies. These firms work with hospitals and physicians to provide healthcare services to patients in their own homes and in skilled nursing facilities. An increasing emphasis has been placed on using these types of services due to an increase in the number of people over age 65 and in response to hospital reimbursement changes (Lewin 1991; Zinkewicz 1993).

METHODS

A study was conducted of all home health agencies (HHAs) in Connecticut. The primary purpose of the study was to determine whether economies of scope existed in the home healthcare field and, if it did, at what level economies were present. Data were collected from all of the state-licensed, Medicare-certified HHAs in Connecticut. Data were collected for a period of five years (1987–1992) for a total of 488 observations, with the actual number of agencies each year ranging from 94–106. Data were both cross-sectional and time series. The primary data collection instrument was the *Cost Report* (HCFA Form 1728–86). Agencies are required to submit an updated *Cost Report* each year reflecting the agency's actual costs of rendering services during the previous fiscal year.

The scope of services offered by healthcare firms was examined as a continuous variable. Scope was defined as the number of different types of services offered. The *Cost Report* specifies the following possible types of services: skilled nursing care, physical therapy, occupational therapy, speech pathology, medical social services, home health aide, durable medical equipment (rented or sold), supplies, home dialysis services, respiratory therapy, private duty nursing, clinic, health promotion activities, day care program, home-delivered meals, hospice, and homemaker services. Scope was measured by counting the actual number of different types of services that home

health agencies offered. For purposes of this study, scope was measured as an unweighted sum; this implies that all services were equal in terms of their associated cost to the firm.

Utilizing the concepts of microeconomics, it is acknowledged that all home health agency services may not be equally profitable. In differentiating healthcare activities the incremental costs of each service must be compared to the incremental revenue. Using the theory of marginal analysis, the marginal cost and marginal revenue of each service can be analyzed, and services can then be ranked against each other (Ellis 1984). The acceptance criteria to establish economies of scope would be:

- Where marginal benefit $>$ marginal cost there would be economies of scope; and
- Where marginal benefit $<$ marginal cost there would be diseconomies of scope.

Consideration of the results of marginal analysis would assist individual HHA managers in determining which particular services their firm should provide in order to achieve economies of scope (those services where marginal benefit $>$ marginal cost). Marginal analysis was not undertaken as part of this research effort, because data were collected from the publicly available statistics included in the *Cost Report* and application of marginal analysis was not possible. Therefore, the method used to differentiate and count types of services was linked to the definitions of these services within the Medicare/Medicaid reimbursement guidelines (*Cost Report Guidelines* for HCFA Form 1728-86).

Total cost was measured as the sum of the fixed and variable costs of the agency. These data were also obtained from the *Cost Report*. As such, total cost was a continuous variable. In order to compare time series data, adjustments for inflation were necessary. Since the average consumer price index (CPI) is computed using the calendar year, monthly data were used and the average CPI was calculated for the home health agency fiscal year July 1 through June 30. Total cost was then deflated by the CPI.

In addition to the total cost and types of different services delivered (scope), data on other factors were collected so that these factors might be controlled for in the final cost model. Other factors included firm size (measured by total number of healthcare visits), legal form (for-profit or not-for-profit), percentage of Medicare patients (controlling for patient age), visits per patient, and community characteristics (urban or nonurban). Both nonlinear

and logarithmic specifications were examined to derive an estimated cost function. The functional relationship of the variables was as follows:

$$\begin{aligned} \text{Total cost (deflated)} = & b_0 + b_1(\text{scope}) + b_2(\text{size}) + b_3(\text{legal form}) + \\ & b_4(\text{percent Medicare}) + b_5(\text{percent nursing visits}) + \\ & b_6(\text{urban/nonurban}) + e(\text{error term}) \end{aligned}$$

FINDINGS

The means of the variables collected are shown in Table 1. It is clear that over the five-year period studied the size of home health agencies has been increasing. Data reflect that from 1987 to 1991 size increased almost 97 percent. This growth is indicative of the increase in demand for home healthcare. The number of visits per patient has increased over the sample years as well as the percentage of patients that were on Medicare. Scope of services appears to remain fairly stable across the five years, with a yearly average of 8.90–9.35 services. These data reflect no significant changes on this variable over time. When considering the 488 observations together, the mean value of scope is 9.14, the median value is 9.00, and the range is from 1.00 to 17.00. Frequencies of this variable for the five years combined can be found in Table 2.

Table 1: Variable Means

<i>Variable Name</i>	<i>1987–1988</i>	<i>1988–1989</i>	<i>1989–1990</i>	<i>1990–1991</i>	<i>1991–1992</i>	<i>5-Year Average</i>
Total cost (deflated)	\$1,273,193	\$1,243,533	\$1,478,860	\$1,836,904	\$1,784,326	\$1,528,958
Size	19,023	20,981	27,130	37,465	37,430	28,560
Visits per patient	18.61	19.02	21.50	25.53	25.98	22.20
Scope	9.35	9.21	9.15	9.11	8.90	9.14
Medicare patients (%)	40	38	45	47	54	45
Skilled visits (%)	28	28	28	26	26	27
Legal form						
Nonprofit	71	69	69	67	70	–
Profit	26	26	25	29	36	–
Community characteristics						
Urban	35	35	41	35	37	–
Nonurban	62	60	53	61	69	–
Sample size (<i>n</i>)	97	95	94	96	106	488

Table 2: Five-Year Frequency of Scope of Services

<i>Value</i>	<i>Frequency</i>	<i>Percent</i>	<i>Cumulative Percent</i>
1	1	0.2	0.2
2	2	0.4	0.6
3	6	1.2	1.8
4	3	0.6	2.5
5	12	2.5	4.9
6	32	6.6	11.5
7	60	12.3	23.8
8	50	10.2	34.0
9	97	19.9	53.9
10	105	21.5	75.4
11	69	14.1	89.5
12	28	5.7	95.3
13	6	1.2	96.5
14	7	1.4	98.0
15	5	1.0	99.0
16	1	0.2	99.2
17	<u>4</u>	<u>0.8</u>	<u>100.0</u>
Total	488	100.0	100.0

REGRESSION RESULTS

Several models were developed to assess these associations over time. The model chosen was dependent on the relationship of the variables under study and related theoretical assumptions.

A logarithmic regression model was developed to assess the associations related to economies of scope. The equation used total cost deflated by the CPI as the dependent variable. Table 3 shows the results of the regression equation with the variables and their respective coefficients. Scope appeared significant in this initial equation controlling for community characteristics, legal form, size, proportion of the population that was on Medicare, and visits per patient. In order to examine this issue further, various other functional models were examined. The best model included computation of a new variable measuring nonlinearity in scope based on Taylor's Theorem (Ellis and Gulick 1978: 523): $\text{scope}^2 = \text{scope} \times \text{scope}$ ($\text{SSSQ} = \text{SS} * \text{SS}$). This new variable measured extremely high levels of scope. A linear model was developed, and once SSSQ was included in this model the resulting functional form was nonlinear. The results of this regression indicated both economies and diseconomies of scope. Table 4 shows these regression results.

Table 3: Logarithmic Regression Results

<i>Variable</i>	<i>Coefficient</i>	<i>t</i>	<i>Sig. t*</i>
Community characteristics (0 = nonurban)	.389994	7.440	.0000
Legal form (0 = nonprofit)	-.309331	-4.750	.0000
Scope	.319553	3.407	.0007
Proportion of population on Medicare	.225099	5.103	.0000
Size	.764987	31.185	.0000
Visits per patient	-.300786	-6.381	.0000
(Constant)	6.701308	22.657	.0000

Note: coefficients represent logged values.

* Factors were significant at the .05 level.

Table 4: Nonlinear Regression Results

<i>Variable</i>	<i>Coefficient</i>	<i>t</i>	<i>Sig. t*</i>
Community characteristics (0 = nonurban)	241841.949	2.543	.0114
Legal form (0 = nonprofit)	-381978.251	-3.172	.0016
Scope	-472570.060	-4.853	.0000
Proportion of population on Medicare	48.343	43.197	.0000
Size	47.327	42.409	.0000
Visits per patient	-19014.372	-5.880	.0000
Scope ²	26533.878	5.180	.0000
(Constant)	2313822.070	4.665	.0000

* Factors were significant at the .05 level.

For small values of scope, after setting all other independent variables to zero, and considering that the squared term coefficient is much less than that of the linear term for low values of scope, it could be determined that, initially, as scope increases costs go down, thus proving economies of scope. For larger values of scope, following this same procedure relative to the independent variables, it was determined that costs go up, thus proving diseconomies of scope.

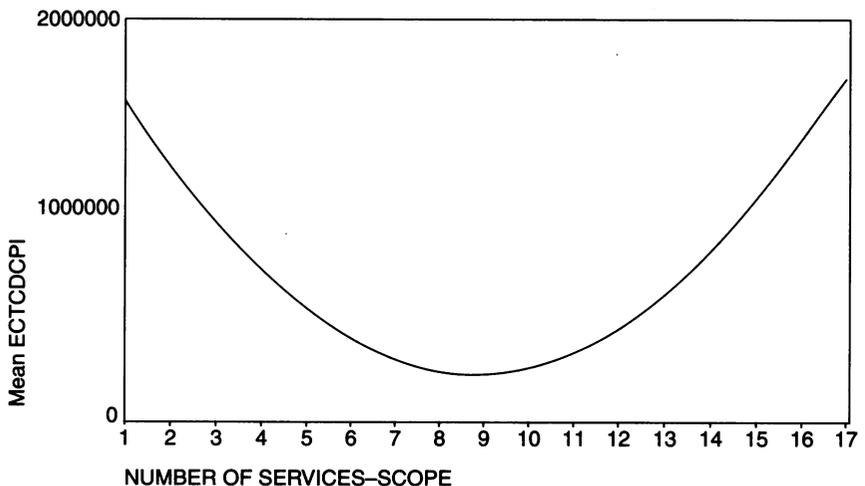
These data suggest that if costs go down first, and then go up, there must be an optimum point of minimum costs. An equation was formulated, and the optimum point of minimum costs for these data was calculated. Data suggest that this optimum point was nine services. Figure 1 displays the economies of scope curve.

Figure 2 is a line graph of the actual mean number of services offered by those HHAs studied. The data from this figure suggest that there is a tendency for home health agencies to have a slightly large scope, as the average scope is nine to ten services.

Several models were developed and tested using economic theory as a basis. The two models used in this study (logarithmic and nonlinear) were the best estimate of the total cost function related to economies of scope. Both models were examined for linear assumption violations (multicollinearity, heteroscedasticity, and autocorrelation) as well as model stability.

The presence of multicollinearity was found in both models through the examination of covariation and correlation coefficients. This multicollinearity may be the result of using a large sample. As the sample size increases so does the probability that correlation with independent variables will be significant.

Figure 1: Calculated Economies of Scope Curve



Note: controlling for size = 0

Figure 2: Data Collected–Scope



The coefficients of the variables reflect the fact that only about 18 percent of the relationship between the variables is explained; therefore, this relationship is not an important factor in assessing these models.

Plots of the regression residuals were examined to test for the presence of heteroscedasticity. Inspection of these plots indicated that the magnitude of the residuals on average was the same, and therefore that no heteroscedasticity was present.

In order to examine the possible presence of autocorrelation, a new variable was created to act as a year proxy. The regressions were run again with this variable included. This variable was not significant in either model, suggesting, therefore, that no autocorrelation was present in either functional form.

CONCLUSIONS

Many of the home health agencies included in this study have scope larger than the minimum cost point. These agencies are offering too many different types of services and, therefore, are not obtaining cost advantages. From a solely economic perspective, managers should determine which services

provide the most competitive advantage and begin eliminating more marginal activities.

From a competitive position or customer satisfaction perspective, or both, however, elimination of activities may not be possible. Depending on the location and the competitive nature of the firm's environment, these decisions must be made on a case-by-case basis.

IMPLICATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

This study has been the first to analyze economies of scope in the home healthcare field. It makes an important contribution to the field of healthcare research in its effort to begin to measure a service industry. Economies of scope is far easier to measure in a production or manufacturing environment, and numerous examples of this are present in the literature. Measurement in the field of healthcare is much more difficult due to variation in such areas as service intensity, quality, delivery setting, and so forth. This model is an attempt at a beginning. Development of this technique for other healthcare settings needs to be further explored.

As the competitive nature of healthcare increases and the pressure from managed care groups intensifies, it will be a challenge for the home care industry to provide all of the services needed in an efficient manner. The economic principles by which manufacturers have been doing business need to be applied to the service sector. Data suggest that beyond a certain point, it is no longer economically prudent for home health agencies to provide additional types of home healthcare services. Economic theories relative to economies of scope can be applied to home health firms to determine the point at which cost advantages may be obtained. The application and use of economic cost models needs to be an important component in healthcare management decision making.

These additional questions are raised as a result of this research:

- What is the specific service mix required in order for individual firms to achieve economies of scope?
- Are there economies of scope for payers of healthcare?
- What is the impact of case management on economies of scope?
- What is the impact of alternative payment mechanisms on economies of scope?

- What is the relationship between economies of scope and healthcare quality?

LIMITATIONS

The results of this research should be generalizable to a limited population: licensed HHAs in the state of Connecticut. When Connecticut information is compared with national home healthcare data (persons served, visits per person, charges per person, etc.), it is very close to the national mean. But Connecticut has a very high per capita income and generous healthcare coverage. The fact that these results cannot be generalized to other states does not preclude the use of similar modeling techniques in other states in an attempt to apply basic economic efficiency models to healthcare. Replications of this study in other states and perhaps even nationally is necessary before global generalizations can be made.

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REFERENCES

- Anderson, O. W. 1985. *Health Services in the United States: A Growth Enterprise Since 1875*. Chicago: Health Administration Press.
- Ackerman, F. K., III. 1982. "The Movement Toward Vertically Integrated Regional Health Systems." *Health Care Management Review* 17 (Summer): 81-88.
- Callan, M., and D. Yeager. 1991. *Containing the Health Care Cost Spiral*. New York: McGraw Hill.
- Cost Report* (HCFA Form 1728-86). 1986. Hartford: State of Connecticut, Commission on Hospitals and Health Care.
- Cost Report Guidelines for HCFA Form 1728-86*. 1986. Hartford: State of Connecticut, Commission on Hospitals and Health Care.
- Cowing, T. G., and A. G. Holtmann. 1983. "Multiproduct Short-Run Hospital Cost Functions: Empirical Evidence and Policy Implications from Cross-Section Data." *Southern Economic Journal* 49 (January): 637-53.
- Ellis, L. 1984. *The Financial Side of Industrial Research Management*. New York: John Wiley & Sons.
- Ellis, R., and D. Gulick. 1978. *Calculus*. New York: Harcourt Brace Jovanovich.
- Feldstein, P. J. 1988. *Health Care Economics*, 3rd ed. New York: John Wiley and Sons.

- Folland, S., A. Goodman, and M. Stano. 1993. *The Economics of Health and Health Care*. New York: MacMillan Publishing Co.
- Kass, D. J. 1987. "Economies of Scale and Scope in the Provision of Home Health Services." *Journal of Health Economics* 6 (June): 129-46.
- Lewin, K. 1991. "Economic Analysis of Home Medical Equipment Services." Report prepared for the National Association of Medical Equipment Suppliers, 29 May.
- U.S. Government, Office of the President. 1993. *The President's Health Security Plan*. New York: Random House.
- Zinkewicz, P. 1993. "In-Home Health Care Services: A Growth Market for Agents." *Rough Notes* 136 (October): 74-75.