CERTIFICATE OF NEED REGULATION

OF ENTRY INTO HOME HEALTH CARE

A Multi-Product Cost Function Analysis

An Economic Policy Analysis

by

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EXECUTIVE SUMMARY

This study examines the justification for requiring Certificate of Need approval before new firms can begin providing home health care services. Certificate of Need regulations impose barriers to new entry and therefore may impede competition in the health care markets to which they apply. As a result, prices may rise and costs may increase, particularly those of non-profit firms.

Proponents of Certificate of Need regulations argue that they are necessary to achieve efficiency in health care markets. These people fear that competition will result in too many firms, each providing too few units of each service. The result of this process would be that costs were higher than necessary because of unneeded expenditures on fixed, or capital, costs. The purpose of this study is to examine whether the conditions necessary for this "public interest" theory of Certificate of Need regulation are satisfied in the home health area.

To examine this question, we estimated a multi-product cost function for a home health care provider. Using this estimated function, we first examined whether there are significant economies to be realized if home health care firms were larger in size -- economies of scale. We found no such substantial economies. First, we estimated that the fixed, or capital, costs necessary to establish a home health care provider were only about $15,000. Thus, we would expect economies of scale to be exhausted at a relatively small firm size. Further examination supported this expectation. We found that only 26.87 percent of firms in urban markets had substantial unrealized economies of scale -- i.e., the firm's costs would have fallen by more than 5 percent if the firm were of a more efficient size.

We also examined whether unrealized scale economies were smaller where Certificate of Need regulations were imposed than where entry was unrestricted. We found no differences in the extent of economies in the two cases. Thus, we have no

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evidence that CON regulation contributes to efficiency in the realization of scale economies.

We next examined whether there are economies associated with the extent to which home health care firms were diversified. We found that, while there may be economies associated with the joint provision of skilled nursing and home health aide care, the vast majority of the firms in our sample provided both of those services. Further, there was no significant difference in the degree to which firms in CON regulated markets and firms in unregulated markets achieved these economies. We therefore again failed to find a "public interest" justification for CON regulation.

Finally, we examined how a firm's costs of providing a given quantity of home health services were affected by the presence of CON regulation. We found that costs were higher in the presence of CON regulation. The estimated average increase in cost was about 2 percent. This translates into an additional cost of providing home health services of approximately $46 million in 1984. We further suggest that the regulations may lead to price increases that cost consumers, health insurers, and government agencies upward to $100 million per year in increased payments for home health services.

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PREFACE

This study is divided into two parts. The first part, Highlights of the Study, offers a non-technical summary of the essential aspects and findings of the study and will probably be more useful to non-economists. Part II contains the more-detailed and technical discussion of the issues considered, the methodology employed, and the results obtained.

PART I

HIGHLIGHTS OF THE STUDY

Many states -- 34 as of June 1985 -- impose Certificate of Need (CON) regulations on the entry of new providers of home health services. Home health firms provide health care in the patient's home. Services provided include skilled nursing, physical therapy, speech therapy, occupational therapy, medical social services, and home health aide services. The availability of home health services can mean earlier discharge for hospital patients and the ability for some elderly or disabled patients to live in their own homes rather than in nursing homes.

By requiring the approval of a state governmental agency before new firms can begin providing services, Certificate of Need regulations may delay, if not completely prohibit, entry into the home health area. The purpose of this study is to examine the need for these regulations which create barriers to new entry into this market. By so doing, we hope to determine whether the application of CON regulations to this part of the health care sector improves the working of home health care markets and, therefore, can be justified as being in the "public interest."

In order to examine the appropriateness of Certificate of Need regulation in the home health area, we need to consider the justifications that have been offered for this type of regulation. Since we are unaware of any analyses presenting a special justification for this form of regulation in the home health area, we examine the more general discussion of the need for CON regulation in hospitals and nursing homes. Once we understand the rationale for Certificate of Need regulation in these markets, we will attempt to determine whether these justifications are relevant to home health care.

One justification for Certificate of Need regulation may be referred to as the "public interest" theory. Advocates of this theory argue that competition will not result in the provision of health care services at the lowest cost. Instead, administrative controls on entry into health care fields such as

hospitals and nursing homes -- and presumably home health care -- are believed necessary to insure the efficient provision of health care.[1] Proponents of this theory argue that the failure to regulate entry will result in excessive numbers of firms providing various health care services. As a result, it is argued that excessive expenditures will be made on capital equipment and the average firm will not serve enough patients to achieve efficiency in its operations. Therefore, according to those who argue that Certificate of Need regulations serve the "public interest," reliance on competition will result in costs of providing health care that are greater than necessary.[2]

The purpose of this study is to empirically examine whether Certificate of Need regulation of home health care can be

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[1] While the belief that competition will not result in firms operating efficiently is a necessary part of a "public interest" justifiction for CON regulation of home health care providers, it is interesting to note that this argument was explicitly rejected by the House Committee on Interstate and Foreign Commerce when it rejected a proposal to require the inclusion of home health care in state CON programs. The Committee stated that "Certificate of Need regulation should be extended to only those services where the market forces of supply and demand will not appropriately allocate the supply of that service. The Committee feels that home health services is a developing field and that competition between those who provide home health services should be encouraged." (House Committee on Interstate and Foreign Commerce (1979), p. 76).

[2] It is unclear why free entry and competition do not result in the efficient provision of health care services even though health care has some characteristics that differentiate it from other markets. (See pp. 30-32 for a discussion of these issues.) In addition, empirical studies generally have not found CON regulation to be an effective way to reduce hospital costs. (See the sources listed in footnote 12 on p. 29.)

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justified under this "public interest" theory. If CON regulations do not contribute to a more efficient provision of home health care services, there would be no justification for maintaining them. Indeed, there would be reason for concern that the regulations' purpose was to protect incumbent providers from beneficial competition from new firms. The notion that the CON process could be used by incumbent hospitals and other providers to limit competition is the crux of an alternative explanation of CON regulation -- the so-called "economic" theory. If the "economic" model of these regulations is correct, the regulations are apt to result in higher prices for health care services since the regulations limit competition among providers. The "economic" theory may also imply higher costs in regulated markets. This is particulary true for providers that are not organized as for-profit firms. In addition to testing the implications of the "public interest" theory, we shall test the "economic" theory by seeing whether costs are indeed higher in regulated markets.

THE STUDY METHODOLOGY

To determine whether Certificate of Need regulation of entry into the home health area can be justified on the basis of the "public interest" theory, we must ask whether firms that provide home health services are too small to operate efficiently. That is, would the cost-per-visit of such firms be lower if each firm provided more home health care visits? In the parlance of economics, we wish to determine the degree to which home health firms fail to realize the available "economies of scale." Such economies of scale are unlikely to be very large unless the capital, or fixed, costs incurred in providing home health care services are large. Thus, a first test will be to examine the extent of these costs.

If there are unrealized scale economies, then it is useful to consider whether firms located in states with CON restrictions achieve the available economies to a greater degree than firms in states with no restrictions on entry. Even if costs would be lower if firms were larger, CON regulation cannot be

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justified unless the presence of the regulations contribute to greater efficiency.

In addition to efficiencies resulting from an increase in firm size, there may be efficiencies that result if the same firm offers more than one service. For example, if a firm provides both visits by skilled nurses and visits by home health aides, there may be greater efficiency than if the firm only offered skilled nursing care and it was necessary to contact another firm to arrange for a visit by a home health aide. The economic term for these gains through diversification is "economies of scope." There may also be diseconomies of scope that result from excessive diversification. As with economies of scale, we will determine whether there are economies or diseconomies of scope in the provision of home health services and will then consider whether the presence of CON regulation results in greater realization of any economies that exist.

We will also seek to determine whether Certificate of Need regulations increase the costs that firms incur in providing a given number of home health visits. Such cost increases would be expected according to the "economic" explanation for the existence of the CON regulations. The regulations create barriers to new competitive entry. Since most of the home health firms included in our analysis are not for-profit firms, a reduction in the amount of competition in the provision of home health care may mean that less attention is paid to cost control. Thus, a final measure of the effect of CON regulation

will be a comparison of the costs of providing the same quantity of services in regulated and unregulated environ- ments.[3]

Our first step in resolving these issues involves the esti- mation of a multi-product cost function for a home health firm. This cost function relates the total costs incurred by the home health firm to the number of visits of each type of services provided by the firm and to several other variables that may affect the firm's costs. Six home health services are included in the estimation: skilled nursing care, physical therapy, speech pathology, occupational therapy, medical social

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[3] It is possible that Certificate of Need regulation could be used to assure that minimum quality standards are met by health care providers. Agencies making CON decisions appear to have the authority to consider issues related to quality in making their decisions. While such a rationale is possible, this does not appear to be the primary motivation for these laws. Rather, the primary concern appears to have been dupli- cation of facilities with the result that costs of health care are excessive. (See Joskow (1981) and House Committee on Interstate and Foreign Commerce (1979).) Further, previous analyses of the purpose and effects of CON regulation focus, as does this one, on the effectiveness of these regulations in controlling costs and promoting economic efficiency. (See Joskow (1981), Havighurst (1973), Gelman (1982), Sloan and Steinwald (1980), and Rappaport, Robertson, and Stuart (1982).)

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services, and home health aide care. The equation is estimated using 1981 cost data for 1,764 home health firms.[4] The cost data come from the Medicare Cost Reports that must be filed with the Health Care Financing Administration by home health firms that receive reimbursement from Medicare.

Using the estimated cost function, the percentage reduction in per-visit costs that would result if the firm were of a more efficient size is estimated for each firm in our sample.[5] These estimates of potential savings are then averaged across all of the firms in the sample and across various subsets of the firms. The results of this analysis are discussed below.

We also use the estimated cost equation to estimate the gains associated with the joint provision of skilled nursing and home health aide services. Similarly, the gains or losses associated with jointly providing all six of the included services are estimated. Rather than conducting this analysis on a firm by firm basis, we consider only the gains realized by the "average" firm that is diversified to a particular degree.

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[4] Some readers may be concerned that an analysis based on 1981 cost data may not be relevant in 1986 or beyond. We do not believe that the age of the data poses problems for the analysis we are doing. Clearly the demand for home health services has increased since 1981. This may be due to changes in Medicare reimbursement for hospital services and other factors. However, we see no reason to believe that changes in demand should affect the degree to which efficiency is achieved in the cost of providing services; and it is this latter issue we address in this study.

[5] For each firm in our sample, the firm's more efficient size is defined as the minimum efficient size along the firm's - output ray, or a level of output that is twice that currently provided by the firm, whichever is smaller. For a discussion of this approach, see pp. 65-67.

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The fixed costs, or capital costs, incurred in operating a home health firm appear to be quite modest. Based on our estimated firm cost equation, fixed costs appear to be about $15,000.[6] Such a small estimated value for fixed, or capital, costs is not surprising given the technology of home health care. However, such low fixed costs suggest that economies of scale should be substantially achieved at relatively low levels of output. Thus, we have some preliminary evidence that Certificate of Need regulation in home health care is unnecessary.

Further insight into the need for CON regulation to assure the realization of available scale economies is obtained from our analysis of the cost savings that would result if home health firms were of more efficient sizes. The results of this analysis are summarized in Table A. In this analysis, we focus our attention on those firms located in urban markets since the data for these firms provides a better test of the hypothesis that competition results in an excessive number of firms and that firms, therefore, fail to achieve available economies.[7] For these firms, Panel 1 of Table A shows that the average cost savings if they operated at a more efficient scale is 1.89 percent.

Such a level of unrealized scale economies is relatively small. Further, the form in which we estimated our home health

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[6] Since we are estimating a long run cost function, these fixed costs should not be considered fixed in the sense that they must be paid even if no output is produced. Rather, they are the costs that must be incurred if any quantity of home health services are to be supplied.

[7] In non-urban markets, there is a greater likelihood that a single firm provides home health care services and that any unrealized scale economies are the result of the small demand for home health care services. (See pp. 70-72.)

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TABLE A

Unrealized Economies of Scale

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1. Average Percentage Cost Increase Because Firms Are Not of More Efficient Size

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All Firms in Urban Markets	1.89 %
Firms in Urban Markets With No CON Restrictions	1.81 %
Firms in Urban Markets With CON Restrictions	2.07 %

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2. Percentage of Firms With Unrealized Economies of Scale of Five Percent or More

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All Firms in Urban Markets	26.87 %
Firms in Urban Markets With No CON Restrictions	26.25 %
Firms in Urban Markets With CON Restrictions	28.21 %

Source: Tables 5 and 6 and accompanying text.

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care cost function may cause this figure to overstate the actual realizable gains associated with having larger firms.[8] Because of this problem, cost savings of less than 5 percent are not considered to be substantial. Average cost savings for urban firms are considerably below this level. Further, only 36.07 percent of the firms in our sample had potential cost savings in excess of the 5 percent figure. Only 26.87 percent of firms in urban markets had potential savings above this level.

Although the level of unrealized economies was quite small, we still examined the effect of CON regulation on these economies. If unrealized economies are smaller in markets with CON regulation than in unregulated markets, one might argue that there is still a case for this form of regulation. Examining first the average potential cost savings measure, we see from the data in Panel 1 of Table A that firms in urban markets where entry is not regulated have average potential savings of 1.81 percent. The average potential savings for firms in urban markets with CON regulation is 2.07 percent. The difference between these two averages is not statistically significant. Thus, this analysis does not support the "public interest" justification for Certificate of Need regulation in home health care.

We also compared the percentage of firms with potential savings of more than 5 percent in CON-regulated markets with those in unregulated markets. The data utilized to perform this test for urban firms is reported in Panel 2 of Table A. We again failed to find evidence that Certificate of Need regulation makes any difference in the realization of economies of scale. Firms in regulated urban markets had substantial unrealized economies 28.21 percent of the time. Those in non-regulated urban markets had potential cost savings in excess of 5 percent in 26.25 percent of the cases.

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[8] For a discussion of these problems, see pp. 74-76.

SAVINGS ASSOCIATED WITH DIVERSIFICATION

Our analysis of the cost savings associated with diversification suggests that there may be economies of scope in the joint provision of skilled nursing and home health aide services. The "average" firm providing only these two services had estimated costs that were 12.61 percent lower than the estimated costs of providing the same quantity of these two services through two separate firms, one of which offered only skilled nursing care and the other of which offered only home health aides.[9]

We also performed a similar analysis of the gains from joint provision of all six services. In this case, we compared the costs of a single firm which provided all six services with the costs of two firms, one of which offered skilled nursing and home health aide services and the other of which offered the other four services. Based on this comparison, we found that whether or not a firm diversifies beyond the provision of skilled nursing and home health aide services appears to have virtually no effect on the efficiency with which home health services are provided.

Given the apparent gains from the joint provision of skilled nursing and home health aide care, it is interesting to note that less than 4 percent of the firms in our sample do not offer home health aide services. All of the firms offer skilled nursing visits. Thus, there does not appear to be a substantial problem of failure to achieve the economies associated with the joint provision of these two services. To test the effectiveness of CON regulation in forcing firms to offer both skilled nursing and home health aide services, we again compare urban firms in regulated and non-regulated states. We find that 2.4 percent of urban firms in unregulated states do not offer home health aide services. In regulated states, 1.3 percent of the firms located in urban areas do not

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[9] While this difference appears to be quite large, it is not statistically significant at the traditional 5 percent level.

offer home health aide visits. There is a higher percentage of firms that do not offer home health aide services in unregulated states. However, this difference is not statistically significant. Thus, CON regulation does not appear to make a significant difference in terms of achieving the economies associated with joint offering of home health aide and skilled nursing care.

CON REGULATION AND THE LEVEL OF COSTS

We also used our individual firm cost function to estimate the effect of CON regulation on the costs firms incur in providing a given quantity of services. If the correct explanation of the effect of CON is offered by the "economic" theory and CON effectively limits competition, we may expect to see firms in regulated environments incurring higher costs to provide a given quantity of services. This is particularly true of non-profit firms where the absence of a profit-making motive may lead to firms not minimizing costs when competition does not force them to do so.

We found that costs were significantly higher for non-profit firms where CON regulation is present. This finding is consistent with the "economic" theory of CON regulation. However, we did not find similar results for government providers. For this group of home health agencies, costs were lower, *ceteris paribus*, in markets with Certificate of Need regulation. This is somewhat surprising, since presumably these firms, like non-profit firms, have reduced incentives to minimize costs. Finally, costs for for-profit firms were higher, but not to a significant degree, where there was CON regulation. The lack of a significant increase in costs for these firms is as we would expect, since firms aiming to maximize their profits should seek to minimize costs whether or not they have market power.

In addition to the effect of CON on government firms, there is a second caveat that keeps us from concluding that the higher costs for non-profit firms where there is CON provide clear support for the "economic" theory of regulation. Our

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data do not permit us to control for the quality of care being offered by different home health providers. As we noted above, while it does not appear to be the primary purpose of CON regulation, it is possible that this form of regulation could be used to assure that providers meet minimum quality standards. If this is occurring, it is possible that the higher costs we are observing merely reflect the costs of providing higher quality care.

Having raised the possibility that the cost increases we observe are the result of higher quality, we would note that Certificate of Need regulation would not appear to be the most efficient way for a state to insure appropriate minimum quality standards. States already license some of the health care professionals who provide home health care. For example, nurses and physical therapists are generally licensed. If a state is concerned with the quality of service offered by home health agencies, licensing of the workers providing the services would appear to be preferable to limiting entry of additional home health firms. Since licensed professionals can practice in a variety of settings, there is less likelihood that the licensing procedures will be used to limit competition in any particular segment of health care.

Our estimates of the effect of CON on cost levels can be used to estimate the effect of CON regulation on the total costs of providing home health services. We estimated that costs were approximately 2 percent higher, on average, where there is CON regulation. This translates into a total increase in costs of approximately $46 million in 1984.[10]

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[10] This figure is based on an estimate that total expenditures on home health care services in 1984 were $6.7 billion. (Health Care Financing Administration (1985)) It further assumes that the percentage of expenditures in markets with CON regulation can be approximated by the 34.2 percent of all visits in our sample that were provided by firms in markets with CON regulation.

While this figure is not insubstantial, it may underestimate the extent to which Certificate of Need regulation causes consumers, private insurers, and government programs such as Medicare and Medicaid to pay more for home health services. This would be true if the higher costs we observe for nonprofit firms in regulated markets represent decreased attention to cost control because of reduced competition. The $46 million figure does not include any increases in price that are not reflected in cost increases. Thus, for example, it does not include any higher prices charged by firms that translated the higher revenues into higher profits. While estimating the price effects of CON is extremely difficult since our data is on costs and not prices, we can very tentatively suggest that if such increases were incorporated into this figure, they may push the total cost upward to the neighborhood of $100 million in 1984.[11]

RESULTS OF AGGREGATE ANALYSIS

The results discussed so far have been based on a cost function estimated at the level of the individual home health provider. Some additional analyses were performed where the individual firm data were aggregated to form market level data. Using these data we can gather additional evidence concerning the effect of Certificate of Need regulation in home health care.

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[11] This figure is derived by assuming that the estimated cost increase for non-profit firms due to CON regulation is an approximation for the increase in prices of home health services in those markets. Such an assumption may be reasonable if the higher costs for non-profit firms in the presence of CON regulation arise because these firms are dissipating the higher revenues resulting from reduced competition in the form of higher costs.

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The first analysis with this market level data was designed to determine whether home health firms tended, on average, to be larger or smaller in regulated markets than in unregulated ones. Further, we sought to determine whether firms in regulated markets were more or less diversified than their counterparts in unregulated markets. Based on some simple regression models that controlled for the total number and types of home health visits in a market area, we found that there were fewer firms in regulated markets. The difference between regulated and unregulated markets amounted to 11.6 percent of the average number of firms in a market. Further, home health firms tended to be more diversified, *ceteris paribus*, in markets where there was CON regulation. Thus, on average, firms in markets with Certificate of Need regulation tended to be larger and more diversified than their counterparts in unregulated markets.

A second analysis involved the estimation of a cost function at the market level. The total costs of the various firms in the market were combined and were modeled as a function of the total number of visits of each type of service in the market. By including a variable to identify markets with CON regulation in the regression model, we performed another test of the hypothesis that costs are lower in regulated markets. Based on two different specifications of the model, no evidence that CON regulation results in lower costs was found. In one case, costs were found to be significantly higher in regulated markets. In the other, costs were higher in regulated markets, but the difference was not statistically significant.

CONCLUSIONS

This study provides no evidence to support a "public interest" justification for continued Certificate of Need regulation of home health firms. Cost savings that would result if home health firms were of a more optimal size are quite small. Further, firms in states without CON regulation do not have larger unrealized potential cost savings than do firms in

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regulated markets. Economies associated with diversification appear to be largely realized provided a firm offers at least skilled nursing and home health aide services; and almost all of the firms in our sample offer both of these services. The percentage of firms that do not offer home health aide services does not vary significantly with the presence or absence of CON regulation.

While we find no evidence to support a "public interest" justification, some of our results are consistent with the alternative "economic" theory of CON regulation. Analyses at both the firm and the market levels suggest that costs are higher in regulated markets than where entry is unrestricted. These findings are consistent with the notion that CON limits competition by functioning as a barrier to entry. –

Our findings provide no justification for continued Certificate of Need regulation in the home health care area. Such regulations do not result in lower costs. If anything they cause costs to be higher. Further, a Certificate of Need program for home health firms involves administrative costs. Perhaps more importantly, by retarding or preventing entry of new firms, CON regulation of home health markets may be denying consumers the benefits of innovative or low cost services that could lower the cost or improve the quality of health care. There are important reasons for allowing the market to function unencumbered by these regulations.

PART II

THE STUDY IN DETAIL

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CHAPTER 1

INTRODUCTION

As of June 1985, firms that wished to begin providing home health care services were required to obtain approval under a state Certificate of Need (CON) regulation in approximately 34 states.[1] CON regulations create barriers to new entry into a market. Under these regulations, a firm must seek permission to provide services through a process that, in general, involves both local and state health planning agencies. First, an applicant must seek approval from a local Health System Agency (HSA). The HSA is either a non-profit corporation or a public agency. Its governing board includes representatives of incumbent health care providers, although the majority of the board members are required to be "consumers". The HSA makes recommendations to a state agency that makes the final decision regarding the approval of a new entrant into an entry-regulated sector of the health care market.[2] Thus, unlike most markets

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[1] In some states, only certain types of home health providers, e.g., hospital-operated or proprietary home health agencies, were required to obtain CON approval. Telephone conversation with Susan Petty, Home Health Services and Staffing Association, September 23, 1985.

[2] This discussion of the CON review process is drawn from Joskow (1981) and Havighurst (1973). According to Havighurst,

> "Usually a state agency, either a separate one or the department of health, appears to have final authority, but influential advice and comments are frequently provided by local planning agencies and state advisory councils. The complex advisory and review processes tend to obscure such matters as whether advice received from various planning and advisory agencies is merely window-dressing or is tantamount to being final and whether appellate review is *de novo* or accords substantial weight to the initial decision." (Havighurst (1973), p. 1172)

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in our economy where a firm that sees the opportunity to satisfy consumer wants is free to begin providing services, a firm that seeks to provide home health services must expend time and effort overcoming regulatory barriers to entry.

Is there any economic justification for these barriers to entry? Do CON regulations result in the more efficient operation of home health care markets, or do they merely hinder the competitive operation of the market? In this study, we will explore these issues.[3]

WHAT IS HOME HEALTH CARE?

Home health firms perform health care services in the patient's residence. The availability of these services can mean earlier discharge for some hospital patients and the ability of some disabled or elderly patients to live in their own homes rather than being institutionalized or placed in a nursing home. According to Kurowski, Schlenker, and Tricarico,

> "The term 'home health care' generally refers to those medical, therapeutic, and professional services provided to patients in their homes on an intermittent basis, e.g., skilled nursing care, physical therapy, speech therapy, occupational therapy, medical social services, and home health aide services. Many individuals who use these

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[3] It is useful to note that in 1979 Congress rejected a proposal to require CON review of entry of new home health providers. In rejecting this proposal, the House Committee on Interstate and Foreign Commerce stated that "Certificate of Need regulation should be extended to only those services where the market forces of supply and demand will not appropriately allocate the supply of that service. The committee feels that home health services is a developing field and that competition between those who provide home health services should be encouraged." (House Committee on Interstate and Foreign Commerce (1979), p. 76)

services are elderly and/or chronically ill and in
need of assistance with the basic activities of
daily living. Other individuals who use home
health services are recovering from an acute
episode of illness and have been recently dis-
charged from an inpatient facility. Providers of
care, often called home health agencies (or
programs), are typically administered by visiting
nurse associations, governmental units (e.g. county
health departments), private non-profit organiza-
tions, hospitals, and proprietary firms."[4]

There has been a tremendous growth in home health care in
recent years. In 1984, total expenditures on home health care
were $6.7 billion. Of this total, 38.8 percent was paid by
private patients and private insurance. The remaining $4.1
billion was paid by government programs.[5] By comparison, in
1977 only $1 billion of government funds went to pay for home
health services.[6]

In 1967, less than 2,000 home health agencies were certified
to provide care to Medicare beneficiaries. By 1981, the number
had only risen to about 3,000 firms.[7] However, by July 1985,
the number of Medicare-certified home health agencies had risen
to 5,682, and, according to one source, there may have been as
many as 10,000 agencies in total, including agencies not
certified to provide care to Medicare recipients.[8] According
to the Health Care Financing Administration, the dramatic
growth in the number of Medicare-certified agencies since 1980

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[4] Kurowski, Schlenker, and Tricarico (1979), p. I.2.

[5] Health Care Financing Administration (1985).

[6] Kurowski, Schlenker, and Tricarico (1979), p. H.1.

[7] Health Care Financing Administration (1985).

[8] Anderson (1985), p. 51.

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has been caused by changes in federal legislation that eliminated visit limits and prior hospital stay requirements for reimbursement under Medicare, by increases in the elderly population, and by advancements in medical technology such as home intravenous therapy.[9]

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[9] Health Care Financing Administration (1985).

CHAPTER 2

WHY CERTIFICATE OF NEED REGULATION?

To determine whether it is possible to justify Certificate of Need regulation in the home health care area, it is first desirable to understand what this form of regulation was designed to achieve. In order to do so, we must examine the literature regarding the regulation of hospitals, since CON regulations appear to have been a response to perceived problems in the hospital and nursing home industries[1] and previous analyses of CON regulations have dealt with hospitals. Once we understand the supposed need for these regulations for hospitals, we can then examine whether the conditions that would justify such regulations exist in the home health area.

Two hypotheses concerning the effect of Certificate of Need regulation of hospitals have appeared in the economics literature. The first is based on the notion of a failure in competitive markets and a "public interest" use of regulation to correct for this failure. The second model is based on the notion that incumbent providers control the issuance of CON approvals and that they use their control of the regulatory process to their own economic advantage. This model is based on the "economic" theory of regulation.[2]

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[1] Havighurst (1973) reports that 23 states had CON laws as of 1973. All but one of these laws covered new hospital construction. Most of the laws also covered the construction of new nursing home facilities and the expansion of bed capacity and the physical plant of existing hospitals and nursing homes. (pp. 1145-1147) Further, he reports that the first mandatory CON law was New York's Metcalf-McCloskey Act of 1964 which covered hospitals and nursing homes. (p. 1151)

[2] The "economic" theory of regulation, also called the "capture" or "interest group" theory, was first developed by Stigler (1971) and Posner (1974b).

A. *THE "PUBLIC INTEREST" THEORY OF CON REGULATION*

The "public interest" justification for Certificate of Need regulation of hospitals is based on the belief that unregulated competition will result in the construction of unnecessary facilities.[3] As a result, proponents of this theory believe, that, if competition is permitted, facilities will be under-utilized and the costs of providing health care will be higher than necessary. One of the clearest and most complete discussions of this model is found in Paul Joskow's 1981 book Controlling Hospital Costs: The Role of Government Regulation. In this book, Joskow argues that the National Health Planning and Resource Development Act of 1974,[4] that required states to establish Certificate of Need programs or face the loss of federal funds, was "clearly more concerned with issues of unnecessary facility construction and escalating health care costs," than it was with planning for the expansion of existing health care facilities and making certain that these facilities

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[3] It is possible that Certificate of Need regulation could be used to assure that minimum quality standards are met by health care providers. Agencies making CON decisions appear to have the authority to consider issues related to quality in making their decisions. While such a rationale is possible, this does not appear to be the primary motivation for these laws. Rather, the primary concern appears to have been duplication of facilities with the result that costs of health care are excessive. (See Joskow (1981).) Further, previous analyses of the purposes and effects of CON regulation focus, as does this one, on the effectiveness of these regulations in controlling costs and promoting economic efficiency. (See Joskow (1981), Havighurst (1973), Gelman (1982), Sloan and Steinwald (1980), and Rappaport, Robertson, and Stuart (1982).)

[4] Public Law 93-641.

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were located where they were most needed.[5] While Joskow suggests two possible types of unnecessary facility construction, he concludes that the most that can be expected even where a CON program is effective is elimination of unnecessary duplication of facilities.[6]

[5] Joskow (1981), p. 79. Other authors have also suggested that CON regulation is designed to eliminate unnecessary construction of facilities. See Gelman (1982), p. 109, Sloan and Steinwald (1980), p. 83, and Rappoport, Robertson, and Stuart (1982), p. 429.

[6] Joskow's second model of CON regulation suggests that CON control over capital construction could be a response to the incentive to consume excessive amounts of health care. This incentive arises because, given current forms of health insurance, the consumer does not directly pay the costs incurred in providing him with health care. Joskow suggests that CON agencies could seek to reduce the consumption of health care by limiting capacity. A problem with this approach is that it leaves to the hospital the task of choosing which patients are to receive treatment. There is no reason to believe that hospitals are well equipped to identify and provide treatment only to patients who value the service more than the true social cost of providing it. See Joskow (1981), pp. 80-88.
    After describing this alternative objective of CON regulation, Joskow concludes that it is very unlikely that state and local CON agencies would take this approach to CON implementation absent federal constraints on capital expenditures. While it is conceivable that welfare would be improved by such a program, he argues that the benefits of such restrictions are likely to be far less immediately apparent than the costs, and the state and local planning agencies are likely to yield to provider and consumer pressures when the demand for additional facilities can be demonstrated. (See Joskow (1981), pp. 85-87).

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The problem here is that health care services may not be efficiently provided if, in an attempt to compete for physicians and to increase the prestige of its administrators,[7] every hospital in an area offers every type of hospital service rather than specializing in the provision of some subset of services. If this problem creates inefficiency in the provision of health care services, it could manifest itself in two different ways. First, if too many institutions have the same expensive equipment, the average hospital will not fully utilize its equipment. For example, if each hospital in an area has a CAT scanner which is only used ten hours per week, the cost of providing CAT scans may be higher than if only one-half or one-third of the hospitals had this expensive equipment and the equipment was in operation 20 or 30 hours per week.[8]

Figure 1 illustrates this form of inefficiency for a single, hypothetical procedure that utilizes some type of capital equipment. The curve AC represents the average or unit cost of performing this hypothetical procedure. If two institutions offer the procedure and each performs it Q times per year, the unit cost of performing the procedure will be C_1. If only one institution offers the procedure and therefore performs it 2Q times per year, the unit cost will only be C_2. This cost is lower than C_1 because the expense of purchasing the second piece of equipment has been avoided.

By producing only Q units of output, each institution fails to achieve available economies of scale. Economies of scale,

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[7] See the discussion of hospital motivation on pp. 31-32.

[8] While such increased utilization will result in a lower average cost of using the equipment, it will not always result in more efficient health care delivery. If fewer hospitals have the equipment, additional time will be spent transporting patients to the hospital that has the equipment and additional coordination effort may be needed. Increases in these costs may more than offset the savings realized from the more intensive utilization of equipment.

Figure 1

Economies and Diseconomies of Scale
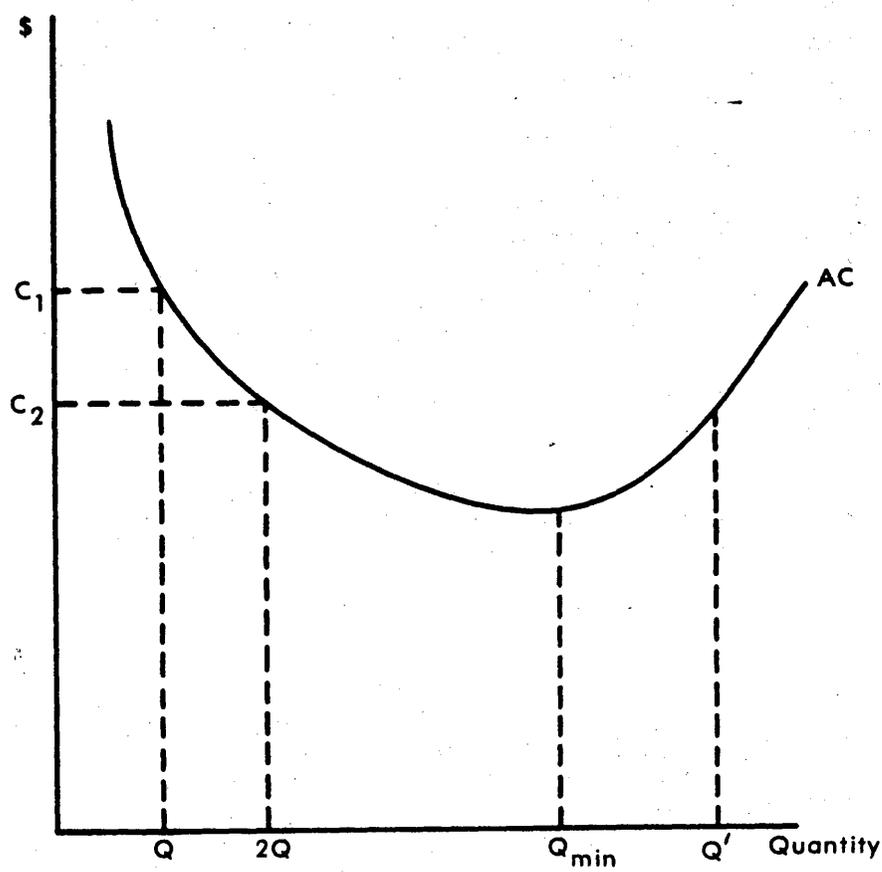
exist when the average cost curve is downward sloping.[9] Thus, in Figure 1, economies of scale exist for any output level less than Q_m. As a general matter, we can show that, if there is more than one firm in a market providing a product or service and if these firms operate where there are economies of scale, the total cost of providing the product or service could be reduced by having fewer firms offer the product with each firm providing more units and thereby more completely realizing the available economies.[10]

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[9] Baumol, Panzar, and Willig argue that average cost may be decreasing at a point and yet local economies to scale may not exist there. This situation arises because they define an average cost curve as decreasing even if its derivative at a point is zero, provided the derivative is negative for both slightly larger and slightly smaller quantities. (See Baumol, Panzar, and Willig (1982, p. 22). This problem does not arise with the form of the cost function estimated in this study.

[10] There is an analogous concept known as diseconomies of scale. Diseconomies of scale exist when the average cost curve is upward sloping, as at point Q' in Figure 1. If firms in an industry are operating in the range of diseconomies of scale, total cost would be lower if more firms produced the good or service with each firm producing fewer units.

It should be noted that if a good or service is provided by a single firm operating where there are unrealized economies of scale, it is not possible to increase efficiency. In this case the firm is a natural monopoly and the failure to achieve available economies of scale is the result of insufficient demand rather than inefficient organization of the firms in the industry. A natural monopoly situation may exist even if the only firm in the market is operating in the upward sloping portion of the average cost curve. Provided the average cost of the single firm is lower than the average cost of a firm operating at one-half of the market demand, costs are minimized when a single firm provides the product or service.

ECONOMIES AND DISECONOMIES OF SCOPE

The second source of potential inefficiency that might provide a "public interest" justification for CON regulation is excessive diversification of providers. Hospitals are multi-product firms -- they provide many types of health services. It is not obvious that it is most efficient for the same institution to provide all of these services. If competition for physicians and prestige leads hospitals to diversify excessively, the result could again be excessive costs.

The technical economic concept of economies of scope is used to refer to situations where costs depend upon the degree of diversification in a firm. If costs are lower when two services are provided by the same firm rather than by two separate firms, economies of scope are said to exist. If costs are higher with joint production, there are diseconomies of scope.[11]

Thus, according to the "public interest" theory of regulation, CON regulation should reduce or eliminate these two sources of inefficiency. CON regulators should seek to eliminate unnecessary duplication of facilities in order to achieve available economies of scale. In addition, regulators should attempt to make certain that hospitals engage in the optimal amount of diversification. Institutions should not engage in too much diversification in attempting to attract physicians and should not be overly specialized.[12]

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[11] See Baumol, Panzar, and Willig (1982), pp. 71-75.

[12] While this is the theoretical justification for CON regulation in the case of hospitals, most empirical studies have not found CON to be an effective way of reducing hospital costs. See Rappoport, Robertson, and Stuart (1982), pp. 429-431, Joskow (1981), pp. 139-141, Sloan and Steinwald (1980), and Salkever and Bice (1976). For a study showing that CON has constrained hospital investment, see Joskow (1980).

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While this is the proffered "public interest" explanation for Certificate of Need regulation, it is not clear that regulation should be necessary to generate efficient operation in the hospital industry. Economies of scale and economies of scope exist in many other industries, and regulation is not believed to be necessary to cause those industries to operate efficiently. Rather, we expect that competition and free entry will result in efficient production as consumers choose to deal with those firms that provide the goods and services they desire at the lowest prices and firms minimize their costs in order to earn the highest possible profits.

What is so unique about the hospital industry that competition will not result in efficient production? Two arguments have been advanced as contributing to this situation. First, consumers have been found to have very low elasticities of demand for hospital services.[13] In part this is likely due to the fact that the individual consumer often directly pays only a small portion of his hospital bill. Either a government program such as Medicare or Medicaid, or a private health insurance provider pays the bulk of the bill.[14] As a result, consumers have reduced incentives to shop for a hospital or health-care provider that charges lower prices.

What this explanation fails to demonstrate, however, is that consumers do not still have sufficient incentives to engage in enough shopping to result in competitive behavior among hospitals. Further, as Posner has noted, the argument that there is a reduced incentive to control costs because insurers and the government pay a large portion of the costs of hospitalization "is a bit odd, for it runs counter to the normal assumption

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[13] See Newhouse and Phelps (1976) and Feldstein (1977).

[14] In 1975, 88 percent of the cost of hospital inpatient care was paid by private insurance or by government. (Feldstein (1977), p. 1683).

that a large, knowledgeable purchaser can drive a better bargain than a single individual."[15]

The second explanation advanced for the inability to rely on competition to cause health care services to be provided efficiently is that most hospitals are non-profit institutions and are believed to pursue goals other than economic efficiency. As Wendling and Werner argue, "[h]ospitals appear to be concerned with providing a comprehensive and sophisticated array of services."[16] Among the reasons advanced for this behavior is a belief that

> "providing comprehensive services, even though some are seldom used or needed, is considered the responsibility of the general hospital. [Further,] hospitals compete for top medical staffs, partly because such staffs can mean more patients. The more sophisticated the medical technology, the better is the hospital's bargaining position in this labor market."[17]

A similar argument has been advanced by Maw Lin Lee who argues that hospitals compete for physicians and for prestige for their administrators on the basis of having the latest and fanciest equipment on the market.[18]

There are at least two shortcomings of this argument. First, as Posner has noted, non-profit hospitals have to compete with each other and with other charitable institutions for either charitable contributions or government funds to pay for capital construction. And, "[i]t is not obvious . . . that the competition for such funds is less intense than, say, the

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[15] Posner (1974a), pp. 116-117.

[16] Wendling and Werner (1980), p. 7.

[17] Wendling and Werner (1980), pp. 7-8.

[18] Maw Lin Lee (1971).

competition among ordinary commercial enterprises for construction capital."[19]   Thus, it is not clear how the non-profit hospital can raise the funds to implement its inefficient goals.   Why should government or private contributors be expected to provide funds for the construction of unneeded health care facilities?[20]

Second, if competition will not generate efficient outcomes because non-profit hospitals do not operate so as to achieve efficiency, CON controls may make the problem worse rather than better. As we shall see below, the "economic" theory of CON regulation is based on the argument that incumbent hospitals use the CON process to limit entry by new competitors -- particularly by for-profit hospitals. The motivation for doing this is that additional competition would force the existing hospitals to operate more competitively. Thus, if the problem is that existing hospitals do not behave like competitive firms, the solution is likely to be more competition, not less.

B.   *THE "ECONOMIC" THEORY OF CON REGULATION*

While the "public interest" theory posits that Certificate of Need regulation was enacted to rectify a market failure in the health care industry, according to the "economic" theory, the effect of the regulations is to protect the economic interests of incumbent providers of hospital services. In the case of hospitals, the need for protection from new entry arguably stems from more than a mere desire for a monopoly position. Several authors have suggested that hospitals seek

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[19]   Posner (1974a), p. 116.

[20]   While competition for capital contributions may limit the construction of unneeded facilities, the absence of property rights over any profits earned by a non-profit hospital and the inability to sell the future rights to such profits may reduce the efficiency with which such a non-profit hospital operates once it is constructed. (See Frech (1976))

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control over competitive entry in order to protect their current practices of cross-subsidizing unprofitable services with the revenues from profitable ones.[21]

As Havighurst has stated:

> "Internal subsidization is already an important phenomenon in the hospital industry. Laboratory, x-ray and pharmacy services, and basic per diem charges are ordinarily profitable, while obstetric care, the emergency room, and the intensive care unit are usually subsidized to some degree. Where hospitals have underutilizied facilities, revenues from other services usually support them."[22]

Wendling and Werner have also suggested that the more sophisticated services, which hospitals wish to provide in order to attract physician staff and to enhance the hospital's prestige, are often unremunerative and require subsidization from other services.[23] Thus, the hospital, in order to achieve its goals of providing comprehensive services and continuing to operate as it has in the past, must maintain the ability to cross subsidize.

However, cross subsidization is not possible if new entry into an industry is permitted. With free, unregulated entry, new firms will begin to provide hospital services and will concentrate on those services on which incumbent hospitals are earning profits. By providing only remunerative services and charging a price slightly below that of the incumbent

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[21] See Havighurst (1973), pp. 1188-1194, Posner (1974a), p. 115, and Wendling and Werner (1980), pp. 7-8.

[22] Havighurst (1973), p. 1191.

[23] Wendling and Werner (1980), p. 8.

firms, the new entrant can take business away from the incumbent and still earn a profit.[24] Faced with such competition, the incumbent firm must either reduce its prices for the remunerative services or face a loss in revenue for this type of business. In either case, the profits used for subsidizing unremunerative services will be reduced. For this reason, the existing hospital will wish to control competitive entry.

Thus, according to the "economic" theory of CON regulation, existing hospitals will wish to control entry of firms that provide services that compete with those services provided by hospitals.[25] Control of competitive entry clearly includes the control of entry by new hospitals -- particularly proprietary or for-profit hospitals which are more likely to offer only the remunerative services and not offer those that are being subsidized.[26] However, the desire to control competitive entry may also extend to other health care providers -- such as ambulatory surgical centers or home health agencies -- that may compete with hospitals in the provision of some services and may use innovative organization methods or technology.[27]

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[24] See Posner (1974a), p. 115. Posner recognizes that such entry may be wasteful if the new entrant is less efficient at providing these services than the incumbent firm. However, he rejects this as a justification for maintaining CON controls.

[25] Havighurst also suggests that CON regulators may share the desire of incumbent hospitals to maintain the hospitals' ability to engage in cross subsidization. "The health planners . . . sense many unmet needs and desire the power to compel the provision of certain unremunerative services through the franchising of hospitals." Havighurst (1973), p. 1192.

[26] See McCarthy and Kass (1983).

[27] See Havighurst (1973), pp. 1204-1207. Empirical tests have generally found support for the "economic" theory of CON regulation. See Wendling and Werner (1980) and McCarthy and Kass (1983).

CHAPTER 3

AN OVERVIEW OF THE APPROACH OF
THE CURRENT STUDY

What do these two theories of Certificate of Need regulation in the hospital sector imply concerning the need for CON regulation of home health care firms? The "economic regulation" hypothesis provides a clear rationale for existing providers to want entry controls extended to home health providers. Home health firms compete with hospitals to provide treatment of patients who could be treated at home. If home health care is not available, or if it is not of sufficient quality, these patients will have to remain in the hospital. ¯ Further, treating such patients in a hospital is likely to be profitable. These patients are apt to require less-intensive care than others and yet they may be charged the standard per diem rates. Thus, keeping such relatively healthy patients in the hospital is likely to increase the revenues available to a hospital to use in subsidizing other non-remunerative services. As a result, if hospitals control the CON process, they may wish to limit entry by home health firms.

Is there a "public interest" justification for maintaining entry controls on home health agencies? Our discussion of the "public interest" theory of CON regulation of hospitals has focused on the need to regulate entry in order to achieve available economies of scale and to avoid diseconomies of scope. Thus, if there is a "public interest" reason for regulating home health care, it must be because of the presence of such economies in the provision of home health services.[1]

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[1] A "public interest" justification might also be argued to exist if the availability of substitutes for hospital services caused hospitals to be less successful in achieving economies of scale. We do not consider such a possibility in this paper, but note two things about the argument. First, such an argument could potentially be made against many new types of health care providers. If, because of such an argument, new types of

<div align="right">(footnote continued)</div>

This study will seek to determine if such a "public interest" justification exists. Specifically, we seek to determine whether home health firms are subject to significant economies of scale. If unrealized economies of scale exist, do home health firms located in states with CON regulation do a better job of realizing available economies of scale than firms in non-CON-regulated states? Even if there are unrealized economies, there would be little justification for continuing entry regulation if the regulation does not result in improved efficiency. Similarly, the presence of unrealized economies of scope and the success of CON regulation in realizing the available economies will be investigated.[2]

In addition, we will consider whether, independent of economies of scope and scale, home health care firms subject to CON regulation are more or less efficient than their unregulated counterparts. That is, is the cost to provide a given quantity of services higher where there is regulation than where entry is unrestricted? Such a result might be expected, particularly where the providers of home health services are non-profit firms. Certificate of Need regulations may reduce

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(footnote continues)

providers are kept out of health care markets, it could considerably retard innovation and cost reductions in the provision of health care. Thus, one should require strong evidence of substantially increased costs before accepting such a justification for blocking entry of such competitive technologies. Second, provided there are no substantial diseconomies of scale when a home health firm becomes large, once one provider is permitted to provide home health services, this argument would appear to provide little justification for keeping out competitive providers.

[2] We do not investigate whether Certificate of Need regulation has an effect on the quality of services provided. As we noted in footnote 3 on page 24, most discussions of the need for CON do not consider these regulations to be intended for quality control. Further, the data we have available for this study do not permit us to examine quality issues.

the actual or potential competition faced by home health care providers. As a result, providers may be under less pressure to minimize their costs. Non-profit firms in particular may respond to this reduction in competitive pressure by incurring higher than necessary costs since the inability to directly take profits from the firm may lead to the maximization of something other than profits.[3]

To analyze these issues, we will estimate a multi-product cost function for individual home health firms. Using this estimated cost function, we will then examine the degree to which existing home health firms do not realize available economies of scale or are subject to economies, or diseconomies, of scope. Further, we will compare the extent to which firms in states with CON regulation have unrealized economies of scale and economies of scope with the extent of such unrealized economies among firms in non-CON states. The estimated cost function will also permit us to compare the cost of providing a given quantity of services in regulated and unregulated environments. Finally, we will estimate an aggregate cost function in which a community's total cost of providing home health care is explained as a function of the total quantity of services provided in the community.

Before proceeding further, it may be useful to more clearly specify what a multi-product cost function is and what economies of scale and economies of scope mean in the context of a multi-product cost function. A multi-product cost function expresses the relationship among the total costs incurred by a firm providing more than one product, the quantity of each output produced, and the prices of the various inputs used in the production process. That is

$$TC = f(Y_1, Y_2, ..., Y_N; W_1, W_2, ... , W_M)$$

where TC = the total cost the firm incurs in producing these products;

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[3] See Frech (1976).

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Y_i = the quantity of output i produced by the firm; and

W_j = the price of input j used by the firm.

The specific form of the cost function utilized in this study is quadratic in the output variables. Thus, the estimated function includes linear and squared terms in each of the outputs as well as cross-product terms. Ignoring input costs,[4] the form of a quadratic cost function with two products would be

$$TC = a_0 + a_1 Y_1 + a_2 Y_2 + a_3 Y_1^2 + a_4 Y_2^2 + a_5 Y_1 x Y_2$$

Since the quantity of capital used by the firm is not included among the independent variables, the estimated relationship will be thought of as a long run cost function.

With this functional form, the a_0 coefficient represents the fixed costs of doing business. These are costs that have to be incurred in order to do any business at all and that do not vary with the quantity of business.[5] A quadratic form is sufficiently flexible that the estimated function can exhibit economies of scale at low levels of output and diseconomies of scale at higher levels. Alternatively, a quadratic function can exhibit scale economies for all levels of output. It is also possible with a quadratic cost function to estimate the minimum average cost level. This will be useful in determining the relative efficiency of firms in regulated and unregulated states. Finally, the function can exhibit either economies or diseconomies of scope.

One problem with a quadratic form is that it is not possible to have average cost equal its minimum value over a range of

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[4] See pp. 52-56 for a discussion of the treatment of input prices.

[5] Since we are estimating a long run cost fuction, these fixed costs are not to be considered fixed in the sense that they must be paid even if no output is produced.

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outputs. Rather, there is a single output level at which average cost is at its minimum value.[6] As a result, our estimation procedure may suggest that costs continue to fall with quantity increases beyond the point at which the cost curve actually becomes flat. This may suggest that costs would be slightly lower if a firm was of larger scale when, in fact, the firms' costs would not change at all. Because of this, we will want to be careful in interpreting estimated average costs that exceed the minimum value by only a small amount.[7]

We have previously defined economies of scale as existing when the average cost curve is downward sloping.[8] In the context of a multi-product cost function, however, it is necessary to expand on the definition to deal explicitly with the path along which output is changed. In the single product case, there is only one way in which output can be expanded: producing more units of the single product. If total costs increase less than proportionately when output of that single product is increased, average costs will decline and economies of scale will be present.

When a firm produces two or more products, there is no unique way to define an expansion in output. The firm could expand its output by producing more of one product while maintaining its output of other products, or it could expand the output of all of its products. Further, total costs could rise more rapidly with some kinds of increased production than with others. Thus, economies of scale can only be measured after the way in which output is assumed to change is defined.

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[6] As discussed below, in the multiple output context, average cost is only defined along a particular output ray and therefore we talk about ray average cost. Along each ray in output space ray average cost can only attain its minimum value at one level of output. However, the minimum value can occur at different points on different rays.

[7] The way we handle this problem is discussed on p. 76, below.

[8] See pp. 26-28.

Baumol, Panzar, and Willig propose the measurement of economies of scale for the multi-product firm along a path that involves proportional changes in all of the firm's outputs. They define a concept they call ray average cost, which corresponds to the traditional concept of average cost except that it is measured along a ray in output space that goes through the origin and through the firm's current output level. Along such a ray, all of the firm's outputs expand or contract proportionately.[9] Scale economies can then be measured along such a ray in the same way as in the single product case. If ray average costs are declining, economies of scale are present; if ray average costs are increasing, there are diseconomies of scale.[10]

This concept of ray average costs and the changes in costs as outputs are expanded or contracted proportionately will form the foundation for examining the extent of unrealized economies or diseconomies of scale in home health care.[11]

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[9] See Baumol, Panzar, and Willig (1982), pp. 48-50. Technically, ray average cost can be defined as $C(ty^o)/t$ where y^o is a vector of the firm's initial output level and t is a scalar.

[10] See Baumol, Panzar, and Willig (1982), pp. 50-52. Again the case of a strictly decreasing function with a zero derivative is ignored.

[11] In the context of a quadratic cost function, it can be seen that a cost function involving a single output, Y, will either exhibit intially increasing and then decreasing returns to scale or will exhibit economies of scale throughout the range of outputs depending on the coefficient on the quadratic term. If the fixed-cost coefficient a_0 is positive and the coefficient on the quadratic term is positive, average cost will first fall and then rise. To see this, note that such a cost function has the form

$$TC = a_0 + a_1 Y + a_2 Y^2$$

and average cost, AC, is equal to

$$AC = a_0/Y + a_1 + a_2 Y.$$

The derivative of AC with respect to Y is

$$dAC/dY = -a_0/Y^2 + a_2.$$

Since a_0 is positive, the AC function reaches a minimum at

$$Y^2 = a_0/a_2$$

and is negatively sloped for smaller values and positively sloped for larger values. If a_2 is negative, AC will decline for all values of Y, never reaching a minimum value.

In the multi-product case, there is no such simple way to determine whether a firm is subject to economies of scale. Whether a firm faces economies of scale at all output levels along a ray or eventually faces diseconomies of scale depends on the relationships among the coefficients on the various quadratic and cross-product terms. This can be illustrated for the two-output case where

$$TC = a_0 + a_1 Y_1 + a_2 Y_2 + a_3 Y_1^2 + a_4 Y_2^2 + a_5 Y_1 x Y_2.$$

In such a case, expansion along an output ray can be defined by letting

$$Y_2 = k Y_1.$$

Using this definition, the quadratic cost function can be rewritten as

$$TC = a_0 + (a_1 + k a_2) Y_1 + (a_3 + k^2 a_4 + k a_5) Y_1^2$$

and

$$AC = a_0/Y_1 + (a_1 + k a_2) + (a_3 + k^2 a_4 + k a_5) Y_1.$$

The concept of economies of scope has been introduced by Baumol, Panzar, and Willig to measure the gains from diversification. Economies of scope are defined as the cost savings realized when two groups of products or services are produced jointly by a single firm rather than by two independent firms, each of which only produces one group of products. These savings are expressed as a percentage of the costs of joint production.[12] If there are positive cost savings from joint production, economies of scope are said to exist. On the other hand, if it is more costly to produce two groups of products jointly, that is cost savings from joint production are negative, it is said that there are diseconomies of scope.[13]

(footnote continues)

This average cost function has the same form as in the one-product case with the term

$$a_3 + k^2 a_4 + k a_5$$

replacing the a_2 term in the one-product case.

[12] See Baumol, Panzar, and Willig (1982), pp. 71-75. They define the degree of economies of scope at an output level y relative to the product set T as:

$$SC_T(y) = [C(y_T) + C(y_{NT}) - C(y)]/C(y)$$

where $C(y_i)$ is the total cost of producing y_i units of the goods in subset i.

[13] In the context of the quadratic cost function, the presence of economies or diseconomies of scope depends on the signs of the cross-product terms. In the two-product case, if the cross product term is negative, it will be less costly to produce the two goods together and therefore there are economies of scope associated with such joint production. If the cross-product is positive, costs are higher with joint production -- there are diseconomies of scope. With more than two products, the presence of economies or diseconomies of scope depends in more complex ways on the cross-product terms.

CHAPTER 4

PREVIOUS STUDIES OF HOME HEALTH CARE COSTS

There have been two previous studies of the costs of pro-
viding home health care. The first study, performed at the
Center for Health Services Research of the University of
Colorado Medical Center, sought to identify the factors that
determine the cost of all the home health services consumed by
a patient during a particular episode of illness. The size of
the home health provider was only one of many variables con-
sidered. The authors of the report suggest that their findings
with regard to firm size show that "service efficiencies may
exist for larger agencies in the delivery of home health care
services."[1]

However, there are several problems with the analysis on
which this conclusion is based. First, the dependent variable
used in this study is total cost of home health care per
episode of illness, i.e., cost per case rather then the cost
per visit. This cost measure depends not only on the effici-
ency with which a firm provides services, but also on the
patient's need for services. For example, while in 57.2
percent of the cases treated by the four included Massachusetts
firms, the patients received between one and ten visits, 6
percent of the cases involved more than sixty visits. For the
four Philadelphia firms, the comparable percentages are 43.2
and 2.4.[2] Thus, a true measure of provider economies of scale
can only be obtained after controlling for differences in the
intensity of patient needs. When the authors include patient-
specific characteristics to control for these differences, the
size of the provider does not have a statistically significant

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[1] Kurowski, Schlenker, and Tricarico (1979), p. III.5.

[2] Kurowski, Schlenker, and Tricarico (1979), p. III.6.

relationship with cost per episode.[3] Thus, using the best
specification of the model for examination of the question of
economies of scale, the reported results do not appear to
support the authors' conclusions.

A second problem with the Kurowski, Schlenker, and Tricarico
study is that, in estimating the relationship between the cost
of home health care per episode of illness and the size of the
provider, the relationship is assumed to be linear. Such a
specification implicitly assumes that there are no fixed costs
incurred in providing home health services. While, the fixed
costs of a home health firm may be relatively small, use of a
specification that requires them to be zero seems undesirable.
Further, use of a linear specification for average cost means
that the size of firm for which costs are minimized cannot be
determined; and there is no minimum cost with which to compare
observed cost figures. Rather cost must continuously increase
or decrease with firm size.

In addition, the study's results are based on a very small
sample of firms. Data for only four visiting nurse
association-sponsored agencies in Massachusetts and four
hospital-based agencies in Philadelphia were used in the
study.[4] Further, the firms in the two geographic regions were
found to be sufficiently different that separate analyses were
performed for each location. Thus each set of results is
location specific and is based on only four firms.[5]

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[3] The reported results appear to be at odds with the
authors' claim that "The regression findings suggest that [the
negative relationship between the size of the provider and the
cost of care per episode], though tenuous, is not due to
differences in patient use mix or outcomes. . . ." (Kurowski,
Schlenker, and Tricarico (1979), p. III.5).

[4] Kurowski, Schlenker, and Tricarico (1979), p. II.2.

[5] No tests to determine whether the results for the two
analyses can be pooled as regards certain coefficients are
reported.

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Finally, Kurowski, et al., do not consider the existence of economies of scope or whether Certificate of Need regulation aids in achieving available economies of scale or scope. Thus, even if their findings of unrealized scale economies are correct, the case for maintaining CON regulation is incomplete.

The second study, done by Hay and Mandes, appeared in the Health Care Financing Review in the Spring of 1984. This study examined economies of scale by estimating a quadratic cost function for 74 non-profit, non-institutionally-based home health agencies in the State of Connecticut. The data used were for 1981. The authors found that economies of scale existed until a firm provided 7,159 skilled nursing visits[6] per year. This is about 1,000 visits per year more than was made by the "average" firm in the sample of firms included in the study. They then concluded that "[i]f all agencies were operating at the optimal production point, the potential savings to consumers Statewide would be about 10 percent of the $11.8 million spent for all sample agencys' [sic] skilled nursing visits."[7]

This study fails to account for the multi-product nature of firms in the home health care industry. Instead, Hay and Mandes based their analysis only on the number of skilled nursing visits provided by a home health agency. They report that skilled nursing visits accounted for between 22 and 87 percent of the total business of the firms in their sample. On average, skilled nursing visits made up 45 percent of an agency's business. Thus, Hay and Mandes have ignored substantial diversification on the part of the firms they are analyzing. They, therefore, cannot consider the presence or absence of economies of scope. In addition, their approach can cause problems in estimating economies of scale. If large

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[6] A visit is a single treatment session performed by a provider of home health services -- such as a visiting nurse.

[7] Hay and Mandes (1984), p. 113. The authors do not explain how this figure was derived, nor do they explain how the "average" firm was determined.

firms tend to be more diversified than small firms, what appears to be economies of scale in the Hay-Mandes analysis may actually be economies of scope. Even if there is no correlation between size and the extent of diversification, the failure to account for the multi-product nature of home health agencies will reduce the precision of the resulting statistical estimates.

Another problem with the Hay-Mandes analysis is that it uses costs allocated to skilled nursing visits, as reported to the Connecticut Commission on Hospitals and Health Care, as the dependent variable. Thus, the cost figures depend upon the methods adopted for allocating cost among the various services provided by home health agencies. It is well known that the allocation of costs to one product of a multi-product firm frequently involves a fair amount of arbitrary accounting convention. The resulting costs allocated to one product -- in this case skilled nursing care -- may bear little relationship to the underlying cost relationships.[8] Thus, any relationship estimated on the basis of such allocated costs may be substantially affected by the allocation rules employed.

The Hay-Mandes study is also based on data for only one state and includes only one type of provider -- traditional non-profit, non-institutionally-based agencies. Further, the study does not consider whether CON regulations further the realization of available economies of scale. Indeed, such an analysis is not possible with a sample of firms from a single state since comparisons between regulated and unregulated environments cannot be made.

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[8] See Braeutigam (1980), pp. 182-185, and Benston (1985), p. 47.

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CHAPTER 5

ESTIMATION OF A MULTI-PRODUCT COST FUNCTION FOR INDIVIDUAL HOME HEALTH FIRMS

By estimating a quadratic, multi-product cost function, we can avoid the shortcomings of the earlier studies. With a quadratic form, the cost function can either exhibit initially increasing and then decreasing returns to scale or exhibit increasing returns to scale throughout. The multi-product function also permits a direct study of the effects of diversification. In addition, since the dependent variable in estimating the multi-product cost function is the total costs incurred by the firm, the allocation of costs to individual services is not necessary. Thus, the problems associated with cost allocation are avoided.[1]

The cost function was estimated using individual firm cost and output data taken from the 1981 Medicare Cost Reports filed with the Health Care Financing Administration (HCFA).[2] These

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[1] To the extent that the firms in the sample provided services in addition to those included in the Medicare reports, problems associated with the allocation of costs between services included in the Medicare reports and those not included can remain. However, the problem should be substantially smaller than if the analysis was restricted to the costs allocated to one service as was done by Hay and Mandes (1984).

[2] Some readers may wonder whether any results based on an analysis of 1981 data are still relevant. As we noted above, the number of Medicare-certified firms has risen from about 3,000 in 1981 to 5,682 by July 1985. Further, there have been substantial changes in Medicare reimbursement for hospitals that may have increased the demand for home health services. For purposes of the analysis being done here, however, these changes should not affect the results. If demand expansion has any effect on the realization of scale economies, it should be to reduce the extent of urealized economies. If CON regulation

(footnote continued)

reports are required of firms certified to provide home health services to Medicare recipients.[3] Data for a total of 2,382 firms were included on the data tapes provided by HCFA. Of these, data for 1,764 firms -- 74 percent of the total -- were used in this study.[4]

(footnote continued)

did not contribute to the efficient operation of home health care firms in the environment of 1981, it is hard to see why it would do so with the expanded level of demand found in 1985.

[3] Unless otherwise noted, all of the data used in the study come from these reports.   —

[4] Hospital-based firms, amounting to about 15 percent of the total firms included in the HCFA files, were deleted from the sample because their reports were not comparable to those for non-institutional providers. (Similarly, Kurowski, Schlenker, and Tricarico (1979) found significant differences between the costs of hospital-based and other home health agencies.) In addition, a few firms that reported on an earlier form were excluded because of data incompatability. Data for 28 firms located in Puerto Rico and two firms in Hawaii were also deleted because of concerns that these firms' costs might differ from those in the rest of the United States. (There were no Alaskan agencies in the data base.)
Finally, during the estimation process, attempts were made to verify the data for observations that appeared to be having a large effect on the estimated cost function. Highly influential observations were identified by a method developed by Belsley, Kuh, and Welch (1979, pp. 14-15). Observations identified as being highly influential were checked against the original reports filed with HCFA. Where data inconsistencies were uncovered or where evidence that the firm did not actually provide home health care services was uncovered, the observation was deleted. (In some cases, firms that provide treatment on an outpatient basis at a hospital, skilled nursing facility, or rehabilitation center can be reimbursed as home health services. See Health Care Financing Administration, "From
(footnote continued)

There were six services included in the multi-product cost function. The services, and the notation used for each, are: skilled nursing care (Y1), physical therapy (Y2), speech pathology (Y3), occupational therapy (Y4), medical social services (Y5), and home health aide care (Y6).[5] These are the six home health services for which Medicare reimbursement is available and are therefore the six services for which data are available on the Medicare Cost Reports.[6]

Table 1 shows the number of firms among the 1,764 in the sample providing each of the services. In addition the table

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(footnote continues)

Simple Idea to Complex Execution: Home Health Services Under Titles XVIII, XIX, and XX," Draft Report, April 1979, as quoted in Kurowski, Schlenker, and Tricarico (1979), p. H.3.) A total of 10 observations were deleted in this process.

While no formal tests were conducted to determine whether deleting these various groups of firms leads to biased results, we see no reason to believe that it does.

[5] In using the number of visits of each service as the unit of output for our analysis, we assumed that a visit by a particular type of provider was a homogenous unit of output. This assumption was necessary since the available data did not allow us to discriminate among visits or to develop a measure of the complexity of cases treated by a firm.

[6] Health Care Financing Administration, "From Simple Idea to Complex Execution: Home Health Services Under Titles XVIII, XIX, and XX," Draft Report, April 1979, as quoted in Kurowski, Schlenker, and Tricarico (1979), p. H.3. Kurowski, et. al. report that other services provided by home health agencies include nutrition counseling, inhalation therapy, and laboratory services. They report, however, that in their sample of firms "the frequency of such visits and the subsequent cost of care were relatively minimal." (Kurowksi, Schlenker, and Tricarico (1979), p. II.10) Their study, like this one, considered only the six home health services for which Medicare reimbursement is available.

Table 1

Number of Sample Firms Providing Each
Home Health Care Service and Summary Statistics
on Number of Visits Per Firm in 1981

	Number of Firms Providing Service	Mean Number of Visits	Minimum Number of Visits	Maximum Number of Visits
Skilled Nursing Care	1,764	7,692	8	371,857
Physical Therapy	1,463	1,823	1	56,132
Speech Pathology	1,077	379	1	6,437
Occupa-tional Therapy	771	451	1	6,382
Medical Social Services	622	362	1	6,324
Home Health Aides	1,701	6,069	1	507,840
Total Firms in Sample	1,764			

shows the minimum, maximum, and average number of visits of each type provided by these firms in 1981.[7] All of the firms in the sample offered skilled nursing care, and the average number of skilled nursing visits per firm during 1981 was 7,692.[8] Home health aide visits were provided by 96 percent of the firms in the sample, with the average number of such visits for firms providing this service being 6,069. At the other end of the distribution, less than half of the firms in the sample offered occupational and medical social service visits.

THE TOTAL COST VARIABLE

The dependent variable in the cost function estimation was, of course, the total costs incurred by the firm in providing the six home health services. This variable was constructed from average cost per visit figures for each service that the firms provided on their HCFA reports.[9] For each firm, the average cost figures were multiplied by the total number of visits of each type provided by the firm and then aggregated

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[7] Reports are for the firms' 1981 fiscal years. For most firms this is January 1 to December 31.

[8] To be eligible to receive reimbursement under Medicare, a home health agency is required to provide skilled nursing care. (Health Care Financing Administration, "From Simple Idea to Complex Execution: Home Health Services Under Titles XVIII, XIX, and XX," Draft Report, April 1979, as quoted in Kurowski, Schlenker, and Tricarico (1979), p. H.3)

[9] We have not audited the data provided to HCFA. With the exception of the cases discussed in footnote 4 on p. 48, we have simply employed the HCFA data in our analysis. Thus, if there are reporting problems in the reports filed with HCFA, they could affect the results reported here.

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across the six services.[10] This sum was then adjusted by an index of relative wage rates in different parts of the country to form the total cost variable actually used in the estimation.[11] The dependent variable in the regression can therefore be thought of as a constant-wage measure of firm total costs.

OTHER VARIABLES INCLUDED IN THE COST FUNCTION ESTIMATION

Adjusting the total cost figure for differences in wage rates means that it was not necessary to include a wage rate variable in the cost function. Differences in other factor costs were also not explicitly included in the estimating equation. Instead, a number of other variables were included to control for cost differences across firms in the sample. Because home health care is highly labor intensive, avoiding explicit consideration of cost differences from non-labor factors was felt to be a reasonable simplification.

Among the variables included was URBAN, which takes on the value one for firms located in urban areas. This variable was included to capture possible cost differences between urban and rural firms. For example, urban firms may have higher capital costs. On the other hand, firms located in rural areas may spend more time and incur greater expense in travelling from one visit to another. Thus, while there are theoretical reasons for including URBAN, there is no prediction on the sign of the coefficient.

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[10] These data are reported on Part I of Worksheet C of the reports. Since the reported average costs were aggregated back to a firm total cost figure, the methods used to allocate costs and arrive at the individual average costs do not affect the variable of interest to us.

[11] The wage index used was based on an index included in the Medicare Cost Reports and was adjusted so that the average value of the index was equal to 1.0.

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A variable reflecting the fraction of a firm's costs that were reimbursed by Medicare was also included in the cost equation. This variable is MCARE and is a continuous variable between 0 and 1.0.[12] It was included to capture the effects of Medicare reimbursement on cost minimization by home health firms. Because Medicare pays 100 percent of costs, a firm for which Medicare recipients comprise a higher percentage of its business may feel less pressure to contain its costs than a firm that obtains most of its business from private pay patients. On the other hand, because Medicare will not reimburse at a rate above the 75th percentile, high cost firms may feel more pressure to control their costs if Medicare is responsible for a high percentage of their costs.[13]

Variables to reflect the organizational structure of the home health firm were also included. These variables, which assume the values zero and one, are: NPROF for non-profit firms, PROF for for-profit firms, and GOV for government agencies. They were included to capture cost differences across different types of firms.[14] For example, non-profit and

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[12] This variable is constructed as follows: The number of Medicare-reimbursed visits of each service type is multiplied by the firm's cost per visit for that service, and the resulting figures are then summed across the six included home health services. This total is then divided by the firm's total costs. It should be noted that this figure can be affected by the allocation methods used by the individual home health provider. We have not analyzed the effect of these allocations on the results reported here.

[13] Each year, Medicare establishes a national reimbursement ceiling at the 75th percentile for each home health service category. These national ceilings are adjusted for wage rate differences in different parts of the country and for differences in fiscal years to arrive at the final payment ceilings.

[14] Including all three firm-type variables in the estimating equation would create statistical problems. To avoid this, the variable PROF was not included in the equation. The variables
(footnote continued)

government firms may have lower costs because they are not required to pay certain items such as taxes that are paid by for-profit firms. Alternatively, non-profit firms may have higher costs because, absent pressure to earn profits for investors, they may be more likely to respond to a lack of competitive pressure by failing to aggressively control costs and by incurring increased expenses for employee benefits such as fancy offices.[15] Government firms may be less cost-conscious than other types of firms because they do not directly face market discipline. Thus, there are various possible explanations for the inclusion of these variables, and no sign predictions are possible.

A variable CON, reflecting the presence or absence of Certificate of Need regulation, was also included in the cost equation.[16] This variable was entered interactively with the firm organization variables.[17] By entering the CON variable in this way, it is possible to test the hypothesis that non-profit firms in states with CON restrictions on entry engage in less cost control than their counterparts in states with no restrictions on entry. As discussed previously, this could occur

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(footnote continues)

NPROF and GOV then represent the cost differences between non-profit and for-profit firms and between government and for-profit firms respectively.

[15] For a discussion of the presence or absence of this type of behavior in non-competitive industries, see Scherer (1980), pp. 464-466. For a discussion of the effect of non-profit status on such behavior, see Frech (1976).

[16] The CON data comes from Home Health Services and Staffing Association as reported in Home Health Line, 8 (May 30/June 6, 1983), pp. 2-13.

[17] These interacted variables are then multiplied by the total number of visits provided by the firm as discussed below.

because CON regulation lessens the degree of actual or potential competition faced by incumbent firms. Similarly, government agencies may be less cost-conscious where a lack of competition permits them to charge higher prices.

Finally, regional dummies were included to capture nonlabor, regional cost differences.[18]

Each of these non-output variables was included in the estimated cost function in a form that multiplies the variable by the total number of visits provided by the firm. Thus, for example, the variable URBAN was multiplied by the variable YSUM, which is the sum of Y1 through Y6, in the estimated cost equation. This was done because of an expectation that the total costs of a large firm would be more affected by cost-increasing or cost-decreasing factors than would a small firm. By using this form, it is implicitly assumed that these factors have an equal effect on each firm's "average" cost of providing services rather than having equal effect on the total costs of the various firms.[19]

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[18] The regional variable for the western states was omitted from the regression equation.

[19] Since average cost is not well-defined in the multi-product context except along a ray defined by a constant proportion of outputs, what is being assumed here is that the effect on average cost will be the same for firms operating at different points along a ray in output space. See Baumol, Panzar, and Willig (1982), pp. 47-49.

A less restrictive estimating equation would interact each of these non-output variables with the number of visits of each output individually. This would permit the included factor to have a different effect on the cost of providing different services. This was not done here because of the substantial increase in the number of parameters and the added complexity of interpretation that would result from such an approach. If the more general approach had been utilized, six new parameters would have been introduced for each non-output variable.

Table 2 provides a summary of the form of the equation to be estimated and the definitions of the variables used.

THE ESTIMATED COST FUNCTION

Table 3 provides the estimated cost function for individual home health care firms. Examination of the estimated relationship suggests that the fit is extremely good with an R^2 of 0.9845. The presence of several significant coefficients on squared-output and cross-output variables suggests that there may be significant economies or diseconomies of scale. That several of the cross-output coefficients are significant raises the possibility of economies or diseconomies of scope.

The estimated value of the constant term in the regression suggests that a home health agency had fixed costs of not much more than $15,000.[20] These are costs that do not vary with the amount of business the firm does, but are incurred if the firm does any business at all. They would include the cost of renting office space, equipping the office, and providing administrative staff to book appointments and maintain records.

The presence of such small fixed costs suggests that even if unregulated competition does result in unnecessary duplication of facilities, the gain from Certificate of Need regulation of this sector is likely to be very small.

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[20] Following a suggestion of Baumol, Panzar, and Willig, dummy variables for each combination of services were included in early runs. Using such a formulation permits the firm's fixed costs to vary with the combination of services offered. (See Baumol, Panzar, and Willig (1982), pp. 454-455) However, an F-test for the significance of the coefficients on these dummy variables indicated that they did not contribute significantly to the overall explanatory power of the equation. As a result they were eliminated in later runs.

Table 2

The Form of the Individual Firm Cost
Function and Definition of Variables

$$TC = a_0 + a_1 Y1 + a_2 Y2 + a_3 Y3 + a_4 Y4 + a_5 Y5 + a_6 Y6 + a_7 Y1xY1 + a_8 Y2xY2$$

$$+ a_9 Y3xY3 + a_{10} Y4xY4 + a_{11} Y5xY5 + a_{12} Y6xY6 + a_{13} Y1xY2 + a_{14} Y1xY3$$

$$+ a_{15} Y1xY4 + a_{16} Y1xY5 + a_{17} Y1xY6 + a_{18} Y2xY3 + a_{19} Y2xY4 + a_{20} Y2xY5$$

$$+ a_{21} Y2xY6 + a_{22} Y3xY4 + a_{23} Y3xY5 + a_{24} Y3xY6 + a_{25} Y4xY5 + a_{26} Y4xY6$$

$$+ a_{27} Y5xY6 + a_{28} GOVxYSUM + a_{29} GOVxCONxYSUM + a_{30} NPROFxYSUM$$

$$+ a_{31} NPROFxCONxYSUM + a_{32} PROFxCONxYSUM + a_{33} URBANxYSUM$$

$$+ a_{34} MCARExYSUM + a_{35} DR1xYSUM + a_{36} DR2xYSUM + a_{37} DR3xYSUM$$

$$+ a_{38} DR4xYSUM$$

where

TC = total cost incurred by the agency

$Y1$ = number of skilled nursing visits

$Y2$ = number of physical therapy visits

$Y3$ = number of speech pathology visits

$Y4$ = number of occupational therapy visits

$Y5$ = number of medical social service visits

$Y6$ = number of home health aide visits

$YSUM$ = total number of visits (sum of $Y1$ through $Y6$)

GOV = 1 for agencies operated by government entities, 0 otherwise

$NPROF$ = 1 for agencies operated as non-profit firms, 0 otherwise

$PROF$ = 1 for agencies operated as for-profit firms, 0 otherwise

CON = 1 for agencies located in states where certificate of need approval is required before a new agency can be established, 0 otherwise

$URBAN$ = 1 for agencies located in urban areas, 0 otherwise

$MCARE$ = the fraction of the business done by the agency that is paid for by Medicare

$DR1$ = 1 for agencies located in the East, 0 otherwise

$DR2$ = 1 for agencies located in the South, 0 otherwise

$DR3$ = 1 for agencies located in the Rockies or Great Plains regions, 0 otherwise

$DR4$ = 1 for agencies located in the Midwest, 0 otherwise

Table 3

Estimated Cost Function for Individual
Home Health Care Agencies
(t-ratios are in parentheses)

$TC = 15076.04 + 48.05\ Y1 + 54.93\ Y2 + 103.9\ Y3 + 80.51\ Y4$
$\quad\quad\quad\quad\quad\ (22.70)^{**}\quad (9.23)^{**}\quad\quad (3.92)^{**}\quad (3.20)^{**}$

$+\ 95.63\ Y5 + 34.52\ Y6 + 0.0001047\ Y1xY1 - 0.004453\ Y2xY2 - 0.07702\ Y3xY3$
$\quad (3.86)^{**}\quad (18.78)^{**}\quad (3.90)^{**}\quad\quad\quad\quad (-6.01)^{**}\quad\quad\quad (-5.15)^{**}$

$+\ 0.004755\ Y4xY4 - 0.006184\ Y5xY5 + 0.00009260\ Y6xY6 - 0.0003473\ Y1xY2$
$\quad (0.36)\quad\quad\quad\quad (-0.64)\quad\quad\quad\quad (3.15)^{**}\quad\quad\quad\quad (-1.99)^{*}$

$+\ 0.001119\ Y1xY3 + 0.0003222\ Y1xY4 + 0.0002631\ Y1xY5 - 0.0002560\ Y1xY6$
$\quad (1.14)\quad\quad\quad\quad (0.34)\quad\quad\quad\quad (0.24)\quad\quad\quad\quad (-4.89)^{**}$

$+\ 0.03477\ Y2xY3 + 0.01553\ Y2xY4 - 0.01693\ Y2xY5 + 0.001080\ Y2xY6$
$\quad (5.98)^{**}\quad\quad\quad (3.15)^{**}\quad\quad\quad (-4.18)^{**}\quad\quad\quad (4.53)^{**}$

$-\ 0.04148\ Y3xY4 + 0.05295\ Y3xY5 - 0.0007616\ Y3xY6 - 0.03888\ Y4xY5$
$\quad (-2.04)^{*}\quad\quad\quad (1.80)\quad\quad\quad (-0.62)\quad\quad\quad\quad (-2.28)^{*}$

$+\ 0.003908\ Y4xY6 + 0.004371\ Y5xY6 + 7.363\ GOVxYSUM - 2.054\ GOVxCONxYSUM$
$\quad (-4.70)^{**}\quad\quad\quad (3.67)^{**}\quad\quad\quad (5.64)^{**}\quad\quad\quad (-2.09)^{*}$

$-\ 1.173\ NPROFxYSUM + 1.428\ NPROFxCONxYSUM + 1.750\ PROFxCONxYSUM$
$\quad (-1.02)\quad\quad\quad\quad (3.54)^{**}\quad\quad\quad\quad\quad\quad (1.04)$

$+\ 0.2230\quad URBANxYSUM - 5.439\quad MCARExYSUM$
$\quad (0.38)\quad\quad\quad\quad\quad\quad (-5.08)^{*}$

$-\ 10.21\quad DR1xYSUM - 4.768\ DR2xYSUM - 9.691\ DR3xYSUM$
$\quad (-11.90)^{**}\quad\quad (-5.51)^{**}\quad\quad (-7.83)^{**}$

$-\ 7.239\ DR4xYSUM$
$\quad (-8.07)^{**}$

$R^2 = 0.9845\ F = 2877.994^{**}\ n = 1,764$

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* Indicates significance at 5 percent level in a two-tailed test.
** Indicates significance at 1 percent level in a two-tailed test.

Table 4 provides estimates of the marginal cost of providing each of the six home health care services based on the estimated equation in Table 3. Because the estimated equation has a quadratic form, the marginal cost of any service depends on the total quantity of that and other services offered by the firm.[21] The table provides estimates for hypothetical firms providing the average number of visits of each service as well as firms providing one-half and twice the average number of visits of each service. For firms providing the same level of services, there is still a range of values for the marginal cost of each service. This arises because different firms have different values for the non-output variables included in the cost function. For example, the estimated marginal cost of providing an additional visit of any of the six services is $10.21 lower for a firm located in the East -- DR1 $=$ 1 -- than for a firm located in the West.

The estimated marginal costs reported in Table 4 generally appear to be quite reasonable. With the exception of occupational therapy, the estimated marginal costs do not vary more than 15 percent between a firm providing one-half of the average number of visits of each service and a firm providing

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[21] To see this, consider the simple two-product quadratic cost function where

$$TC = a_0 + a_1 Y_1 + a_2 Y_2 + a_3 Y_1^2 + a_4 Y_2^2 + a_5 Y_1 \times Y_2.$$

Since the marginal cost of one of the products, for example Y_1, is the partial derivative of total cost with respect to that product, the marginal cost of Y_1 can be written as

$$MC = a_1 + 2 a_3 Y_1 + a_5 Y_2.$$

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Table 4

Estimated Marginal Costs for Individual Home Health Care Agencies at Different Levels of Output and Average Reported Cost per Visit*

	Estimated Marginal Cost Per Visit at			
	One-Half Average Number of Visits of Each Service	Average Number of Visits of Each Service	Twice Average Number of Visits of Each Service	Average of Cost Per Visit Reported on Medicare Cost Reports
Skilled Nursing Care	$31.14 to 53.83	$31.06 to 53.75	$30.89 to 53.58	$39.78 —
Physical Therapy	$39.20 to 61.89	$40.32 to 63.01	$42.52 to 65.21	$38.04
Speech Pathology	$ 91.73 to 114.42	$ 96.23 to 118.92	$105.38 to 128.07	$44.21
Occupational Therapy	$54.51 to 77.10	$45.06 to 67.75	$26.43 to 49.12	$45.82
Medical Social Services	$76.89 to 99.58	$75.07 to 97.76	$71.32 to 94.01	$76.46
Home Health Aides	$17.92 to 40.61	$18.14 to 40.83	$18.58 to 41.27	$25.24

* The estimated value for each marginal cost within the range reported depends upon the values of the non-output variables included in the cost equation. Minimum values are obtained for a non-profit firm located in a non-urban area of an eastern state which has no CON regulation and whose costs are fully covered by Medicare. The maximum values are for a government agency in an urban location in a western state without CON regulation and which has the minimum amount of expenses covered by Medicare -- 32 percent in our sample.

twice the average number.[22] Since home health care involves health professionals visiting patients in their homes, it seems likely that marginal costs would not vary widely with firm size. It should be relatively easy to increase capacity by hiring additional staff or by employing full-time rather than part-time people.

Some additional insight into the reasonableness of the marginal cost estimates may be gained by comparing the marginal cost estimates to the cost-per-visit figures for each type of service reported by the firms on their Medicare Cost Reports. The average value of these reported cost-per-visit figures is also shown on Table 4. While these reported cost figures are

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[22] That the marginal costs of skilled nursing care, occupational therapy and medical social services are lower for a firm providing twice the average number of visits of each service than for a firm providing the average number of visits, which in turn are less than the marginal costs for a firm providing one-half the average number of visits does not mean that the marginal cost of providing any one of these services is negatively sloped. Each of the columns in Table 4 involves a different quantity of all of the six home health services, whereas the traditional marginal cost function is defined as changing the quantity of one output while holding all other things constant. In the context of a quadratic cost function, the marginal cost for a particular output will decline continuously as quantity increases if the coefficient on the quadratic term of that output is negative. With our estimated equation, this is true for physical therapy and speech pathology. (The quadratic term for medical social service visits is negative but not significantly different from zero.) This means that these two products are subject to decreasing average incremental costs. (See Baumol, Panzar, and Willig (1982), pp. 316-317.) Therefore, for these two services, an efficient market organization would have only one firm in a local market providing each of these services. It does not follow, however, that there would only be one home health firm in a local market. It could be efficient to have multiple firms, only one of which provides each of these services.

to some degree arbitrary and depend on the accounting conventions used to allocate costs,[23] finding that the estimated marginal costs are similar to the average reported cost per visit would appear to provide some evidence that the estimated cost function is reasonable. This appears to be the case with the exception of speech pathology. The estimated marginal costs for speech pathology are approximately twice as large as the reported cost per visit.

By examining some of the other coefficients of the estimated cost function reported in Table 3, we can learn something about other sources of cost differences. First, we see that the variable GOVxYSUM has a positive and statistically significant parameter. This indicates that government firms had higher costs than other firms. The estimated additional cost of $7.36 per visit for a government agency when compared with a for-profit firm is 21 percent of the $34.60 average cost per visit reported for all services by the firms in our sample. This may indicate that government agencies were less efficient than their private counterparts -- perhaps because their continued existence is less threatened by a failure to successfully compete.[24]

The regression results also indicate that costs did not differ significantly between firms located in urban areas and those located in rural areas. However, costs did differ among regions of the country with the lowest costs occurring in the East -- DR1 = 1 -- and the highest costs occurring in the West -- all of the regional variables equal to zero. This may indicate cost differences for non-labor inputs used in providing home health care services or it may indicate greater travel distances in one area than in another. Finally, the variable

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[23] See the sources cited in footnote 8 on p. 46, above.

[24] The regresison results suggest that non-profit firms have lower costs than for-profit firms. However, the difference is not statistically significant.

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measuring the extent to which a firm's costs are reimbursed by Medicare has a negative and significant sign. This may indicate that the reimbursement ceiling imposed by Medicare acts to constrain home health firms' costs.

CHAPTER 6

UNREALIZED ECONOMIES OF SCALE

The estimated cost function reported in Table 3 can be used to analyze the extent of unrealized scale economies in the provision of home health care. There are two aspects of this analysis. First, we need to determine whether firms that provide home health care services fail to realize available economies of scale to any substantial degree. Second, we want to compare the extent of unrealized economies where entry is limited by CON regulations with the extent of unrealized economies in unregulated markets.

This analysis forms one of the key aspects of our evaluation of the "public interest" theory of Certificate of Need regulation in home health care. The presence of unrealized economies of scale plays a key role in this justification for regulating entry into these markets. Only if there are substantial unrealized economies of scale, and if the extent of these unrealized economies is greater in states without CON than in those with these laws, would we conclude that CON serves a "public interest" role by limiting unrealized economies of scale.

METHODOLOGY

The first step in this analysis is to determine the extent to which the firms in our sample have unrealized scale economies. In order to do this, we must define a more efficient output level that may be used for comparisons. In order to find such an output level, we first determined the point at which ray average cost reaches a minimum along the ray defined by the firm's current output mix. To do this, we set marginal

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cost along the firm's output ray equal to ray average cost.[1] Provided this minimum existed,[2] and provided this minimum was reached at an output level that was not more than twice the current output level of the firm, we defined the output level at which the minimum was reached as the more efficient size for this firm. Where no minimum existed along the firm's output ray, or where the output at which the ray average cost function reached that minimum was more than twice the current output level of the firm, the "more efficient size" to be used in

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[1] If the cost function is written in the form

$$TC = F + \sum_{i=1}^{n} a_i Y_i + \sum_{i=1}^{n} \sum_{i=1}^{n} b_{ij} Y_i Y_j$$

$$+ \sum_{k=1}^{m} c_k D_k \sum_{i=1}^{n} Y_i$$

where D_k is the kth non-output variable in the equation, and F is fixed costs represented by the constant in the estimated equation

and if k_i is defined as

$$k_i = Y_i / Y_1$$

for i = 1 through n,

then the level of output of Y_1 that corresponds to the minimum point on the average cost curve defined by the k_i's is

$$Y_1^m = \sqrt{F / (\sum_{i=1}^{n} \sum_{j=1}^{n} k_i k_j b_{ij})}$$

[2] Along some output rays, the estimated ray average cost function does not reach a minimum but continuously declines as output increases.

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estimating potential cost savings was an output twice the firm's current level of output.[3]

Once the more efficient size for a firm was determined, the cost savings from operating at that more efficient size could be estimated. To do this, we estimated the average cost at the firm's current output level and the average cost at the more efficient size. We evaluated the cost function at each of these output levels. By expressing the difference between average cost at the current level and average cost at the more efficient size as a percentage of the lower average cost at the more efficient size, we developed a percentage measure of the cost savings that could be realized from operation at a more efficient scale.[4]

After the cost savings from operating at a more efficient scale were estimated for each firm in the sample, geometric means of these individual firm savings were computed for all sample firms and for various sub-groups of the sample firms. The geometric mean was used to facilitate statistical tests of the differences between means for various sub-groups. Because the savings from operating at minimum efficient scale must be non-negative, it is not reasonable to assume that the estimated savings are normally distributed. However, since the log-normal distribution assumes no negative values, it is a

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[3] We limited increases in output to twice the current level in order to minimize the cases in which estimated economies could not be achieved because of the size of the market.

[4] Comparisons of average costs across firms producing different outputs and producing them in different ratios could pose a number of difficulties. However, these problems should be avoided by measuring efficiency in terms of a percentage change in cost along the firm's output ray.

reasonable distribution to use in this case.[5] With a log-normal distribution for the individual elements of the distribution, the log of the geometric mean has a normal distribution and standard t-tests for differences in the log of the geometric means can be employed.

By estimating the extent of unrealized scale economies for each firm in the sample and then averaging these figures, we obtain a better estimate of the extent of unrealized economies than we would obtain by computing the extent of unrealized economies for the "average" firm in our sample. We can see this by considering an average cost function for a firm producing only a single output. Such an average cost function is depicted in Figure 2.

To illustrate the differences between the two approaches, let us consider a simple example involving only two firms. Firm A produces quantity Q_A and the second firm, B, produces Q_B. We have constructed Q_A and Q_B so that the average output for these two firms is Q_{MIN}. Firm A has an average cost equal to AC_A, which exceeds minimum average cost by $AC_A - AC_{MIN}$. Similarly, firm B's average cost exceeds the minimum achievable value by $AC_B - AC_{MIN}$. It is clear that neither firm is achieving the efficiencies associated with operating at the minimum efficient scale. Firm A is too small to achieve all of the economies of scale; Firm B is so large that it suffers from diseconomies of scale.

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[5] The actual distribution of the percentage cost savings from operating at MES proved too complicated to estimate. There are three sources of variability in the estimate of the percentage cost savings. First, the ray average cost at the firm's observed output level is uncertain. Second, because the coefficients in the cost function are stochasticly estimated, the output level at which ray average cost achieves its minimum value is not precisely known. Finally, the level of ray average cost at that minimum value can only be estimated.

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Figure 2

Estimation of Average Unrealized Economies of Scale
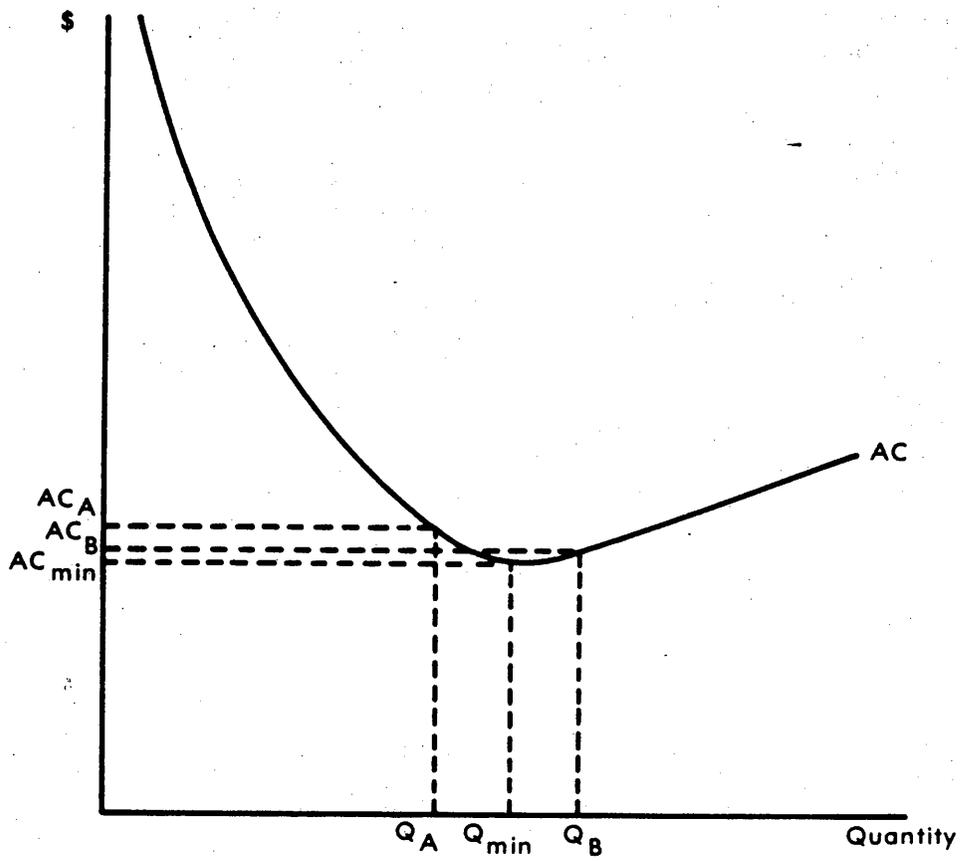
However, since Q_A and Q_B have been constructed so that the average of these two values is Q_{MIN}, if we were to average the quantities produced by the two firms and then measure the extent of unrealized scale economies at that average, we would find no unrealized economies. This would occur in spite of the fact that we have seen that neither firm is operating at the output level that minimizes average cost.

This result may appear to result from the artificial construction of Q_A and Q_B in Figure 2. However, the result is general. The average extent of unrealized economies of scale will be understated if one averages the outputs of the firms in a sample and evaluates the extent of unrealized economies at that average output.[6] This is true if some firms are of greater than minimum efficient size while others are of less than minimum efficient size. Such an underestimation would also result if all firms are on one side of the minimum efficient size quantity. Thus, in order to obtain a realistic estimate of the extent of unrealized scale economies, it is important to evaluate the extent of unrealized economies for each firm in the sample and then to average this figure across firms.

One additional methodological issue needs to be considered. What is the sample of firms on which our analysis should be based? The concern here is that the failure to achieve all possible economies of scale can result from insufficient demand as well as from an excessive number of firms in the market. In small markets, a single firm may provide home health services and still not be operating at its minimum efficient size. In such a case, it is the smallness of the market, and not the presence of too many small firms, that is responsible for the unrealized economies.

In order to have a strong test of the hypothesis that CON regulation contributes to the realization of available economies of scale, we should restrict our attention to firms

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[6] This result assumes that the average cost function is convex from below.

operating in markets that are served by two or more home health firms. In such markets, the failure to operate at an efficient scale should be the result of having too many firms in the market. Including firms that are the sole provider of home health services in their markets reduces the precision of the comparisons since the extent of unrealized economies for these firms is a result of market size.

Because of this concern, we will focus our attention on firms operating in urban markets. For the 990 firms in our sample operating in urban markets, in only 116 cases is a firm the only sample firm operating in a market.[7] By focusing on

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[7] For purposes of this analysis, we define a market as being an SMSA or, in the case of non-urban markets, a county. This seems an appropriate definition since the market for home health care would appear to be local in nature. A patient who needs home health care will be served by a firm operating in his location, not by a firm operating in a different city or state.

There are two caveats to the definition of urban markets. First, in New England, SMSA's are not defined on the basis of whole counties. Rather, portions of a county may be included in an SMSA and other parts not be included. This posed a problem because the home health agency file supplied by the Health Care Financing Administration identifies firm location by state and county only. In order to match home health agencies with metropolitan areas, an alternative classification developed by the National Bureau of Standards -- New England County Metropolitan Areas (NECMA) -- was used for urban areas in New England.

Second, where an SMSA or NECMA included portions of two or more states, the market area was defind as the area *within a single state* that was in the urban area. Thus, for example in the Washington, D.C., area, there would be three market areas -- one for the District of Columbia proper, one for the Virginia suburbs, and one for the Maryland suburbs. This approach was adopted to avoid having market areas that were partially CON-regulated and partially unregulated. Such a split in a market area would have posed problems for the analysis of aggregate costs reported on pp. 93-103.

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firms in urban markets, at least 89 percent of the included
firms provide a test of our hypothesis.[8] In the case of non-
urban firms, 629 of the 773 firms -- 91 percent -- are the
only sample firm in a market. Thus, if we look at all firms,
or only at firms located in non-urban markets, we would include
many firms for whom the size of their market, rather than the
efficient organization of firms, was the cause of any failure
to achieve available economies.

RESULTS

The average cost savings from operating at a more efficient
scale are reported in Table 5. On average, costs per visit
would be 2.69 percent lower for the home health firms included
in our sample if they operated at a more efficient scale. If
we restrict our attention to firms in urban markets, the
average cost savings from more efficient operation are only
1.89 percent.

Table 5 also reports the average cost savings for firms in
markets with Certificate of Need regulation and for those in
markets without regulation. Considering first the sub-sample
consisting of firms in urban markets, we find that the average
cost savings amount to 2.07 percent for firms in regulated
markets. For firms in markets without CON regulation, the
average costs saving are only 1.81 percent. The difference
between these two figures is not statistically significant.[9]
Thus, using the data that provides the best test of the "public
interest" theory of CON regulation, we find no support for the

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[8] Since our sample of firms does not include all home health
care providers, there may be some cases in which a market has
two or more providers though only one firm in our sample
operates in that market.

[9] The t-ratio for a difference in the logs of these
geometric means is 1.12.

Table 5

Unrealized Economies of Scale:
Average Percentage Cost Increase Because
Firms Are Not of More Efficient Size*

All Firms	2.69 %
Firms in Markets With No CON Restrictions	2.66 %
Firms in Markets With CON Restrictions	2.74 %
Firms in Urban Markets	1.89 %
Firms in Urban Markets With No CON Restrictions	1.81 %
Firms in Urban Markets With CON Restrictions	2.07 %
Firm in Non-Urban Markets	4.23 %

* Where the cost function fails to achieve a minimum along the ray defined by a firm's output at less than twice the firm's current output level, the cost savings from doubling the firm's output have been used.

theory. The extent of unrealized scale economies is not reduced by CON regulation.

If we look at the full sample of firms, we find similar results. In regulated markets, the average cost saving amounts to 2.74 percent; in non-regulated markets, the average savings are 2.66 percent. Again the difference in the means is not statistically significant.[10] Thus, we find no support for the "public interest" theory of Certificate of Need regulation which posits that regulation is necessary in order to avoid having firms that are too small to achieve available economies of scale. Firms in unregulated markets do at least as good a job of achieving available economies of scale as do firms in markets where entry is restricted by CON laws.

Some readers may be concerned about the presence of average potential cost savings of 1.81 percent if those of our sample firms operating in unregulated urban markets were of a more efficient scale. While the evidence reported in Table 5 suggests that current Certificate of Need regulation is not successful in reducing unrealized economies of scale, the fact that there are unrealized cost savings may appear to suggest that competition is not successfully achieving efficient operation of the markets and that some form of regulation is necessary. For several reasons, we do not believe that this interpretation of our results is correct.

First as we noted above, the failure to achieve all possible economies of scale can be the result of insufficient demand rather than the result of having an excessive number of firms in the market providing home health services. Evidence that insufficient demand can contribute to the extent of unrealized economies can be seen by comparing the extent of unrealized cost savings for firms in urban markets with those for non-urban firms. Non-urban firms are much more frequently constrained by the size of the market. For urban firms, the

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[10]   The t-ratio for a difference in the logs of these geometric means is 0.41.

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average potential cost savings are 1.89 percent. For non-urban firms, the savings are 4.23 percent.[11] This suggests that unrealized economies tend to be greater where the realization of available economies is constrained by the size of the market. While urban firms are less often so constrained, there may be cases in which firms are constrained by the size of the market; and this may be contributing to the estimated inefficiency.

In addition, the functional form used in estimating the cost equation may overstate the extent of unrealized economies of scale. If, as many economists believe is true of long run average cost curves in most industries, the average cost function for a home health provider is essentially flat after an initial downward sloping segment, the functional-form that we have employed will not accurately describe the actual form of the cost function. With a quadratic form, there must be a unique minimum point to the average cost function along each output ray. Because of this, the estimated minimum efficient size using our cost function may be larger than actual. While the cost function should be relatively flat in the area around that minimum estimated value, our methodology may show that there is some slight achievable cost savings when a more general form would show none at all.

Finally, studies of the minimum efficient size of firms in various industries have found that in some cases there is no actual minimum. Rather, average cost continues to decline at a slow rate as size increases.[12] For some combinations of outputs, our estimated cost equation similarly exhibits continuously declining ray average costs. In response to the problem of continuously declining costs, Pratten, in a 1971 study of economies of scale in manufacturing industries, defined scale economies as being relatively insignificant if a doubling of

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[11] These means are significantly different at the 1 percent level. The t-ratio for the difference is 11.46.

[12] See Pratten (1971), p. 26, and Scherer, Beckenstein, Kaufer, and Murphy (1975), p. 79.

firm size resulted in a decline in average cost of less than 5 percent.[13]

In order to examine the effect of these problems, we shall use an approach similar to Pratten's to deal both with the failure of the cost function to achieve a minimum and the tendency of the cost function to overstate economies of scale. For the purposes of this analysis, we will not regard a firm as exhibiting significant economies of scale unless its estimated costs would fall by 5 percent or more if it operated at a more efficient scale. That is, any firm with potential cost savings of less than 5 percent will be considered to be operating efficiently.

The first thing to note about such an approach is-that the average estimated cost saving is below this 5 percent cutoff. Indeed, for urban firms, the average potential cost saving of 1.89 percent is less than 40 percent of the level that would be defined as efficient. Another indicator of the extent of substantial unrealized scale economies is the percentage of firms that have potential cost savings of more than 5 percent. In our sample, we find that only 26.87 percent of firms in urban markets and 36.07 percent of all the firms in our sample have potential cost savings associated with operating at a more efficient scale that exceed 5 percent. This suggests that the extent of inefficiency exhibited by home health firms is quite small.

If we regard any potential cost savings of under 5 percent as being relatively insubstantial, we can perform another test of the effect of Certificate of Need on unrealized economies of scale. If CON regulation is effective in reducing unrealized economies, we should find a smaller percentage of firms in regulated than in unregulated markets with potential cost savings of more than 5 percent. The data for these comparisons are reported in Table 6.

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[13] Pratten (1971), p. 26.

Once again, we focus first on firms in urban markets since these firms provide us with the cleanest test of the hypothesis that Certificate of Need regulation assists in the realization of available economies. As Table 6 shows, 26.25 percent of urban firms in unregulated markets had estimated unrealized scale economies of 5 percent or more. For firms in regulated markets, the percentage was 28.21. The difference in these means is not significant.[14]

Similar results are found when all firms are included in the test. With all firms, 36.29 percent of firms in free entry markets had unrealized cost savings from operating at a more efficient scale that exceeded 5 percent. Among firms in regulated markets, the percentage was 35.67. Again the difference in the means is not significantly different from zero.[15]

Thus, the results of an examination of the percentage of firms with estimated unrealized scale economies in excess of 5 percent are consistent with those from a comparison of average potential cost savings. There is no evidence that Certificate of Need regulation aids in achieving economies of scale. Firms in unregulated markets have no greater unrealized scale economies than do those in regulated markets. As a result, we must reject the economies of scale portion of the "public interest" justification for Certificate of Need regulation.

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[14] These means are traditional arithmetic means and the t-ratio to test the significance of the difference in the means is 0.64.

[15] The t-ratio is 0.26.

TABLE 6

Unrealized Economies of Scale:
Percentage of Firms With Unrealized Economies
of Scale of Five Percent or More

All Firms	36.07 %
Firms in Markets With No CON Restrictions	36.29 %
Firms in Markets With CON Restrictions	35.67 %
Firms in Urban Markets	26.87 %
Firms in Urban Markets With No CON Restrictions	26.25 %
Firms in Urban Markets With CON Restrictions	28.21 %
Firms in Non-Urban Markets	47.87 %

CHAPTER 7

ECONOMIES OF SCOPE

Having concluded that Certificate of Need regulation does not contribute to the realization of available economies associated with firm size, we now shift our attention to the economies or diseconomies associated with diversification. Specifically, we seek to determine whether home health care providers have a tendency to engage in excessive diversification. That is, do they operate where there are diseconomies of scope? Or, alternatively, do they operate where there would be savings from greater diversification, i.e., where there are unrealized economies of scope? Further, we want to know whether the presence or absence of Certificate of Need regulation has any effect on the degree to which economies or diseconomies of scope are realized.

The extent of economies or diseconomies of scope will be analyzed by considering the gains from additional or reduced diversification by various "average" or representative firms.[1]

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[1] A more elaborate estimation procedure, such as that used to determine the extent of unrealized economies of scale, was not attempted here because we expected to have difficulty in finding any significant results in the area of economies of scope. In order to measure economies of scope, costs for firms that do not produce certain products must be estimated. For example, in order to test for economies of scope between the provision of skilled nursing and home health aide services, it is necessary to estimate costs for a firm that provided only skilled nursing care and for a firm that provided only home health aide visits. However, because of the Medicare requirements (see p. 51), all of the firms in our sample provided skilled nursing visits. Further, home health aide services were provided by 96.4 percent of the firms in the sample. Thus, estimating costs for a firm providing only home health aides required estimation outside the range of our sample data; and estimating costs for a firm offering only skilled nursing

<div align="right">(footnote continued)</div>

These firms will be assumed to provide the average number of visits provided by different subsets of the firms in our sample that offer a specific combination of services -- e.g., urban firms in unregulated markets or non-urban firms in markets with CON regulation. For example, the "average" firm providing only skilled nursing and home health aide services in an urban market in a state that has Certificate of Need regulation provided 4,667 skilled nursing visits and 3,373 home health aide visits. The "average" firm in a non-urban market in a CON state provided only 1,828 skilled nursing visits and 1,376 home health aide visits. Thus, to the extent that an urban location or the presence or absence of CON affects the number of visits an "average" firm provided and thereby the degree to which there were economies of scope, this will be reflected in our analysis.

Our results are presented in Tables 7 and 8. Table 7 presents estimates of the economies or diseconomies of scope from jointly offering skilled nursing and home health aide services, rather than providing these two services through separate firms. Table 8 considers the gains or losses realized when a single firm provided all six home health services jointly rather than one firm providing skilled nursing and home health aide services and another firm providing physical therapy, speech pathology, occupational therapy, and medical social services.

(footnote continues)

care required estimation in a part of the sample that was very thin. As a result, these estimates are apt to have high variances associated with them. This will lead to a high variance for the estimated economies of scope from joint production which will reduce the likelihood of obtaining significant results. (This problem is noted in Evans and Heckman (1984).)

As will be seen, even fairly large potential economies of scope that result from the joint provision of skilled nursing and home health aide services are not statistically significant using our data set.

Table 7

Economies of Scope Realized by the Average
Firm Providing Skilled Nursing Care and Home
Health Aide Services Jointly Rather Than
Having Separate Firms Each Providing
One of the Services

Type of Firm	Economies of Scope From Joint Provision	t-ratio
All Firms	12.61%	1.68
Firms in Non-urban Markets With No CON Restrictions	13.42%	1.76
Firms in Non-urban Markets With CON Restrictions	15.07%	1.70
Firms in Urban Markets With No CON Restrictions	9.76%	1.74
Firms in Urban Markets With CON Restrictions	8.30%	1.70

Table 8

Economies of Scope Realized by the Average
Size Firm Providing All Six Home Health Services
Jointly Rather Than Having One Firm Provide
Skilled Nursing and Home Health Aide Services
And Another Provide the Remaining Services

Type of Firm	Economies of Scope From Joint Provision	t-ratio
All Firms	-0.38%	-0.15
Firms in Non-urban Markets with No CON Restrictions	3.34%	0.97
Firms in Non-urban Markets With CON Restrictions	0.85%	0.26
Firms in Urban Markets With No CON Restrictions	-0.31%	-0.12
Firms in Urban Markets With CON Restrictions	-1.30%	-0.48

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The estimates in Table 7 suggest that there may be substantial gains from jointly providing skilled nursing and home health aide services. A hypothetical firm supplying skilled nursing and home health aide services equal to the average number of visits provided by all firms in the sample diversified to this degree had estimated costs that were 12.61 percent lower than if separate firms provided the skilled nursing and the home health aid services. T-ratios for tests of the statistical significance of the cost savings resulting from joint provision are also presented in Table 7.[2] The cost savings of this hypothetical "average" firm are not significant at the conventional 5 or 1 percent levels in a two-tailed test. The savings are, however, significant at the 10 percent level. The failure to achieve significance at the higher levels may well be due to the uncertainty problem discussed in footnote 1 on page 79.

Table 7 also provides estimates of the economies of scope realized by the "average" firm in various subsets of our database. For example, the average firm providing only skilled nursing and home health aide services in urban areas with no Certificate of Need restrictions is estimated to have costs that were 9.76 percent below the costs that would be incurred if separate firms provided these two services. In urban markets with CON regulation, the comparable savings were 8.30 percent. As with the all-sample "average" firm, none of the estimated savings reported in Table 7 is statistically significant at more than the 10 percent level.

Less than four percent of the firms in our sample did not provide both skilled nursing and home health aide services. While the percentage of firms not offering home health aide services varied a little depending on the subset of firms being considered, more than 90 percent of the firms offered at least

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[2] Using the notation of Baumol, Panzar, and Willig, the hypothesis tested is that $C(y_T) + C(y_{NT})$ is not significantly different from $C(y)$.

these two services in every environment.[3] Thus, most home health firms apparently achieve the economies of scope from jointly offering these two products.

While there may be substantial economies of scope associated with joint provision of skilled nursing and home health aide services, Table 8 suggests that there are very few, if any, economies or diseconomies associated with providing the remaining home health services jointly with skilled nurses and home health aides. For the all-sample average firm providing all six services there may be a very slight diseconomy from offering all six services. However, none of the estimated cost savings is even close to being significantly different from zero. Thus, there do not appear to be any real gains or losses from jointly providing these two groups of services. –

Since we have found that there may be substantial economies of scope from the joint provision of skilled nursing and home health aide services, it is interesting to inquire as to whether a lower percentage of firms offer only one of the services in states with Certificate of Need regulations than in states without this form of regulation. If fewer firms in CON-regulated states failed to achieve the economies of scope from jointly offering these two services, we may have uncovered a "public interest" justification for continued Certificate of Need regulation; if not, no such justification exists.

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[3] It should be noted that just because there are economies of scope for an "average" firm, it is not necessarily true that there are economies for every firm. The degree of economies of scope may vary depending on the precise combination of outputs provided by a particular firm. Further, even if economies of scope exist, Baumol, Panzar, and Willig demonstrate that while some firms in a cost-minimizing market equilibrium must jointly produce all products, it is not always true that all firms in the market will jointly produce all products. (See Baumol, Panzar, and Willig (1982), pp. 249-251.)

Since all firms receiving reimbursement under Medicare must offer skilled nursing services,[4] we will examine the percentage of firms that fail to offer home health aide services. As in our examination of the effect of Certificate of Need regulation on the extent of unrealized economies of scale, we will focus our attention on firms located in urban markets. Our analysis of economies of scope is concerned with the costs or benefits of having a single diversified firm provide home health services rather than two specialized firms. We do not obtain much evidence about firms failing to achieve these economies of scope if the single home health provider in an area does not offer home health aide services in addition to skilled nursing visits. In such a case, there is no other firm providing the home health aide services. Rather, demand must not be sufficient to justify the offering of both services.[5] Since better than 80 percent of the firms in our sample that are located in non-urban markets are the only sample firm in their market, we will focus our analysis on firms located in urban areas.

In urban markets located in states without Certificate of Need regulation, 16 firms in our sample did not offer home health aide services. This amounts to 2.4 percent of the total of 678 such firms in the sample. For urban markets in states with CON regulation, 4 firms out of 312 did not offer home health aide services. These firms constitute 1.3 percent of the total in these urban, CON-regulated markets. Thus, there appears to be a slightly higher percentage of non-diversified

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[4] See p. 51.

[5] Skilled nurses may be able to provide the services provided by home health aides. In most cases this would not be efficient since nurses are more highly skilled and earn higher wages. However, where demand is low, it may be more efficient to fully employ one or two nurses by having them provide all of the services than to employ both nurses and home health aides and not be able to fully employ either group.

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firms in states without CON regulation. However, this difference is not significant using a Chi-square test for the independence of offering home health aide services and the presence of Certificate of Need laws.[6]

In conclusion, there appear to be few unrealized economies of scope in home health care. In addition, there are no indications of excessive diversification by home health firms. While substantial economies may be achieved by jointly providing skilled nursing and home health aide care, all but a handful of firms provided both of those services. Further, comparing urban firms in markets where CON approval is required with urban firms in non-CON states, we have found no significant difference in the percentage of firms not offering home health aides. Finally, when the gains from further diversification were investigated, no evidence of substantial economies or diseconomies of scope was uncovered.

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[6] The value of the Chi-square variable is 0.971. The contingency table, with expected values if the two factors are independent indicated in parentheses, is

	Offers Home Health Aides	Does Not Offer Home Health Aides	Total
CON	662 (664)	16 (14)	678
No-CON	308 (306)	4 (6)	312
Total	970	20	990

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CHAPTER 8

THE EFFECT OF CON REGULATION ON COST LEVELS

The final issue we would like to investigate using the estimated cost function in Table 3 is whether firms in CON-regulated states have higher costs in producing a given quantity and combination of outputs than do firms in unregulated states. Our analysis has not uncovered a "public interest" justification for CON regulation of entry into home health care. Home health agencies do not generally have large unrealized economies of scale and Certificate of Need regulation does not contribute to the realization of any economies that may exist. Further, almost all home health firms in our sample attain the only substantial economies of scope we have identified by offering both skilled nursing and home health aide services.

Since Certificate of Need regulation does not increase efficiency in either of the ways hypothesized by the "public interest" theory of this type of regulation, there appears to be little, if any, reason for maintaining it. While we have been unable to identify any benefits that may result from the regulation, there are certainly administrative costs incurred in operating a CON system. In addition, the danger exists that CON regulation may be used by incumbent firms to shield themselves from increased competition.

If we were to find that costs were actually higher for regulated firms providing a given quantity of services, the case against continued CON regulation of home health firms would be even stronger. The possibility that costs would be higher for regulated than for unregulated firms was raised before. Particularly for firms that are not organized on a profit-making basis, reductions in actual or potential competition may lead to inefficient operation. Since non-profit firms and government agencies do not have owners who can extract any revenues in excess of costs in the form of profits, such firms may choose to maximize something other than profits

when competitive conditions permit. The result may be non-cost minimizing behavior.[1]

Our estimated cost function for individual home health care firms permits us to determine whether costs were in fact higher in the presence of CON regulation. The coefficient on the variable NPROFxCONxYSUM is $1.428, as reported on Table 3 and is significant at the one percent level. This indicates that the costs incurred by non-profit firms in producing any level of output were significantly greater in states that had CON regulation than in unregulated states. The extent of the cost difference amounts to about 4 percent of the average cost of a visit by a home health provider. Thus, non-profit firms may have been responding to reduced potential and actual competition resulting from CON restrictions on entry and to the inability to directly take profits out of the firm by maximizing something other than profits.

While the results of our estimation are consistent with the notion that non-profit firms do not minimize costs when entry is restricted, we do not find the same result for government agencies. Government agencies that provided home health care appear to have had lower costs where there was CON regulation than where there was no such regulation. The coefficient on GOVxCONxYSUM is a negative $2.054 and is statistically significant at the 5 percent level. The explanation for this result is unclear. Our hypothesis was that since government firms, like non-profit firms, have no residual claimant to extract excess revenues in the form of profits, attention to cost minimization might be reduced if CON regulation reduced competition.

Finally, costs appear to be somewhat higher for for-profit firms in states with CON regulation than in unregulated states. However, this coefficient -- PROFxCONxYSUM -- is not significantly different from zero. Thus, we cannot reject the

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[1] See Frech (1976) for a discussion of the behavior of non-profit firms.

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hypothesis that these firms minimize their costs even if CON regulation allows them to charge supra-competitive prices. This is what we would expect from firms that maximize their profits.

One may be tempted to interpret the finding that non-profit firms had higher costs where there was CON regulation as evidence that supports of the "economic" theory of this type of regulation. Certainly this finding is consistent with the "economic" theory. However, there are two caveats that limit the strength with which the evidence can be seen as "proof" of the "economic" theory. First, as noted above, the effect for government firms is not consistent with our expectations based on the "economic" theory. Second, our data do not permit us to control for the quality of care being offered by different home health providers. As we noted above, while it does not appear to be the primary purpose of CON regulation, it is possible that this form of regulation could be used to assure that providers meet minimum quality standards. If this is what is happening, it is possible that the higher costs we observe merely reflect the costs of providing higher quality care.

Having raised the possibility that the cost increases we observe are the result of higher quality, we would note that Certificate of Need regulation would not appear to be the most efficient way for a state to insure appropriate minimum quality standards. States already license some of the health care professionals who provide home health care. For example, nurses and physical therapists are generally licensed. If a state is concerned with the quality of service offered by home health agencies, licensing of the workers providing the services would appear to be preferable to limiting entry of additional home health firms. Since licensed professionals can practice in a variety of settings, there is less likelihood that the licensing procedures will be used to limit competition in any particular segment of health care.

Returning to our estimates of the effects of CON regulation on the costs of various types of firms, we can combine the estimated effects for the different types of firms to provide an indication of the overall effect of CON regulation on the

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cost of providing a given quantity and combination of home health services. In order to do this, we compute a weighted average effect of CON regulation on costs per visit by weighting each coefficient by the fraction of visits provided by firms of that type.[2] Doing this, we calculate that the cost per visit was increased by $0.695 on average. This amounts to about a 2 percent increase in the cost of the average visit. The parameter is significant at the 10 percent level, but not at the more conventional 5 or 1 percent levels.

These estimates of the cost-increasing effects of Certificate of Need regulation can be used to estimate the total annual increase in the cost of home health care due to Certificate of Need regulation. In making this estimate, we ignore costs associated with unrealized economies of scale and scope since we found that CON regulation had no effect on the extent of these costs. Rather, we focus on the 2 percent increase in the cost of providing a given quantity of services in markets with CON regulations.

The Health Care Financing Administration of the Department of Health and Human Services has estimated that total expenditures on home health care in 1984 amounted to $6.7 billion.[3] Of course, not all of these expenditures were made in states that impose Certificate of Need requirements on home health care providers. For purposes of estimating the cost of the CON regulations, we assume that the proportion of expenditures made in states with CON regulation is equal to the percentage of home health visits in our sample that occurred in states with CON regulation. Using this approach, we estimate that 34.2 percent of expenditures were made in states with Certificate of Need regulation. Combining these figures, we estimate that

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[2] The weights are derived from our sample. Based on our sample, 72.5 percent of visits were provided by non-profit firms, 21.6 percent were provided by government agencies, and 5.9 percent by for-profit firms.

[3] Health Care Financing Administration (1985).

total costs of home health care were increased by about $46 million in 1984 as a result of Certificate of Need regulation.

This estimate of $46 million per year represents only the increase in the cost of providing home health services. If the higher costs we observe for non-profit firms in regulated markets represent decreased attention to cost control because of reduced competition, the increase in total expenditures by home health consumers, private insurers, and government programs such as Medicare and Medicaid may be larger than this figure. Since our data measure the cost of providing home health care, we cannot directly estimate the amount by which prices paid for home health care services are increased by any entry-limiting effects of Certificate of Need regulation. However, it may be possible to get a rough estimate of the extent of any price increases.

In order to do this, we recall our reason for expecting Certificate of Need to result in increased costs for non-profit firms. Because profits cannot be extracted from a non-profit firm, we suggested that these firms may have a tendency to dissipate potential profits in the form of higher costs. Since no one can claim the potential profits, costs are not minimized. Rather, costs are permitted to rise to use up the available revenues.

If we assume that this is the explanation of the higher costs observed for non-profit firms in regulated states, we can use the estimate of the cost increase for non-profit firms where there is CON regulation as a very tentative estimate of the price increase associated with these regulations.[4] If we use this approach, we estimate that CON regulation may be associated with a price increase in the neighborhood of $1.40 per visit. This is approximately 4 percent of the cost of the average visit. Combining this 4 percent figure with the other figures used above, we can very tentatively estimate that total

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[4] One problem with using this coefficient to estimate price increases is that we do not see a similar increase in cost incurred by government firms.

expenditures on home health care may be increased by something approaching $100 million per year as a result of Certificate of Need regulation.

Thus, we have some evidence that costs are, on average, increased by Certificate of Need regulation. Certainly they are not, on average, lowered.

CHAPTER 9

ANALYSIS OF AGGREGATE DATA

Another way to analyze the effect of Certificate of Need regulation on the cost of providing home health care services is to examine the relationship between total expenditures on home health care in a community and the total number of visits of each home health care service. If Certificate of Need regulation is effective in limiting costs, it should be possible to detect this effect through this kind of aggregate analysis.

In this section of the paper, the results of regression analyses on an aggregated version of the individual firm data used to this point are reported. First, the aggregated data were examined to determine whether, *ceteris paribus*, there was in fact any difference in the number of firms operating in areas with CON regulation and in non-CON areas. We also examined the possibility of differences in the degree to which home health care firms in the two environments were diversified. Second, total costs of the firms in an area were regressed on the total number of visits and a few non-output variables to determine whether aggregate costs were lower in markets where Certificate of Need regulations exist.

Based on this analysis, it appears that there were fewer firms where there was CON regulation and that these firms were more diversified than firms in non-CON markets. However, aggregate costs appear to have been no lower in markets with CON than in markets where entry was unrestricted. Thus, once again, we find no evidence to support a "public interest" justification for continuing Certificate of Need regulation in the home health area. These results are, however, consistent with the alternative "economic" theory of Certificate of Need regulation, which suggests that incumbent health care providers, either hospitals or incumbent home health agencies, will seek to use the regulatory process to limit entry. We found fewer firms, *ceteris paribus*, in markets with CON. Further, costs may have been higher in CON markets. This is

consistent with firms being less subject to competitive discipline where there are CON regulations.[1]

Before reporting on these analyses, it is necessary to describe the way in which the aggregate data were constructed and to discuss a possible shortcoming of the analysis. For purposes of this aggregate analysis, it was assumed that the relevant market area was the Standard Metropolitan Statistical Area (SMSA) or, for areas that are not part of an SMSA, the county.[2] The individual firm data for firms in each market area were aggregated to obtain the market-area level data used in this analysis. Aggregate total cost for an area was then the sum of the total costs for all home health firms in the sample that were located in that market area. Similarly, the total number of skilled nursing visits was the sum of the skilled nursing visits provided by sample firms located in the market area.

One shortcoming of this analysis should be readily apparent. The aggregate data used are not true market values. In 1981, approximately 3,000 firms were certified to provide home health care to Medicare beneficiaries. An unknown number of other firms may have provided home health services only to non-Medicare patients. The sample of firms used in this study consists of 1,764 Medicare-certified firms. Thus, the analyses reported here are not of market costs. Rather, they are only for a subset of the firms supplying home health services in an area.

DIFFERENCES IN MARKET STRUCTURE

Based on some simple regression analyses reported in Table 9, it appears that the number of firms providing home

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[1] See pp. 32-34 for a more complete discussion of the "economic" theory of these regulations.

[2] This is discussed in footnote 7 on page 71.

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Table 9

The Effect of CON Restrictions on
the Number of Firms and Firm Diversification

$NUM = 1.127 + 0.00001229$ Y1 $+ 0.0001474$ Y2 $+ 0.0005732$ Y3 $+ 0.0003872$ Y4
$\qquad\qquad$ (2.78)** $\qquad\qquad$ (7.21)** $\qquad\qquad$ (4.60)** $\qquad\qquad$ (4.37)**

$- 0.001169$ Y5 $+ 0.000007357$ Y6 $- 0.2110$ CON
$\;$ (-12.38)** $\qquad$ (1.68) $\qquad\qquad$ (-2.07)*

$R^2 = 0.7329$ F $= 379.3$**

$PDA = 30.28 - 0.0002040$ Y1 $+ 0.0002842$ Y2 $- 0.005612$ Y3 $+ 0.001018$ Y4
$\qquad\qquad$ (-1.78) $\qquad\qquad$ (0.54) $\qquad\qquad$ (-1.73) $\qquad\qquad$ (0.44)

$+ 0.001875$ Y5 $+ 0.0001209$ Y6 $- 15.95$ CON
$\;$ (0.77) $\qquad\qquad$ (1.07) $\qquad\qquad$ (-6.03)**

$R^2 = 0.0603$ F $= 8.87$**

$PDB = 20.56 + 0.00006106$ Y1 $+ 0.0008249$ Y2 $- 0.008910$ Y3 $+ 0.0008326$ Y4
$\qquad\qquad$ (0.54) $\qquad\qquad$ (1.60) $\qquad\qquad$ (-2.84)** $\qquad$ (0.37)

$- 0.0007314$ Y5 $- 0.00007842$ Y6 $+ 4.044$ CON
$\;$ (-0.31) $\qquad\qquad$ (-0.71) $\qquad\qquad$ (1.58)

$R^2 = 0.0203$ F $= 2.87$**

$PDC = 13.10 + 0.0001793$ Y1 $- 0.0002660$ Y2 $+ 0.007417$ Y3 $- 0.007491$ Y4
$\qquad\qquad$ (1.85) $\qquad\qquad$ (-0.59) $\qquad\qquad$ (2.70)** $\qquad\qquad$ (-3.84)**

$- 0.003267$ Y5 $- 0.0001049$ Y6 $+ 5.628$ CON
(-1.57) $\qquad\qquad$ (-1.09) $\qquad\qquad$ (2.51)*

$R^2 = 0.0301$ F $= 4.30$**

$PDD = 10.60 - 0.000008237$ Y1 $- 0.000038871$ Y2 $+ 0.001930$ Y3 $+ 0.004329$ Y4
$\qquad\qquad$ (-0.10) $\qquad\qquad$ (-0.10) $\qquad\qquad$ (0.80) $\qquad\qquad$ (2.52)*

$- 0.007686$ Y5 $+ 0.00002319$ Y6 $+ 2.459$ CON
$\;$ (-4.20)** $\qquad$ (0.27) $\qquad\qquad$ (1.25)

$R^2 = 0.0302$ F $= 4.30$**

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Table 9--Continued

PDE = 3.840 + 0.00004303 Y1 - 0.0004432 Y2 + 0.003476 Y3 - 0.003674 Y4
            (0.78)   (-1.72)   (2.21)*   (-3.29)**

+ 0.002663 Y5 + 0.00001728 Y6 + 1.056 CON
    (2.24)*   (0.32)   (0.83)

R^2 = 0.0177 F = 2.49*

PDF = 9.400 - 0.0001587 Y1 - 0.0007275 Y2 + 0.005986 Y3 + 0.004675 Y4
            (-1.93)   (-1.91)   (2.57)*   (2.83)**

+ 0.006119 Y5 + 0.0001307 Y6 + 3.487 CON
    (3.48)**   (1.61)   (1.84)

R^2 = 0.1525 F = 24.89**

where:

NUM = the number of non-hospital-based home health agencies in the local market.

PDA = percent of firms in local market providing services Y1 and Y6

PDB = percent of firms in local market providing services Y1, Y2, and Y6

PDC = percent of firms in local market providing services Y1, Y2, Y3, and Y6

PDD = percent of firms in local market providing services Y1, Y2, Y3, Y4, and Y6

PDE = percent of firms in local market providing services Y1, Y2, Y3, Y5, and Y6

PDF = percent of firms in local market providing services Y1, Y2, Y3, Y4, Y5, and Y6

Yi = total number of visits of service i provided by non-hospital-based home health agencies in the local market

All Regressions have 975 observations.

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health services and the extent to which these firms were diversified differed somewhat depending on whether or not entry into the market was controlled by Certificate of Need regulation. For the same total number of visits, there were slightly fewer firms in markets with CON regulation. On average, the number of firms was 0.21 fewer where there was CON regulation than where entry was unrestricted. This may appear to be a very small effect. However, the average market had only 1.8 firms; and thus, the reduction associated with CON regulation amounted to an 11.6 percent reduction in the number of firms in the average market. The effect is statistically significant at the 5 percent level.

Diversification patterns also appear to be affected by CON regulation. In markets where there was regulation, a significantly smaller percentage of firms provided only skilled nursing and home health aide services. Rather, firms in these markets tended to be more diversified and provided various combinations of services in addition to these two. However, our earlier results suggest that there were no significant cost savings that result from such further diversification.

DIFFERENCES IN TOTAL COST OF SERVICES PROVIDED

Table 10 provides estimates of the relationship between the aggregate cost of home health care services and total services provided. Two forms of the relationship between output and costs were used. First, a quadratic form similar to that of the individual firm cost function was estimated. In this context, however, it is important to note that if the individual firm cost function is of a quadratic form, it does not follow that the sum of the cost functions for a number of firms will be quadratic. Thus, this relationship should not be thought of as being derived from the individual firm relationship. The second estimated relationship between aggregate cost and output was a simple form that is linear in the outputs. Since there is no theoretical justification for the form of the aggregate cost function, this simplified form was estimated to provide an alternative that can be compared with the results of the quadratic equation.

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Table 10

Estimates of the Aggregate Cost of
Producing A Given Number of Home Health
Care Visits in a Market
(t-ratios are in parentheses)

Quadratic Form

$TC = 32461.76 + 47.17\ Y1 + 63.83\ Y2 + 361.72\ Y3 + 15.82\ Y4 + 36.61\ Y5$
$\qquad\qquad (20.3)** \qquad (9.1)** \qquad (9.2)** \qquad (0.4) \qquad (0.9)$

$+ 58.85\ Y6 + 0.0003763\ Y1xY1 - 0.002626\ Y2xY2 - 0.2159\ Y3xY3$
$\ \ (24.2)** \quad (12.0)** \qquad\qquad (-4.4)** \qquad\qquad (-9.7)**$

$+ 0.01810\ Y4xY4 + 0.08302\ Y5xY5 - 0.00001541\ Y6xY6 - 0.001167\ Y1xY2$
$\ \ (1.9) \qquad\qquad (4.8)** \qquad\quad (-0.6) \qquad\qquad\qquad (-8.3)**$

$+ 0.007123\ Y1xY3 - 0.003537\ Y1xY4 - 0.008300\ Y1xY5 - 0.004037\ Y1xY6$
$\ \ (8.0)** \qquad\qquad (-5.2)** \qquad\qquad (-7.0)** \qquad\qquad (-8.0)**$

$+ 0.03628\ Y2xY3 + 0.01474\ Y2xY4 - 0.01282\ Y2xY5 + 0.001316\ Y2xY6$
$\ \ (5.9)** \qquad\qquad (6.2) \qquad\qquad (-2.9)** \qquad\quad (8.4)**$

$+ 0.0009718\ Y3xY4 + 0.09674\ Y3xY5 - 0.005926\ Y3xY6 - 0.08491\ Y4xY5$
$\ \ (0.1) \qquad\qquad\qquad (4.0)** \qquad\qquad (-6.5)** \qquad\qquad (-5.9)**$

$+ 0.001415\ Y4xY6 + 0.009584\ Y5xY6 + 1.397\ CONxYSUM$
$\ \ (2.0)* \qquad\qquad (8.6)** \qquad\qquad (3.6)**$

$- 0.0184\ URBANxYSUM - 21.94\ MCARExYSUM - 10.90\ DR1xYSUM$
$\ \ (-0.7) \qquad\qquad\qquad (-14.9)** \qquad\qquad\qquad (-8.7)**$

$- 3.103\ DR2xYSUM - 7.923\ DR3xYSUM - 7.865\ DR4xYSUM$
$\ \ (-2.5)* \qquad\qquad (-5.3)** \qquad\qquad (-6.5)**$

$R^2 = 0.9947\ F = 5178.872**\ n = 975$

TABLE 10-Continued

Linear Form

$TC = -12949.24 + 65.76\ Y1 + 98.58\ Y2 - 32.26\ Y3 + 54.38\ Y4 + 1.73\ Y5$
$\qquad\qquad (39.3)** \quad (19.2)** \quad (-1.0) \qquad (2.2)* \qquad (0.1)$

$+ 39.84\ Y6 - 0.15\ URBANxYSUM - 19.35\ MCARExYSUM$
$\quad (26.5)** \quad (-13.7)** \qquad\qquad\quad (-14.7)**$

$+ 0.3340\ CONxYSUM - 9.887\ DR1xYSUM - 2.842\ DR2xYSUM$
$\quad (0.8) \qquad\qquad\quad (-11.8)** \qquad\qquad (-3.2)**$

$- 5.754\ DR3xYSUM\ -1.605\ DR4xYSUM$
$\quad (-4.3)** \qquad\quad (-2.1)*$

$R^2 = 0.9895\ F = 6999.011**\ n = 975$

where TC = sum of total costs of firms in the market area

Yi = total number of visits of service i provided by sample firms in the market
    area

YSUM = total number of visits provided by sample firms in the market area

Other variables as defined in Table 2

* Indicates significance at 5 percent level in a two-tailed test.

** Indicates significance at 1 percent level in a two-tailed test.

A variable reflecting the presence or absence of Certificate of Need regulation was included in the regressions; and it is the coefficient on this variable that will be interpreted as indicating whether costs are lower with CON regulation. As with the individual firm cost function, the CON variable was entered in an interactive form multiplied by the total number of visits provided. Thus, we again assumed that any effect of CON will be greater, the larger the number of visits provided by firms in the area.

As with the individual firm cost function, variables reflecting the regional location and a variable denoting urban locations were included. A variable indicating the percent of total costs reimbursed by Medicare was also included; however, in this case, the variable was defined as the percentage of costs incurred by all firms in the region that were reimbursed by Medicare. These variables also appeared in the regression equation multiplied by the total number of visits provided.

Variables reflecting organizational structure were not included in these aggregate regressions. Rather, the type or types of firms that provide home health care in a market was assumed to be a function of the presence or absence of regulation. If there is Certificate of Need regulation, we assume that the CON authorities could influence the types of firms providing home health care by their decisions on approving new entry. If CON regulation is to result in the most efficient provision of home health services, as would be expected by a "public interest" law, the health planning authorities should approve entry by those types of firms that have the lowest costs. Thus, even though firm costs may differ with the form of firm organization, it is not necessary to control for this in our analysis.

The regression results in Table 10 provide no support for the notion that Certificate of Need regulation results in lower costs. In the quadratic form of the equation, the variable reflecting the presence of CON has a positive coefficient that is significant at the one percent level. In the linear form, the CON variable has an insignificant positive coefficient.

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Based on these relationships, costs would appear to have been higher or unaffected by the presence of Certificate of Need regulation.

This result is consistent with our findings based on the individual firm cost function. Using the individual firm function, we found no evidence that firms in markets with CON regulation more completely realized economies of scale or scope. In addition, we found some evidence that CON regulation was associated with higher costs to provide the same quantity of services. Thus, we should expect the aggregate analysis to show higher costs for markets where there was Certificate of Need regulation.

The confidence one can have in these results, of course, depends on how well the entire estimated function performs. On this count, neither function behaves as well as we would have hoped. The linear form suggests that fixed costs were negative, which is obviously unrealistic.[3] Further evidence of the reasonableness of the relationship can be obtained by examining the estimated marginal costs from the two relationships. Estimated marginal costs for a market with the average aggregate number of visits of each service are presented in Table 11. With either functional form, the estimated marginal costs are not as reasonable as those for the individual firm cost function. With both forms, some of the marginal costs are negative at the mean value of services. This is, of course, totally unrealistic. In addition, the estimated marginal cost of speech pathology in the quadratic form is in excess of $300. This seems highly unrealistic as well.

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[3] It should be noted that the constant term in the aggregate regression represents the sum of the fixed costs of all firms operating in the market, not the fixed costs of a single firm. Thus, the constant term of approximately $32,500 in the quadratic function is roughly consistent with the earlier findings that a home health firm can be set up for about $15,000 and that there are an average of 1.8 firms per market.

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Table 11

Estimated Marginal Costs for Market Aggregate
Home Health Care at Mean Aggregate Number
of Visits for Each Service*

| | Marginal Cost Per Visit Based On | |
	Quadratic Form	Linear Form
Skilled Nursing Care	-$20.36 to $13.63	$36.37 to $65.86
Physical Therapy	$31.02 to $65.01	$69.19 to $98.68
Speech Pathology	$306.57 to $340.56	-$61.65 to -$32.16
Occupational Therapy	-$16.99 to $17.00	$24.99 to $54.48
Medical Social Services	$3.38 to $37.37	-$27.66 to $1.83
Home Health Aides	-$25.82 to $8.17	$10.45 to $39.94

* The estimated value for each marginal cost within the range reported depends upon the values of the non-output variables included in the equation.

Because of these problems, the results presented here should probably only be read as providing rough, impressionistic evidence of the effects of CON regulation of home health care market. The estimated regressions may not in general represent a reasonable aggregate cost function. However, these results are certainly consistent with the earlier evidence that CON does not result in lower costs.

CHAPTER 10

CONCLUSION

In this paper, we have examined the rationale for continued Certificate of Need regulation in the home health area. We began by examining the "public interest" justification for regulating entry into this portion of the health care market. Previous discussions of the need for this type of regulation in other health care areas suggested that the application of this form of regulation to home health care could be justified under a "public interest" rationale only if the regulation reduced the extent of unrealized economies of scale, avoided diseconomies of scope, or encouraged firms to realize available economies of scope. The paper, therefore, focused on the extent of economies of scale and scope in home health care. In addition, we considered the effects of the regulations on the costs incurred in providing a given level of services.

We began by estimating a quadratic, multi-product cost function for firms providing home health care. This estimated equation was then used to examine the extent of unrealized economies of scale and the extent of economies or diseconomies of scope. Based on the estimated cost function, the fixed costs necessary to establish a home health care firm were found to be quite small -- only about $15,000 per year. With such low fixed costs, this part of the health care market has no substantial costs of duplication which can be potentially avoided by regulating entry.

Unrealized economies of scale were found to be small. On average, urban firms in our sample would achieve cost savings of only 1.89 percent if they operated at either minimum efficient scale, or at twice their current size where achieving minimum efficient scale required more than a doubling of current size. Further, the cost savings from operating at a more efficient scale were unaffected by the presence of CON regulation. As a result, our analysis of economies of scale suggests that continued Certificate of Need regulation cannot be justified on the grounds that it results in greater economies of scale.

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An examination of the gains from diversification by home health firms -- the extent of economies or diseconomies of scope -- showed that there may be efficiency gains from offering skilled nursing care together with home health aide services. For the average firm supplying only these two services, costs were estimated to be 12.61 percent lower than if one firm had provided the skilled nursing care and another the home health aide services. However, adding additional services did not appear to result in either additional economies or in the loss of efficiency. The average sample firm offering all six home health services had costs that were 0.38 percent higher than if one firm supplied skilled nursing and home health aide services and another independent firm provided the remaining services.

Ninety-six percent of the firms in our sample provided at least skilled nursing and home health aide services. Thus, there was little evidence of unrealized economies of scope in home health care. Further, the presence or absence of Certificate of Need regulation was not significantly related to the percent of firms in urban markets that did not offer both of these services. Again, we found nothing to support a "public interest" need for Certificate of Need regulation in this area.

For a given quantity of visits, we found that costs were somewhat higher on average in regulated markets. Costs were significantly higher for non-profit firms where CON regulation restricted potential competition. Similar results were not found for government providers. Rather, costs for government providers were lower where there was CON regulation. Finally, the costs of for-profit firms were higher, but not significantly so, in markets with CON regulation. Combining these effects, we found that costs were about 2 percent higher, on average, in markets where Certificate of Need regulations restricted entry.

Finally, the relationship between home health care costs and outputs was examined at the market level -- the SMSA or, for non-SMSA areas, the county. Some evidence was found that there were fewer home health firms in markets where CON approval for new entry was required. In addition, firms in CON-regulated markets were found to be somewhat more diversified than those

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in non-CON markets. However, there was no evidence that this smaller number of more diversified firms resulted in lower costs for providing a given total number of visits. Indeed, there was some indication that costs may actually have been higher where there was Certificate of Need.

In conclusion, we found no evidence that Certificate of Need regulation contributes to lower costs for the provision of home health care services. If anything, CON regulation appears to be associated with higher costs. Further, a Certificate of Need program for home health firms involves administrative costs. Perhaps more importantly, by retarding or stopping entry of new firms, CON regulation of home health markets may be denying consumers the benefits of innovative or low cost services that could lower the cost or improve the quality of health care. There is no reason for not allowing the market to function unencumbered by these regulations.

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