THE EFFECTS OF MARKET STRUCTURE ON ORGANIZATIONAL PERFORMANCE: AN EMPIRICAL ANALYSIS OF HOSPITALS

by

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A DISSERTATION

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ABSTRACT OF DISSERTATION
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In efforts to control rising costs of health care, state and federal governments are exploring market-oriented strategies. The success of these strategies depends on the effect that competition has in the health care market. However, the effect of market structure on hospital markets is subject to controversy.

This study applies a modified structure-conduct-performance paradigm to the health care industry in order to investigate the effects of market structure on health care organizational performance, measured by cost efficiency and quality of care. The relationship between health care cost efficiency and quality of care is also examined. In particular, this study examines whether trade-offs occur between these two domains of health care organizational performance and determines if they are compatible in the health care industry.

Two-stage least squares regression is used to analyze 1991 data from 1967 American Hospital Association registered general, acute care hospitals. The market for each hospital is defined as metropolitan statistical area in which the hospital is located. Market structure/competition measures are the Herfindahl index for each hospital market. Herfindahl index for each health maintenance organization market. HMO market

penetration, and interaction between Herfindahl index for each HMO market and HMO market penetration. The cost-efficiency and quality of care organizational performance measures are cost per adjusted admission and overall mortality rate, respectively. Several organizational and environmental factors are controlled statistically.

The results of this study indicated that market structure (i.e., competition among hospitals) was not associated with cost per adjusted admission but had a negative impact on overall mortality rates. HMO competition, HMO market penetration, and interaction terms assessing combined effects of HMO competition and HMO market penetration were not found to have significant effects on either organizational performance indicator. Analysis of the cost and quality trade-off issue found that reductions in cost had unfavorable impacts on either overall or procedure specific mortality rates, suggesting that hospitals may not be able to contain costs without adversely affecting their quality of care.

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TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

APPENDICES

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

Background

The cost of health care continues to be an important economic issue. During the past 3 decades, health care expenditures in the U.S. have risen at an alarming rate. It has been estimated that total health care expenditures have increased from 5.3% of the Gross Domestic Product (GDP) in 1960 to 13.9 percent of GDP in 1993 (Vincenzino, 1995). This represents a 5.9% rate of increase above the Consumer Price Index (CPI) for the same period. Thus, health care expenditures have consumed an increasing amount of the nation's resources in recent history. Among the expenditures for 1993, hospital costs dominate, amounting to $326.6 billion and representing approximately 42% of the health care budget (Levit et al., 1994; Vincenzino, 1995). Table 1 provides an outline of health care expenditures by payment type and source for 1993.

In addition, the quality of health care continues as an important issue in the health care debate. Once the primary concern among health care policymakers, quality has largely been overshadowed by the increasing concern over health care expenditures (Scott & Flood, 1984). Since 1970, direct federal attempts at controlling costs have shifted regulatory interests from promoting quality assurance by liberal subsidization of the nation's health care system to a reliance on accreditation and licensure (Scott & Flood, 1984).

Table 1

Health Care Expenditures by Types and Source of Payment United States, 1993

	Expenditures ($ Billion)	% Change From Previous Year	Source of Payment			
			Out-of-Pocket	Private Third-Party	Medicare and Medicaid	Other Government
				(%	Distribution)	
Hospital Care	$326.6	6.7	2.8	41.2	41.4	14.6
Physicians' Services	171.2	5.8	15.3	50.7	27.6	6.4
Dental Services	37.4	7.7	50.0	45.5	4.0	0.5
Other Professional Services	51.2	10.4	41.4	37.9	13.7	7.0
Home Health Care	20.8	23.8	20.7	24.0	54.8	0.5
Drugs and Other Medical Non-durables	75.0	5.9	63.2	24.5	10.3	2.0
Vision Products and Other Medical Durables	12.6	5.3	60.3	7.1	28.6	4.0
Nursing Home Care	69.6	6.3	33.0	4.3	60.5	2.2
Other Personal Health Care	18.2	15.0	–	15.4	45.0	39.6
Total	$782.5	7.2	20.1	36.8	33.7	9.4

Adapted from Vincenzino, J. V. (1995). Health Care Costs: Market Forces and Reform. Statistical Bulletin, 76 (1), p. 31. Reprinted courtesy of Metropolitan Life Insurance Company.

State planning agencies were authorized by the Social Security Act Amendments (SSAA) of 1972, Section 1122, to review hospital plans for facility and service expansion. In 1974 the National Planning Act (NPA) created a group of Health Systems Agencies (HSA) to oversee federal allocation of resources. Both SSAA and NPA were among the early legislative efforts which were designed and enacted in an attempt to control the spiraling cost of health care by eliminating the duplication of medical services.

Eligibility for federal funding and reimbursement for interest and depreciation costs were determined by state and local agencies through proposed projects which relied heavily on a law referred to as Certificate of Need (CON) (Scott & Flood, 1984). In addition to enacting CON laws, several states also introduced rate regulation programs that were designed to regulate rates for hospital services.

Despite these regulatory efforts, health care costs continued to escalate, particularly federal expenditures for Medicare and Medicaid. Largely due to a growing national concern, the federal government established the Medicare Prospective Payment System (PPS) in 1983. Under PPS, hospitals were paid a variable flat rate per discharge for all Medicare patients; the exact amount for each was determined by classifying each admission into a diagnosis-related group (DRG). Hospitals providing care at a lower cost than the PPS reimbursement rate were allowed to keep the excess. However, hospitals providing more costly care sustained a loss. In 1983, Medicare reimbursement made up approximately 40% of the average hospital's revenues. As a result, PPS provided significant incentives for hospitals to contain costs (Shortell, Morrison, & Frideman, 1990).

Health policymakers are in general agreement that despite regulatory efforts, the performance of the health care industry is poor with regard to cost-efficiency (Scott & Flood, 1984). In addition, hospital costs have risen more rapidly than have most other costs in the health care sector (Vincenzino, 1995). Just prior to the start of the Medicare PPS, during the period 1976-1982, hospital services had an average annual increase in total spending of 7.3% after adjusting for inflation. For a short time after 1982 there was a significant downturn in the growth in total spending for hospital care, particularly in 1984 and 1985 (Altman & Rodwin, 1988). However, in 1986 this downturn reversed, and by 1989 the growth rate for hospital expenditures exceeded the pre-PPS levels by 10% (Lazenby & Letsch, 1990).

Efforts to contain the rise in hospital costs have included the introduction of competitive, market-forcing strategies. The success of the competitive strategy of the 1980s can be measured by the rapid growth of Preferred Provider Organizations (PPOs) and Health Maintenance Organizations (HMOs). PPOs are organizations that have contracts with health services providers to deliver care to the PPOs' customers at discounted rates. The discount is a negotiable amount usually given in return for proprietary referrals from the PPOs' insurer. HMOs restructure traditional health care delivery and financing by integrating the functions of insurance and health care provision. Individuals who enroll in an HMO enter into a contract with an administrative entity for the delivery of health services by a limited panel of physicians for a fixed period and premium. For the Medicare beneficiaries, the premium is calculated according to the average adjusted per capita cost (AAPCC). The HMOs, in turn, contract with health care providers to provide these services. The financial well-being of an HMO depends upon its ability to minimize costs in relation to a fixed revenue stream.

Three variants of HMOs are described in the literature: staff HMOs, where most physicians are HMO employees; group HMOs, where the HMO contracts with a single multispecialty physician group; and network HMOs, which contract with a number of multispecialty physician groups (Wholey & Burns, 1993; Wholey, Felman, & Christianson, 1995). As an option, HMOs may contract predominantly with independent physicians, an arrangement known as an Independent Practice Association or IPA.

The HMO industry experienced rapid growth in the early 1980s, with the number of plans increasing from 234 in December 1981 to 626 in December 1986 (Gruber, Shadle, & Polich, 1988; Christianson, Wholey, & Sanchez, 1991). At the end of 1994, the number of plans went down to 570 HMOs, with total enrollment increasing to over 51 million members (Group Health Association of America, 1995). Table 2 shows the trend of managed care plans enrollment in five states.

It has been argued that HMOs have the potential to infuse price competition into the health care sector, thus improving both the effectiveness and the efficiency of health care delivery (Ellwood, Anderson, Billings, Calrson, Hoagberg, & McClure, 1971). Theoretically, price competition occurs in the health insurance market because plans compete among themselves to gain or retain market share (Goldberg & Greenberg, 1980; Wholey et al., 1995). Competition pressures the plans to contain premium increases, thereby reducing the costs incurred by health insurance purchasers. This downward

Table 2

Change in Percentage of Population in Capitated Plans

	Percentage Enrolled as of January 1994	Percentage Increase 1990-1993
California	33.0	12.3
Massachusetts	32.7	21.8
Oregon	31.5	18.8
New York	19.2	12.1
New Mexico	16.1	12.9

Source: Interstudy (1994).

pressure on premiums causes HMOs to reduce expenditures for services purchased from providers. In theory, competition in the insurance market leads to lower premiums for insurance, lower payments to providers, and more efficient use of medical care resources (Wholey et al., 1995).

In an attempt to understand and develop appropriate remedies for the industry's performance, organizational researchers have devoted attention to the changing structure of the health care markets. The importance of hospital care as the largest component of the health care market, along with the poor organizational performance of the industry with regard to cost, and growing concerns over the effect of cost-containment efforts on quality of care (Scott & Flood, 1984) dominate research efforts. Accordingly, the focus of this study will be on hospitals and their organizational performance with regard to both quality of care and cost-efficiency. The structure-conduct-performance paradigm will be used as a framework to examine the effects of market structure on health care organizational performance.

Structure-Conduct-Performance Framework

The study of organizational performance, applicable to the study of performance in the health care industry, has proceeded along two major avenues: industrial organization economics and strategic management. Industrial organization economics has made great strides in researching organizational performance. This field of research originated with Mason's (1939) and Bain's (1956) structure-conduct-performance (S-C-P) paradigm. The primary principle of S-C-P paradigm is that organizational performance within a market is a function of the conduct of buyers and sellers which in turn, is a function of the industry's structure (Mason, 1939; Bain, 1956).

Organizational performance is measured in terms of welfare maximization (resources employed where they yield the highest valued output). Conduct refers to the activities of the industry's buyers and sellers. Sellers' activities include installation and utilization of capacity, promotional and pricing policies, research and development, and interfirm competition or cooperation. Market structure (the determinant of conduct) includes such variables as the number and size of buyers and sellers, technology, the degree of product differentiation, the extent of vertical integration, and level of barriers to entry (Scherer, 1980). Figure 1 outlines the paradigm as presented by Scherer (1980).

In the S-C-P paradigm, conduct is included as a component; however, research in this field has de-emphasized the importance of conduct as an influence on performance. Instead, the relationship between structure and performance of this paradigm has been investigated extensively, considering market structure to be the main determinant of an organizational performance (Prescott, 1983).

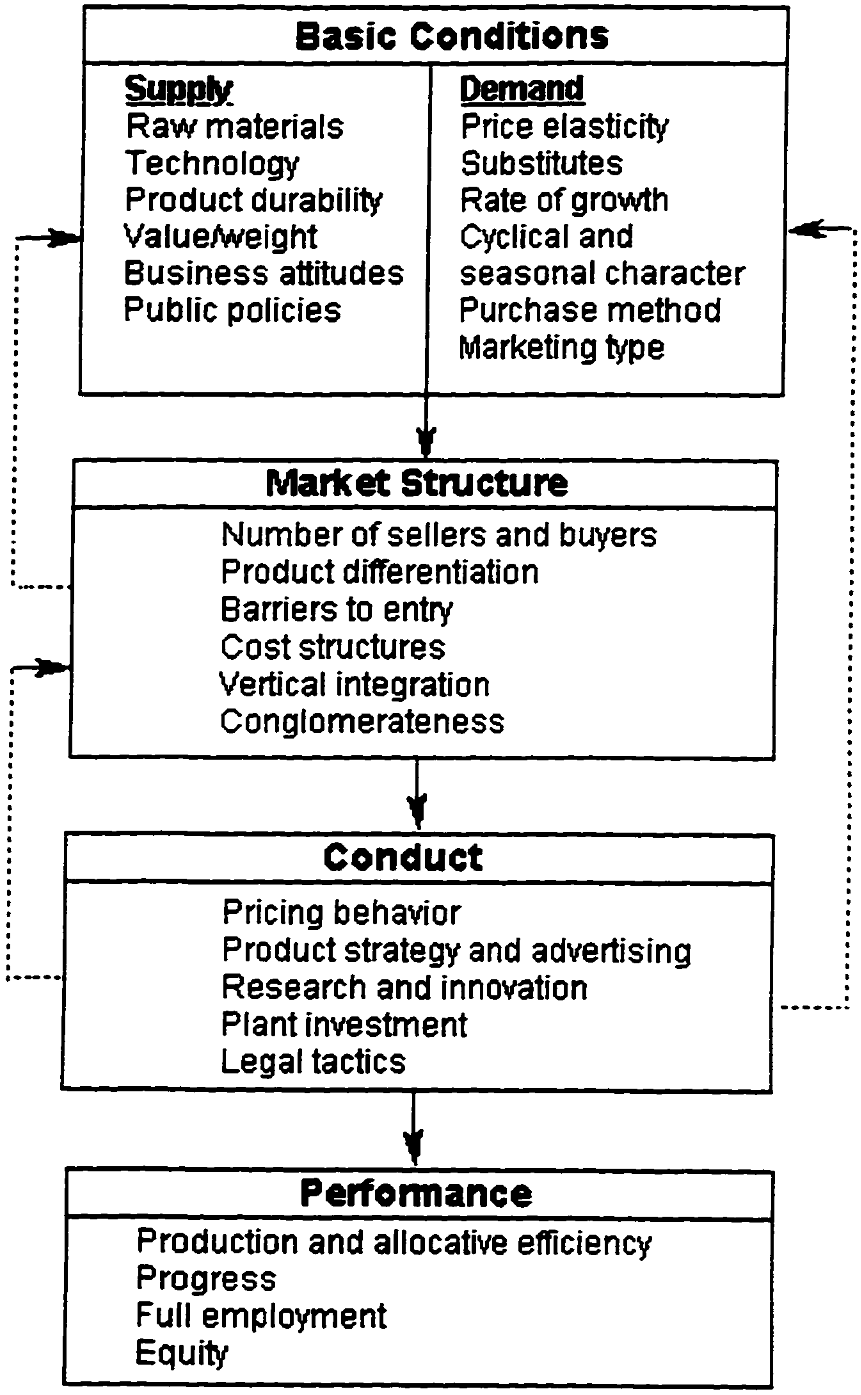

Figure 1. Structure-conduct-performance paradigm. Adapted from Scherer, F. M. (1980). Industrial Market Structure and Economic Performance. Boston: Houghton Mifflin Company. p. 4. Used with permission.

The relationship between market structure and performance is derived from the microeconomic model of perfectly competitive markets (McGee, 1988). Because this is a static model, competition is viewed in terms of an equilibrium condition. In the long run. perfectly competitive markets will result in the optimal (welfare maximizing) allocation of resources in an economy (Samuelson, 1965, ch. 8). All other allocations of resources are judged relative to the optimal that is obtained under perfect competition. Strategic management is a recent field of research that has been applied to the study of an organization and its environment. This field is concerned with studying the co-alignment of internal capabilities of an organization and the external demands of its environment as prime determinants of performance.

The importance of the interdisciplinary approach to studying organizational performance has been recognized by a number of researchers from both industrial organization economics and strategic management (Miles & Snow, 1981; Porter, 1980; Scherer, 1980). The interdisciplinary approach is particularly applicable to the health care industry, where the implementation of both regulatory and market-oriented policies imposes structural changes in the industry. By placing emphasis on the structure-conduct-performance paradigm developed by industrial organization theorists, organizational researchers can provide a framework for the integration of these issues in the studying of health care organizational performance. However, because the health care market deviates from the competitive ideal, modifications must be made to the S-C-P paradigm in order to make it effective.

Market Structure

The structure component of the S-C-P paradigm is defined as those attributes of the market of interest that influence the nature of the competitive process. It includes several important elements, such as market concentration (number and size distributions of firms), product differentiation, the elasticity of demand for the product, and barriers-to-entry, if any. For the health care industry, the two most important structure components are market concentration and barriers-to-entry (Noether, 1988; Prescott, 1983; Starkweather & Carman, 1988).

The most frequently used element of market structure is market concentration. In the absence of product differentiation and before entry can occur, the S-C-P concludes that the fewer the sellers or the less equal their market shares, the more likely seller behavior is to be monopoly-like (Bain, 1968; Stigler, 1968). In markets with homogeneous products and in which firms are profit maximizers and compete based on price, it is feasible to define a market concentration measure by means of some function that is decreasing with the inequality of their market shares (Hannah & Kay, 1977; Scherer, 1980). The most widely used index is the Herfindahl-Hirschman Index (HHI). HHI can be defined as the sum of the squared market shares of firms participating in the market. HHI is used by the Department of Justice Merger Guidelines of 1984 (DOJ Guidelines) to assess the likelihood that a merger will result in excessive market power. (US Department of Justice, 1984). In the health care literature, empirical studies on hospital competition have almost all resorted to the HH as the measure of market concentration (Farley, 1985; Hadley & Swartz, 1989; Joskow, 1980; Noether, 1988; Melnick, Zwanziger, Bamezai, & Pattison, 1992; Zwanziger & Melnick, 1988).

An industry comprised of mainly not-for-profit firms, the health care industry cannot always be adequately described by profit maximization models. In fact, the literature abounds with alternative models of hospital behavior: (a) output maximization (Klarman, 1965); (b) quality maximization (Lee, 1971); (c) quality, quantity, and net revenue maximization (Sloan & Steinwald, 1980); (d) quality and quantity maximization (Newhouse, 1971); (e) physician rent seeking (Pauly, 1987; Pauly & Redisch, 1973). Pauly (1987) recognized the sizeable market share of nonprofit acute care hospitals in the health care industry. Nevertheless, Pauly argued that nominal ownership structure seems to matter much less than fundamental economic incentives. If hospitals behave as profit-maximizers, then HHI is a good measure of market concentration. On the other hand, Kopit et al. (1988) presented persuasive arguments in favor of nonprofit hospitals seeking to maximize their profits. If this is the case, the HHI alone may not be an adequate measure of market concentration.

The relationship between barriers-to-entry and the S-C-P paradigm was popularized by Bain (1956), who defined entry barriers as

> the advantage of established sellers in an industry over potential entrant sellers, these advantages being reflected in the extent to which established sellers can persistently raise their prices above a competitive level without new firms able to enter the industry.(p. 3)

Bain (1956) also identified such barriers as absolute cost advantage, economies of scale, product differentiation, and capital intensity. Barriers-to-entry are essential to the link between market structure and performance in the S-C-P paradigm because without entry barriers, above normal (monopoly) profits cannot exist in the long run equilibrium. All such profits can be eliminated by the entry of new firms. In an industry where above normal profits exist, structure determines potential performance.

In the health care industry, barriers-to-entry consist primarily of government regulatory policies such as certificate-of-need (CON) and rate regulation (Prescott, 1983). CON acts as an entry barrier by inhibiting free entry into the market because health planning agencies must grant approval for capital expansion projects. Rate regulation acts as a barrier to entry by regulating the level of profit and thereby making entry less attractive to potential entrants.

Performance

Among the many factors that must be considered in determining what should be measured to evaluate performance are the nature of the specific organization and the organizational researcher's reasons for measuring performance (Shortell & Kaluzny, 1988). It is, therefore, not surprising to find little consensus in the selection of evaluation criteria. To date, organizational researchers have assumed that efficiency and effectiveness are two interrelated domains of performance. The importance of evaluating performance with respect to these domains of cost and quality is especially critical in health care due to increasing pressures for health care organizations to contain costs (maintain efficiency) and provide high-quality care (maintain effectiveness) (Fottler, 1987).

There has been some serious discussion among health care experts as to whether the simultaneous achievement of cost-efficiency and quality of care is possible or whether trade-offs are inevitable (Fottler, 1987). Since the objective of the regulatory effort in the health care industry is to contain costs while maintaining quality, the policy implications of this discussion are significant. In spite of this effort, a number of studies have continued to focus on a single performance measure. In addition, the majority of the few studies that have considered trade-off issues were conducted in the pre-PPS era before any serious cost-containment measures were initiated.

Framework of Analysis: Structure-Conduct-Performance Paradigm

Industrial organization economics seeks to identify variables that impact economic performance and to build theories about relationships among those variables that impact performance. This concept is based on the fundamental assumption that society wants excellent performance from producers of goods and services (Scherer, 1980).

Relationships among the three components are described in the S-C-P paradigm. The first component is market structure, which includes characteristics of the market that influence the competitive nature of the industry. The second component is conduct. It is concerned with how to compete, the selection of goals, and allocation of resources to various functional areas in an economic environment. The third component, performance, can be considered the result of the degree of fit between the industry's organization conduct and market structure. Industrial organization economists have determined that performance is a multidimensional concept which includes production and allocative efficiency, full employment, equity, and technological progress (Scherer, 1980; Prescott, 1983).

The S-C-P, in its simplest form, proposes a unidirectional relationship which was emphasized by early writers on industrial organization economics, particularly by Mason

(1939) and later by his student, Bain (1956). Many analyses rely on this unidirectional relationship, even today. However, recently, interrelationships and dynamics among structure variables, conduct variables, and performance outcomes have been recognized (Scherer, 1980). It is assumed by a number of more current analyses that if firms adaptively respond or react to their environment, they have the ability to alter market structure (Scherer, 1980).

Some researchers differ as to the amount of emphasis that should be put on the conduct link of the structure-conduct-performance paradigm. Scherer (1980) states the difference by summarizing Bain's (1956) arguments for de-emphasizing intermediate conduct and then countering with his own arguments for the importance of it. Bain (1956) proposes three main arguments for de-emphasizing conduct. First, if structure alone provides satisfactory predictions of performance, the inclusion of conduct is not essential. Second, a priori theory based on structure-conduct and conduct-performance results in a loss of the one-to-one relationship between structure and performance. A range of conduct can result from the specific structural conditions; similarly, varying qualities of performance can result from similar conduct patterns. This leads to ambiguous predictions of performance. Last, Bain (1956) argues that even if satisfactory S-C-P hypotheses could be formulated, there would be serious problems trying to test them. These problems include lack of complete or reliable data and resistance by firms to having their business studied, not to mention the cost and time consumed in studying a firm's decision-making processes.

Scherer (1980) responds to these three arguments by stating that first, although predictions of performance directly from structure may be good enough, it may be possible to explain more statistical variation in performance by including conduct variables. Second, predictions of conduct based on structure and of performance based on conduct can be more precise by introducing a richer complement of explanatory variables. Third, Scherer feels that with the advances in the field and the growing number of economists, sufficient in-depth studies can be accomplished.

Market Structure

One major component of the structure-conduct-performance framework is market structure. Market structure can be defined as those attributes of the market that influence the nature of the competitive process. The amount of emphasis that should be placed on conduct in the structure-conduct-performance paradigm is often the subject of disagreement, unlike strong agreement regarding the importance of market structure. Agreement results because of the importance of market structure in determining the quality of the industry's firms (Bain, 1968), which in turn determines the quality of the industry's performance. To understand what market conditions make for a good or bad performance is the main goal of industrial organization economics. Caves (1967) sums this up like this:

> if we can uncover reliable links between elements of structure and elements of performance, we can with relative ease and confidence predict the performance of any industry in which we are interested. Even more important, the elements of market structure can be changed in some cases as a result of public policy. If we can spot some feature of market structure which regularly causes poor market performance, we may find the key to designing policies to change the environment and raise the level of performance. (p. 16)

Market structure shapes conduct and performance by affecting the character and intensity of competition among firms in the same industry, according to Bain (1968). Therefore, a feasible starting point in deriving the S-C-P approach would be the perfect competition and monopoly theories. Arguments for the propensity of perfect competition stem from one of the fundamental theorems of welfare economics, the Pareto optimality concept. Pareto optimality is defined: "a point in the processes of production and resource allocation where it is impossible to make any person better off (as that person sees his own welfare) without at the same time making another person worse off (as that other person sees his own welfare)" (Greer, 1980, p. 26). If an industry is not at Pareto optimum, the possibility for clear-cut improvement exists, and the result is said to be inefficient, nonoptimal, or unfavorable. Therefore, Pareto optimality is synonymous with allocative and technical efficiency. It is said, then, that perfect competitive industry achieves this optimum.

Broadly speaking, "the structure of a market is a description of the behavior of buyers and sellers in that market" (Fischer & Dornbusch, 1983, p. 4). Table 3, which gives a taxonomy of market structures and their associated characteristics, shows that there are two extremes of market structure and a host of others that fall between these two. At one end of the spectrum is a perfectly competitive market where there are many buyers and sellers, each with a small share in the market such that their buying or selling decisions have no effect on market price. The products produced and sold are homogenous (i.e., perfect substitutes for each other) and there are no barriers to entry or exit in the market. In a perfectly competitive market, the producers are "price-takers"; prices are set at the marginal cost (MC) of production, thus preventing excessive or above-normal profits. Government intervention is unnecessary because the market mechanism ensures the efficient allocation of resources in production and consumption.

Table 3

A Taxonomy of Market Structures

Characteristics	Market Structure Perfect competition	Monopolistic competition	Oligopoly	Monopoly
Number of sellers	Many	Many	Few	One
Type of products	Homogeneous	Close substitute exists	Some real or perceived product	Unique
Ability to affect price	None	Limited	Some	High
Level of profit	Minimum necessary (normal)	Slightly higher than minimum	Higher than minimum necessary	High
Limitation on entry	None	None	Some	No entry
Social welfare	Optimal	Slightly less than maximum	Suboptimal	Suboptimal

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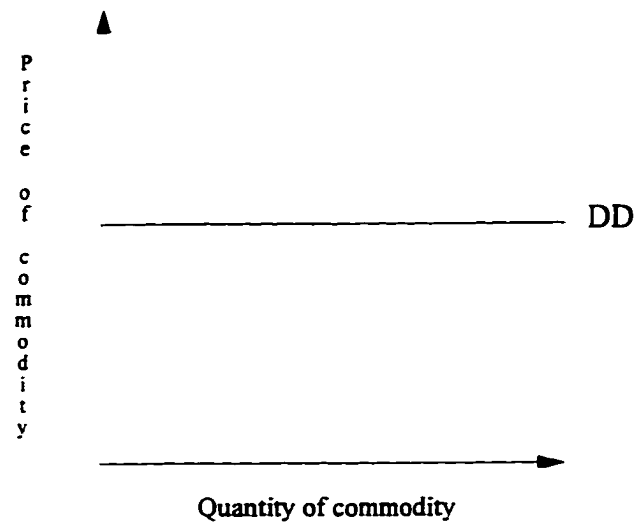
A "normal" profit level, as defined here, is that which is sufficient to keep the existing firms operating in the market but not so high as to attract new firms into the market. Firms in a perfectly competitive industry can sell as much as they want at the going market price, which implies that they are facing a horizontal demand curve, as depicted in Figure 2a.

If the firm is not operating in a perfectly competitive market, then the market structure is imperfectly competitive. The degree of imperfect competition is really

(a)



(b)

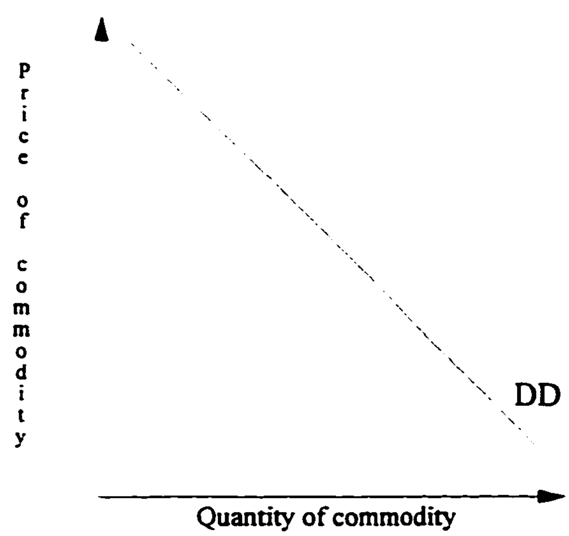


Figure 2. The Demand Curve Includes Perfect and Imperfect Competition. DD, demand curve. Reprinted by permission of the publisher from Craig, A.M.& Molek, M., Market structure and conduct in the pharmaceutical industry. Pharmacology and Therapeutics, 66, p. 304. Copyright 1995 by Elsevier Science, Inc.

dependent on the number of firms operating in the market. The extreme case of imperfect competition is a monopoly, where there is only one seller of goods. The demand curve facing this monopoly is also the demand curve for the entire industry and is downward sloping. This downward-sloping demand curve is true for all other imperfect competitors. This would imply that the monopolist has the choice of fixing the price or the output, but not both. In choosing the level of output, the monopolist must take into account the fact that higher sales tend to produce lower prices (see Figure 2b). The monopolist is usually associated with high levels of price set to maximize profit levels and resulting in suboptimal social welfare.

Between the two extremes of perfect competition and monopoly lie monopolistic competition and oligopoly. Monopolistic competition is a market in which there are many sellers (not as many as the perfectly competitive market) of goods. These goods are close substitutes (although not identical, as in the case of the perfectly competitive market); as such, each seller has a limited ability to fix the price at which it sells. In an oligopoly there is a small number of large firms which dominate the industry and, while recognizing their interdependence, do not collude. Any one of these larger firms can affect the market shares and profitability of its competitors by its own decisions and actions; therefore, the need to consider possible reactions of competing sellers in making decisions about pricing and other marketing strategies is a distinguishing feature, the conjectural variation (Henry & Haynes, 1978). This type of market structure is often associated with barriers to entry and non-price competition, particularly product differentiation, which leads to brand loyalty and the ability of firms to charge high prices (price set above the MC of production) and earn above-normal profits.

Various industrial organization economists include different elements as composing market structure, but there are a few basic elements that are common to all of them. These include market concentration, barriers to entry, and product differentiation. However, product differentiation will be excluded from consideration in the current study. In health care organizations the main dimension for differentiating the product is that of quality (Clarke, 1985), a dimension which is less formal and more difficult to measure than in other industries. In addition, the most common method of differentiating products is through the use of advertising to create brand loyalty. The use of advertising is a relatively recent phenomenon in the health care industry, and data on amounts spent on advertising are not readily available. Furthermore, not-for-profit hospitals have a tendency to avoid advertising all together, since it appears to undermine public and political support for hospitals generally and to jeopardize the favorable tax status of not-for-profits in particular (Higgins, 1989).

Market Concentration

Market concentration refers to the degree to which production in a particular market is concentrated in the hands of a few large firms (Clarke, 1985). Therefore, the measurement of concentration is concerned with the number and relative sizes of firms within the industry. Other things being equal, a market is said to be more concentrated the fewer the number of firms in production or the more unequal the distribution of market shares.

Market Concentration in the Health Care Industry

Luft, Robinson, Garnick, Maerki, & McPhee (1986) reveal a high prevalence of monopolies and oligopolies in hospital markets in the United States. Using both 5- and

15- mile radii from hospital as the market, the number of competitors within the market was calculated for 6,520 hospitals from 48 states.

The results showed that 47% of the hospitals in the United States have no neighbors within 5 miles of each other, and 77% have fewer than five neighbors. In addition, certain geographic areas of the United States contain a higher number of dense hospital markets than other areas. In particular, the Mid-Atlantic, Pacific, and New England states have 21%-38% of their hospitals in densely concentrated markets with 31 or more neighbors within 15 miles. However, states in the middle and southern parts of the United States have few hospitals in dense markets, with 50%-80% of the hospitals existing in markets with fewer than five neighbors. Luft et al. (1986) suggest that public policies to encourage hospital competition might have differential effects across these markets, with such strategies being effective in the more densely concentrated regions but other strategies perhaps being needed for other regions.

Performance

Performance is the third major component of the S-C-P paradigm. Looking at the many conceptual issues that must be considered in evaluating performance, it is not surprising to find that there is a diversity in the performance criteria selected to evaluate organizations. However, all of these criteria can basically be classified as either efficiency or effectiveness measures.

Efficiency is defined as the cost per unit of output. For health care organizations, the decision of cost-efficiency criteria is simple and straightforward and usually consists of cost per admission, cost per discharge, cost per day, and so on. Effectiveness is the degree to which goals and objectives are met. For health care organizations, an evaluation of effectiveness often equates with an evaluation of quality of care. However, the concept of quality of care is a complex one, encompassing many dimensions such as accessibility, appropriateness, and efficacy. Therefore, the primary indicators for assessing quality of care are numerous.

Donabedian (1966) distinguished three classes of quality indicators: structural, process, and outcome. Structural indicators assess organizational features or participant (staff or patient) characteristics that are presumed to be related to organizational performance. Examples of structural indicators include type and quality of facilities and equipment, staff qualifications, and accreditation of the hospital. Process indicators are based on evidence relating to performers' activities in carrying out their jobs, including the management of technical and interpersonal processes. Examples of process indicators include how rapidly and accurately certain procedures are performed. Outcome measures assess whether changes in the patient's health status can be attributed to the work performed upon them. These changes can refer to physiological, social, and psychological functions. Examples of outcome measures include postsurgical infections, mortality rates, and patient or employee satisfaction with the outcome or process of care.

Flood, Shortell, and Scott (1994) point out that certain categories of constituencies may prefer one category of measurements over another, the preference being made because each group feels that they have control over the areas associated with themselves. For example, administrators tend to prefer structural measures, while employees prefer process measures. Patients and outside publics are likely to prefer outcome measures as they are most concerned with the actual results achieved.

Most health care industry studies have treated cost efficiency and quality of care as independent concepts. However, hospital administrators are under enormous pressure to achieve at least a satisfactory level of both simultaneously. In fact, the stated objective of many hospitals is to provide high quality services at minimal cost (Longest, 1978).

There are disagreements among health care experts as to whether cost-efficiency and quality of care can be compatible goals. There are those who argue that costs can only be controlled by cutting back some services and failing to make needed improvements in manpower, facilities, and equipment and that trade-offs between cost-efficiency and quality of care are therefore necessary (Flood et al., 1994). There are others, however, who argue that although severe cost reduction measures could cause quality of care to suffer, there are numerous inefficiencies that could be eliminated, which will not only contain costs but will also result in higher quality of care (Longest, 1978).

Purpose of the Study

The purpose of the current study is twofold. First, a modified structure-conduct-performance paradigm will be applied to the health care industry to investigate the effects of market structure on health care organizational performance, measured by cost-efficiency and quality of care. Second, this study will also investigate the relationship between health care cost-efficiency and quality of care. In particular, this study will examine whether trade-offs occur between the two domains of health care organizational performance and determine if these two goals are compatible in the health care industry.

Research Questions

To accomplish the aforementioned purposes, the following primary research questions will be addressed:

1. What is the effect of market structure on cost efficiency and quality of care in hospitals?

2. What is the nature of the relationship between cost efficiency and quality of care in hospitals?

Rationale for the Study

A review of the literature shows that there are several ways that the current study can contribute to the body of knowledge concerning health care organizational performance. First, although there are several studies that have considered the effect of market structure on health care organizational performance, there are very few published studies that have examined the simultaneous effects of market structure on these two domains of health care organizational performance.

Second, although there are several studies that have applied the market concept to the examination of health care organizational performance, the majority of these studies were done prior to the introduction of PPS. The implementation of PPS in the 1980s and the rapid growth of managed care plans in the 1990s have shifted the health care industry into a more complex environment, making it probable that the market structure of the industry may have been affected by these changes. This question necessitates a study to reexamine structure effect in post-PPS era.

Finally, when examining health care organizational performance, a majority of the studies have concentrated on either efficiency measures or effectiveness measures but rarely both. Again, the very few studies that have examined both domains of health care organizational performance simultaneously were done in the pre-PPS era. Thus, new studies such as this one are necessary to extend the literature by effectively investigating the issue of whether cost-containment measures might have negative or positive impacts on quality of care.

Significance of the Study

The results of this study may have significant implications in three major areas. First, the results of the investigation into whether cost efficiency and quality of care can be compatible will have significant implications for public policy. As noted earlier, the heart of the regulatory effort is to contain costs without diminishing quality. Studies to date have been contradictory in their results as to the relationship between cost-efficiency and quality of care. This study will provide further information for public policy makers to consider when deciding whether current policies are indeed meeting their intended goal, or if modifications may be needed to ensure that policies help improve health care organizational performance.

Second, the results of this study will have managerial implications. If market structure is indeed found to have a significant effect on health care organizational performance, this will reinforce the assumption that managers must carefully analyze their markets. In addition, by examining all possible linkages in the structure-conduct-performance paradigm (i.e., applying the full paradigm) in this study, the effect of structure on health care organizational performance can be determined. This information will assist health care managers in developing a better understanding of the role structure actually plays in determining health care organizational performance.

Finally, this study will contribute to the empirical literature on health care organizational performance by integrating the study of health care organizational performance as two interrelated domains, by the application of the full structure-conduct-performance paradigm, and by the use of post-PPS data. It is hoped that this study will help clarify health care organizational performance issues and will stimulate further interest in research in this area.

Definitions of Terms

Market Structure

A market is all the buyers and sellers of a product (Bain, 1968). The product for this study is acute care hospital service. Because of the local nature of the product, the market is defined as Metropolitan Statistical Area (MSA). Market structure has been defined as the characteristics of the market that affect the behavior of the suppliers of a product (Caves, 1967). Bain (1956) identifies concentration as a significant determinant of market structure. The scope of market structure is gauged by the distribution of firms in the market.

Organizational Performance

The two concepts of efficiency and effectiveness have long been considered as two interrelated domains of organizational performance (Flood et al., 1994). Efficiency is defined as the cost per unit of output. For health care organizations, the measurement of cost-efficiency is simple and straightforward and usually consists of cost per admission, cost per discharge, or cost per day. Effectiveness is the degree to which goals and objectives are met. For health care organizations, an evaluation of effectiveness often equates with an evaluation of quality of care. However, the concept of quality of care is a complex one, encompassing many dimensions such as accessibility, appropriateness, and efficacy. Therefore, the primary indicators for assessing quality of care are numerous.

Summary

The primary purpose of the current study is to apply the structure-conduct-performance paradigm developed by Mason (1939) and Bain (1956) to the health care industry in order to analyze the effects of market structure on health care organizational performance. Health care organizational performance will be defined as cost-efficiency and quality of care. The relationship between health care cost-efficiency and quality of care will also be examined to determine whether these two goals can be compatible in the health care industry or whether trade-offs must necessarily occur between these two dimensions of health care organizational performance.

CHAPTER 2

LITERATURE REVIEW

There have been few empirical studies published which have employed the full structure-conduct-performance (S-C-P) paradigm. However, industrial organization economics research which investigates structure-performance relationship is too extensive to be reviewed comprehensively. Therefore, this chapter will be limited to reviewing those studies which have examined the effects of market structure on various organizational performance indicators in the health care industry. In addition, the pertinent literature involving the tradeoff between cost and quality will also be reviewed.

Market Structure/Concentration and Organizational Performance

Earlier Studies

Many empirical studies have examined the effects of market structure on organizational performance (Wilson & Jadlow, 1982; Farley, 1985; Robinson & Luft, 1985; Salkever, 1979). Organizational performance has been defined as cost-efficiency, clinical services, patient volumes, and bed occupancy rates. Most of these studies were completed during the pre-PPS era when hospitals were reimbursed on a fee-for-service (FFS) basis, so that the more medical care that was provided to a patient, the more income/revenue the hospital received. In addition, hospitals were basically free of cost constraints in competing for physicians by adding specialized services, since the payment system would cover the cost to the hospital for providing these services. Studies during this period found that, contrary to classic economic theory, increased competition in the local hospital market generally resulted in duplication of services, inefficiencies, and high costs (e.g., Farley, 1985; Robinson & Luft, 1985; Salkever, 1979; Wilson & Jadlow, 1982;). These results were due to the fact that competition tended to be in the form of non-price competition for physicians by acquiring sophisticated and expensive technology and facilities. The key empirical studies of market structure/concentration and performance, using pre-PPS data, are summarized in Table 4.

One of the earliest studies regarding the effects of hospital market structure on organizational performance was done by Salkever (1979). He found that holding other factors constant, hospitals in areas with a large number of rivals experienced higher average costs. A great number of later studies, all using pre-PPS data reached similar conclusions (Hersch, 1984; Luft et al., 1986; Noether, 1988; Robinson & Luft, 1985;).

Using 1976 data from a stratified random sample of 346 private, nonprofit hospitals, Joskow (1980) presented perhaps the first attempt to estimate a model in which the relationships between market structure and nonprice competition were explicitly measured. Joskow assumed that hospital administrators seek to maximize their "utility" as defined by the quantity, quality, and scope of services provided. Due to extensive third party reimbursement, he argued that hospitals face few incentives to compete based on price. Also, he argued that patients make hospital choices indirectly, through their choice of physician. Hospitals therefore compete for patients by attracting additional staff physicians by providing higher quality services. "Higher quality" in Joskow's model is measured by the hospital's "average reserve margin," defined as the excess of available beds over the average daily census (in%). Physicians value increases in the average

Table 4

Summary of Market Structure and Performance Research (Pre-PPS Data)

Study	Sample	Period	Market Structure	DV: Performance	Principal Findings
Market Structure-Efficiency (Cost) Studies					
Robinson & Luft (1987)	5,732 U.S. hospitals	1982	Number of competing hospitals located within a 15 mile radius	Cost per patient-day and cost per admission	Lower concentration was associated with higher costs
Garnick, Luft, Robison, & Tetreault (1987).	504 California hospitals	1982	Concentration index: geopolitical boundaries, distances between hospital, patient origin data	Cost per admission	When the first two market definitions were employed--a statistically significant positive relationship between the proxies for competition (lower concentration ratios) and costs
Luft et al. (1986)	3,584 community hospitals	1972	Number of neighboring hospitals	5 clinical services	Found that higher competition increased the availability of services and costs
Wilson & Jadlow (1982)	900 short-term, general hospitals	1973	Hospital density, population density, market size	Technical efficiency	Increased competition is associated with decreased efficiency and increased costs

Table 4 (Continued)

Study	Sample	Period	Market Structure	DV: Performance	Principal Findings
Robinson & Luft (1985)	5,013 U.S. community hospitals	1972	Number of neighboring hospitals within the radius were categorized into series of dummy variables (0, 1, 2-4, 5-10, 10+)	Inpatient admissions, inpatient cost per day, inpatient cost per admission	Hospitals in more competitive environments exhibited significantly higher costs of production than did those in less competitive environments
Farley (1985)	400 short-term, general, nonfederal U.S. hospitals	1970-1977	Herfindahl-Hirschman Index (HHI)	Finances, case-mix, resource usage	No statistically significant differences in profit margins associated with market structure, yet operating expenses per case, a proxy for intensity of care,were 19% higher in competitive than in monopolistic markets, and length-of-stay was longer in competitive than in monopolistic markets

Table 4 (Continued)

Study	Sample	Period	Market Structure	DV: Performance	Principal Findings
Salkever (1979)	Not available	Pre-1983	Herfindahl-Hirschman Index (HHI)	Average costs	Holding other factors constant, hospitals with large number of rivals experienced higher average costs
Market Structure-Effectiveness Studies					
Robinson, Luft, McPhee, & Hunt (1988)	747 short-term hospitals	1982	Number of neighboring hospitals	Length-of-stay (LOS)	Market competition was found to be positively related to LOS for all 10 procedures, confirming the hypothesis that increased competition in the local market encourages hospitals to accommodate patient and physician preferences for longer LOS
Joskow (1980)	346 private, nonprofit hospitals	1976	Herfindahl-Hirschman Index (HHI)	Hospital bed supply	Hospitals in low HHI or high level of inter-hospital rivalry maintain a high reserve supply of beds

reserve margin because it reduces expected admission delays and because physicians believe that hospitals provide better care when they are operating well below their capacity constraints.

Joskow's (1980) empirical model sought to explain variations in "reserve margins" through market concentration indices (measured as the standard metropolitan statistical area), the ratio of physicians to hospitals (to reflect hospital competition for physician affiliations), and market entry conditions (a variable indicating the presence of certificate-of-need). Overall, the empirical results conformed closely to his a priori expectations. Reductions in the number of hospitals, as measured by high values for the Herfindahl Hirschman Index, significantly reduced the size of hospitals' average reserve margins. Also, increased numbers of physicians in the market and certificate-of-need (CON) regulation and rate review programs significantly reduced reserve margins in localized markets. He concluded that policies that encourage hospital competitive behavior may induce hospitals to expand quality and quantity beyond a point of maximum efficiency.

In a study using 1973 data and a two-stage econometrics approach, Wilson and Jadlow (1982) estimated the effect of competition on the productive efficiency of nuclear medicine services. In the first stage of the analysis the authors estimated a "best-practice frontier" production function for nuclear medical services. This technique identifies the maximum quantity of output that can be produced with a given quantity of labor and capital inputs. Using the estimated best-practice frontier, they computed an "efficiency index" for each hospital. This index equaled the percentage difference between the hospital's actual and potential output. In the second stage of the analysis, they asked whether interhospital variations in this efficiency index could be explained by the degree of concentration in each hospital's service area and by the hospital's profit/nonprofit status. They found that increased competition was associated with lower technical efficiency.

Using data on 400 short-term, general, nonfederal U.S. hospitals from 1970 to 1977, Farley (1985) analyzed the effects of market structure on three different aspects of hospital performance: profitability, resource usage, and case-mix. The market area was defined as the county in which the hospital is located, and market concentration was measured by the Herfindahl-Hirschman Index (HHI). Based on HHI, hospitals were classified into one of three market groups: monopolistic, intermediate, or competitive. Farley's results indicated that competition is not associated with differences in profitability, although it appears to increase expenses per admission. Farley interpreted this result as evidence that competition among hospitals raises costs. However, he did not explicitly control for exogenous sources of cost differences (e.g., wage rates) that might positively be correlated with his competition variable.

Farley (1985) found no relationship between market structure and a length-of-stay-based case-mix index. He did find evidence suggesting that patients having similar conditions are treated differently, depending upon market structure. Furthermore, he did find that hospitals in nonconcentrated markets tended to hold more unused bed capacity, offer a broader array of diagnostic and therapeutic services, and employ more capital and more labor per adjusted admission than did institutions in more concentrated areas. All of these results are consistent with the nonprice competition hypothesis.

Consistent with the results obtained by Farley (1985), Robinson et al. (1988) found that increased competition, as measured by the number of "neighboring" hospitals within a 15-mile radius local market, was positively related to length-of-stay (LOS). Using 1982 data on 747 nonfederal general hospitals and consisting of 498,454 patient discharges, Robinson et al. (1988) regressed LOS for each of several surgical procedures on variables measuring hospital case-mix, patient characteristics, population, population density, physician experience, region, teaching status, and ownership status. The results indicated that increasing the number of neighboring hospitals from none to 11 or more in a 15-mile radius was associated with a 7%-23% increase in LOS (Robinson, 1991).

More evidence on the wasteful-competition hypothesis was provided by studies that focused on hospital costs. Acknowledging that price competition was of increasing importance, Robinson and Luft (1985) hypothesized that hospital competition was still conducted primarily along nonprice dimensions. Because higher quality is costly to produce, the assumed importance of nonprice competition leads to the prediction that increased competition will contribute to higher pecuniary costs. Using 1972 data from 5,013 acute care general hospitals, the authors analyzed the impact of hospital market structure on inpatient admissions, inpatient cost per day, and inpatient cost per admission. Hospital markets were defined for each hospital as the 15-mile radius around the hospital. Market competitiveness was measured by several dummy variables indicating the number of hospitals within the 15-mile radius (1, 2-4, 5-10, or more). They found that when other factors are held constant, average costs per admission and per patient day increase significantly with increases in the number of rival hospitals. Unlike Joskow (1980), the authors found that increases in the physician-population ratio (which should reduce competition for staff physicians and could therefore reduce costs) were associated with higher costs.

Using 1972 data for 3,584 general hospitals, Luft et al. (1986) conducted a direct test of the nonprice competition hypothesis. The authors argued that if hospitals in a particular geographic area are inclined to engage in rivalrous behavior, an increase in the availability of a particular service by neighboring hospitals will increase the likelihood that any individual hospital in the area will offer the service. To test this hypothesis, they performed a statistical analysis for 29 clinical services in which they attempted to explain the presence of a particular service at an individual hospital by both the total number of competing hospitals in the area and the percentage of these competing hospitals that offered the service. Their results indicated that the availability of a service at an individual hospital is positively related to the number of competitors that also offer the service but not to the absolute number of competitors in the same location.

Employing 1982 data on 504 California hospitals, Garnick et al. (1987) analyzed the relationship between market concentration and cost per admission. Three different techniques were employed to delineate geographic market boundaries. The first was based on "geopolitical" distinctions (counties or Standard Metropolitan Statistical Areas/SMSAs); the second was derived from information on distances between hospitals; the third utilized "patient origin" data. This yielded three sets of concentration statistics. Each concentration index was then entered as an explanatory variable that explained "average cost per admission." Other explanatory variables included hospital characteristics (e.g., bed size, ownership, staff per bed), inpatient days in various units (e.g., case-mix), and sociodemographic characteristics (e.g., physician:population ratio).

The authors found that when market definition techniques were employed, there emerged a statistically significant positive relationship between the proxies for concentration (lower concentration ratios) and costs. However, when the market boundaries were established by the patient flow data, the observed relationship was negative.

Extending the work of Garnick et al. (1987) to a national sample, Robinson and Luft (1987) assessed the relationship between market structure and costs using 1982 data on a sample of 5,732 hospitals. Market boundaries were derived via the application of an algorithm that computed, for each hospital, the number of competing hospitals located within a 15-mile radius. The corresponding concentration figures were entered into regression equations whose dependent variables were cost per patient day and cost per admission. The authors also included variables to control for ownership-type or chain/nonchain status. Like Garnick et al. (1987), they found that for both cost measures, lower concentration (i.e., greater competition) was associated with higher hospital costs.

The studies reviewed found that decreased hospital concentration was associated with increased unit costs, increased length-of-stay, and increased production of health care services. In other words, hospitals operating in areas with greater competition tend to use more resources and to have higher costs. These studies also provide a convincing evidence that competition will tend to increase costs in a market environment competing on nonprice bases.

Recent Studies

Although these earlier studies suggest that structural indices of competition were associated with increased health care costs and resource use, recent studies, using data from 1983 or later, provide a somewhat different picture. These studies tend to focus on the experience of California hospitals after the introduction of selective contracting allowed third party payers to exclude some providers from participation in their programs if they chose to do so. The key empirical studies of market structure/concentration and performance, using post-PPS data, are summarized in Table 5.

Continuing their analysis of the effects of hospital market structure on costs, Robinson and Luft (1988) studied the effects of various state level hospital regulatory policies from 1982 through 1986. Applying regression analysis to a national sample of 5,490 hospitals, they compared the performance of California's "procompetition" policies with the rate regulation strategies of New York, New Jersey, Massachusetts, and Maryland. The authors used each hospital as an observation and regressed the logarithm of changes in costs per admission from 1982 to 1986 on the logarithm of the 1982 levels and the 1982 to 1986 changes in the level of several independent variables. The explanatory variables included the percentage of discharges by payor type (Medicare/Medicaid), average employee earnings, output measures (bed size, inpatient and outpatient visits, bed size per admission, etc.), teaching status, ownership type, patient mix in six service categories, number of neighboring hospitals, physician density, median income, population density, and dummy variables indicating the form of state regulatory regime. Because the model examines cost changes over a 4-year period, rather than levels of costs at point in time, a failure to adjust explicitly for quality variation across hospitals may not be as important as in earlier studies of hospital costs if the quality of a given hospital does not change markedly over time. They concluded that two policies were equally effective in controlling changes in costs per admission in the short run. From a competition standpoint, their finding was that competition appeared to

Table 5

Summary of Market Structure and Peformance Research (Post-PPS)

Study	Sample	Period	Market Structure	DV: Peformance	Principal Findings
Market Structue-Efficiency (Cost) Studies					
Robinson (1991)	298 private, non-HMO hospitals	1982-1988	HMO market penetration, number of competitors using different method based on an area with a radius of 24 kilometers from the hospital	Cost per admission	Found that cost per hospital admission grew at 9% lower rate in those markets where HMO penetration was high
Hadley & Swartz (1989)	1,293 hospitals	1980-1984	Herfindahl-Hirschman Index (HHI)	Hospital costs	Competition mattered, but it did not matter very much
Robinson & Luft (1988)	5,490 hospitals	1982-1986	Number of neighboring non-federal, short-term general hospitals within 24-km (15-mile) radius	Costs per admission	Competition appeared to reduce rates of cost inflation in the five states, as well as nationally
Market Structure-Effectiveness Studies					
Dranove, Shanley, & Simon (1992)	445 California hospitals	1985	Number of hospitals in the market	Quantity of hospital services provided	Hospitals in more competitive environments provide more services, but that the size of this effect is small

Table 5 (Continued)

Study	Sample	Period	Market Structure	DV: Performance	Principal Findings
Shortell & Hughes (1988)	981 multi-hospital system hospitals in 45 states	July 1983-June 1984	Hospitals within 15 mile radius, percentage of the state's population that was enrolled in HMOs	Case-mix adjusted mortality rate	Higher mortality rates to be associated with more stringent CON and rate review programs, as well as being positively related to greater intensity of market competition
Robinson, Garnick, & McPhee (1987)	3,720 non-federal, short-term hospitals	1983	Number of hospitals in the market (0, 1-4, 5-20, 20+ competitors)	Availability of specialized services	The number of neighboring hospitals, as well as the number with like facilities, was positively associated with the availability of specialized service
Market Structure-Conduct Studies					
Melnick et al. (1992)	190 hospitals in the Blue Cross PPO network	1987	Herfindahl-Hirschman Index (HHI)	Price per inpatient day for medical/ surgical services	Found that BC paid lower prices for medical/ surgical bed days in those markets where there were more competing hospitals
Dranove, Shanley, & White (1993)	300 non-govern-mental hospitals	1983-1988	Herfindahl Index	Price mark-up	Margins are lower in competitive markets

Table 5 (Continued)

Study	Sample	Period	Market Structure	DV: Performance	Principal Findings
Noether (1988)	Hospitals	1977-1978	Herfindahl-Hirschman (HHI)	Prices of 11 disease categories	Found that price is lower in more competitive markets, but the net price effect is not significant
Market Structure-Premiums Studies					
Wholey et al. (1995)	1,730 HMOs in the U.S.	1988-1991	Number of HMOs in the market	Premiums per member month	Found more competition reduces HMO premiums
Feldman, Wisner, Dowd, & Christianson (1993)	95 HMOs	1989	A weighted Herfindahl Index for each HMO, HMO market penetration, based on Medicare HMO enrollment shares	HMO premiums	All three variables were significantly related to premiums for Medicare supplemen-tary policies, with HMOs in areas of high penetration and less competition having higher premiums

reduce rates of inflation in these five states, as well as nationally. Additionally, the rate regulation and procompetition policies seemed to control costs better in local hospital markets where hospitals faced a large number of rivals. California hospitals facing more than 10 rivals experienced increases in their costs per admission that were 22% below those experienced by hospitals that faced 10 or fewer rivals.

Melnick and Zwanziger (1988) examined data for California hospitals from 1980 to 1985 and found that after the introduction of selective contracting by third-party payers in California in 1983, those hospitals in markets with many competitors reduced their costs to approximate more closely the costs of hospitals in less competitive markets. The authors used a multiple regression technique in which various inflation-adjusted measures of the annual percentage change in total cost, average cost, total revenue, and utilization were regressed on dummy variables that indicate (a) the competitiveness of a market both before and after 1982; (b) the 1980 to 1982 period prior to selective contracting, and (c) rural hospitals. Also included as an explanatory variable was a "financial pressure" index based on the Medicare Prospective Payment System's importance and stringency (i.e., reimbursement rate) for a particular hospital. They found that average inpatient costs were higher in more competitive markets both before and after the introduction of selective contracting, but the increases in costs per discharge were 3.5% lower in highly competitive markets (relative to hospitals in less competitive markets) after the switch to selective contracting. The authors argued that as selective contracting spreads to other states, we should observe effects of competition among hospitals.

Robinson and Phibbs (1989) examined the changes in average costs experienced by hospitals in California following the change to selective contracting using a sample of

262 private hospitals. They regressed changes in average costs or length of stay on measures of changes in Medicare and MediCal shares, groupings of numbers of competitors (11 to 20, or 21 or more), changes in area demographics, hospital wages, beds per admission, and eight types of services, as well as the hospital's contract status. They measured the competitiveness that rivals face when the market boundaries were determined by rivals were compared with those with 0 to 11 or more than 11 rivals. The results implied that a larger concentration of competitors was associated with a significantly lower rate of increase in both cost per admission and cost per day.

Hadley and Swartz (1989) assessed the impact of competition proxies on hospital costs using a generalized multipayer cost function applied to data on 1,293 hospitals from 43 SMSAs for 1980 through 1984. They found that competition mattered but not significantly. They argued that large cost reduction effects they observed were due to prospective payment schemes rather than to competition. Unfortunately, the authors were unable to measure competition reliably and had to rely on measures of HMO prevalence, physician density, and type of ownership as proxies.

Although studies of hospitals costs had dominated this literature in the 1980s, Dranove et al. (1992) analyzed the effects of competition on quantity of hospital services provided by 445 California hospitals in 1983; the authors found that hospitals in more competitive environments provided more services but that the size of this effect is quite small. They argued that the major factor in determining the number of available services is simply the population of the area--a factor that has been neglected in other examinations of hospital competition. In addition, the authors presented evidence that the provision of any particular hospital service is likely to be significantly affected by the presence or absence of scope economies among the various service groups.

Using 1983 data for 3,720 nonfederal, short-term hospitals, Robinson et al.(1987) assessed the effects of market competition and regulation on the availability of coronary angioplasty and bypass surgery. Market structure variables were the numbers of hospitals in the local market (defined categorically as having 0, 1-4, 5-20, and 20+ competitors) which maintained cardiac catheterization laboratories or facilities for open-heart surgery and the presence or absence of state rate regulation programs. The authors found that the number of neighboring hospitals, as well as the number of like facilities, were positively associated with the availability of these specialized services. However, the presence of state rate regulation programs decreased the availability of the services, particularly in local markets with greater numbers of neighboring hospitals. They concluded that competition during this period encouraged, while regulation discouraged, proliferation of services.

Shortell and Hughes (1988) tested the hypothesis that in more competitive markets, especially markets with greater regulatory or payment constraints, hospitals would be most likely to have poorer patient outcomes. The outcome measure was the case-mix adjusted mortality rate for 981 multi-hospital-system hospitals in 45 states. The mortality rates were calculated based on patients receiving care for 16 clinical conditions between July 1983 and June 1984. Competition was measured in two ways. First, CEOs were asked to specify which hospitals within a 15-mile radius of their hospital were considered to be competitors. A hospital with two or more acknowledged competitors was considered to be in a more competitive market, while those with under two were considered to be in a less competitive market. The second measure of competition was the percentage of the state's population that was enrolled in HMOs. This was based on the assumption that hospitals in states with larger percentages enrolled in HMOs must compete more for patients on the basis of price. However, the use of state-level percentages was not a good proxy for competition at the local market level (15-mile radius) and would not have been able to reflect differences in competitive intensity in various local markets.

Regulatory and payment constraints were measured in terms of the stringency of the CON and rate review programs in the state, as well as the state's Medicare payment level. Hospital and area characteristics such as median income, median number of years of education hospital ownership, and teaching status were included as control variables. Shortell and Hughes (1988) found higher mortality rates to be associated with more stringent CON and rate review programs, as well as positively related to greater intensity of market competition, thus supporting the original hypothesis of the study.

Robinson (1991) examined the effects of HMOs on the costs of 298 non-HMO, nonpublic hospitals in California from 1983 to 1988. This was a period after the state had removed its restrictions on selective contracting by third-party payers. Holding constant several hospital characteristics, he found that cost per hospital admission grew at a 9% lower rate in those markets where HMO penetration was high. HMO penetration was calculated using a method that defined the market as the aggregate area from which a hospital drew a significant number of patients. Robinson defined the number of competitors using a different method based on an area with a radius of 24 kilometers from the hospital. The latter method resulted in the average hospital having 24 competitors. The effects of HMOs were greater in those markets where a large number of competing hospitals existed. The author concluded that competition among HMOs may have prevented 9% of the 75% increase in cost per admission that occurred in California during this period.

Although there has been a considerable amount of research on the relationship between market structure and hospital costs, less emphasis has been placed on exploring the relationship between market structure and hospital prices. Two studies using prices, a conduct variable, show that hospitals appear to follow the S-C-P paradigm. One study was done by Noether in 1988. Noether estimated two basic regression equations. In the first, the price of a particular hospital service was estimated as a function of a set of exogenous demand, factor price, and market structure variables. In the second, expenses per admission were regressed on the same explanatory factors. Market structure should affect expenses only through its effect on quality competition but will influence price both indirectly (i.e., through its own quality competition) as well as directly (i.e., explicit price competition). Therefore, the author argued that differences in the magnitudes of the market structure parameters in the price and cost equations should indicate the nature of competition (i.e., price versus nonprice) that is most prevalent in hospital markets.

Noether's (1988) results suggested that both nonprice and price competition occur in the hospital industry. The market concentration variable generally exhibited a significant negative effect on expenses per admission (indicating that hospitals in concentrated markets engage in less quality competition) but exercised no significant direct influence on price. If hospitals did not engage in price competition, we would expect to find both prices and expenses increasing with concentration. The results obtained in this study suggest that the cost-increasing impact of competition is offset by its price-reducing impact.

Dranove et al. (1993) analyzed the effects of hospital market concentration on prices charged by hospitals to private pay patients. They studied 300 nongovernmental hospitals in California between 1983 and 1988, a period when selective contracting between health care plans and health care providers was allowed and when HMOs grew from 24% to 80% of the private insurance market in California. They found a statistically significant and economically nontrivial positive effect of concentration on both net markups and transaction prices and concluded that hospitals conform to the S-C-P paradigm.

A study by Melnick et al. (1992) assessed the effects of hospital concentration on prices charged to the Blue Cross (BC) PPO in California in 1987. They found that BC paid lower prices for medical/surgical bed days in those markets where there were more competing hospitals. The regression analysis indicated that a merger leading to a 50% increase in the concentration measure would be associated with a 9% increase in price. The authors also found that, where Blue Cross handled a larger share of a hospital's patient days, BC paid relatively low prices. Thus, the relative bargaining strengths of the hospitals and PPOs are apparently significant. The authors argue that excess hospital capacity must exist in the market for the PPO to maintain a credible threat to move patients to alternative hospitals. Without such a threat, the PPO cannot elicit lower prices from the hospitals.

Other studies have examined the effects of market structure on premiums. Feldman et al.(1993) studied the impact of market structure and competition among

HMOs on premiums for Medicare supplemental policies. They tested predictions generated by a theoretical model of the Medicare HMO market using data from 95 HMOs with Medicare contracts in 1989. Market structure and competition were measured by three variables: a weighted HHI, based on Medicare HMO enrollment shares; HMO market penetration, defined as the proportion of the total market population enrolled in HMOs; and the interaction of these variables. All three variables were significantly related to premiums for Medicare supplementary policies, with HMOs in areas of high penetration and less competition (i.e., high HHI) having higher premiums. The results must be interpreted with caution because they were heavily influenced by four outlier cases. Also, HMOs receive a fixed payment (the Adjusted Average Per Capita Cost) for each Medicare enrollee and are constrained from setting premiums below this level. No such constraint exists in the private sector.

Wholey et al. (1995) analyzed the effects of market structure on HMO premiums using data from all HMOs operating in the United States. Market structure and competition were measured by the number of HMOs in the market area and by HMO penetration, defined as the proportion of the total population enrolled in all HMOs. Premiums per member month were measured by dividing annual premium revenue by member months of coverage. The authors found that HMOs with more competitors have lower premiums; although this effect does not appear for independent practice associations (IPAs) before the highest level of competition is reached, it appears throughout the range of competition for group HMOs. In addition, they found that the cost of producing a member month of the scale economies is exhausted when the HMO has about 50,000 members.

In summary, a large amount of existing empirical evidence suggests that low concentration is associated with increased nonprice competition. Studies published during the period of 1970 to 1987 indicate that low concentration was associated with higher costs and technically inefficient production. The more recent evidence, however, suggests that areas with a relatively large number of competing hospitals have lower rates of cost inflation than do areas where there are fewer competitors.

Cost-Quality Relationship

The relationship between cost and quality is more than just an academic concern. Assumptions about the strength and direction of the association are at the heart of current debate about the future of health care in the United States. If we assume that quality and costs are positively related, then it follows that efforts to contain costs threaten quality (Chelimsky, 1993). If we assume a less linear or even negative relationship, then cost containment and quality improvement may even be complementary (Shapiro, Lasker, Bindman, & Lee, 1993).

Donabedian, Wheeler, & Wyszewianski (1982) suggest that the use of health services beyond those needed for maximum health benefit might actually have a negative effect because of complications of the unnecessary tests and treatments. Empirical studies of cost-quality relationship have been largely confined to hospital care and show no consistency in the associations (Fleming, 1991). Scott and Flood (1984) also point out that the majority of empirical studies which consider both cost and quality have treated these as independent or twin-measures of the effectiveness of care. There are only a few empirical studies that have actually examined simultaneously the relationship between cost and quality of care, and possibly moderating factors of the relationship. In addition.

Table 6

Summary of Empirical Studies on Cost and Quality Relationship

Study	Sample	Cost Measure	Quality Measure	Cost-Quality Relationship
Morey et al. (1992)	300 non-federal, short-term hospitals	Actual hospital's total cost	Risk-adjusted mortality index	Increase in the level of quality of care delivered was estimated to increase hospital cost
Fleming (1991)	657 hospitals	Total variable cost	Risk-adjusted readmission index, risk-adjusted mortality index	The relationship between quality and cost was positive in the first region but negative in the second region
Garber, Fuchs, & Silverman (1984)	Not available	Adjusted cost based on geometric mean of actual to expected cost	Adjusted mortality based on geometric mean of actual to expected mortality rates	Varies by DRG. For 3 of the 12 DRGs, the care provided was more costly but produced better outcomes. For 5 other DRGs, the faculty service had lower mortality rates even though the average cost of care was the same in the community service
Scott, Forrest, & Brown (1976)	17 hospitals	Expenses per occupied bed	Ratio of actual to expected death or morbidity	Higher costs were associated with lower mortality rates

Table 6 (Continued)

Study	Sample	Cost Measure	Quality Measure	Cost-Quality Relationship
Flood, Ewy, Scott, Forest & Brown (1979)	17 hospitals	Service intensity on seven types of service; length of stay	Ratio of actual to expected deaths	Greater cost per case was positively related to better than expected outcome of care
Longest (1978)	10 medium-sized short-term community hospitals	Mean of ranks of average costs for seven departments	Severity-adjusted death rate, Roemer, Moustafa, & Hopkins (1968) Percent specialists Medical staff self-evaluation Outside evaluation	Negative correlations were reported between the cost index and all the quality measures, except medical staff self-evaluation
Shortell, Becker, and Neuhauser (1976)	42 short-term, nonprofit hospitals	Cost per case, medical or nonmedical Cost per day	Medical-surgical death rate, complication rate Medical-surgical death rate, complication rate	Overall cost per case was significant determinant of medical-surgical death rates, with higher costs associated with higher death rates
Neuhauser (1971)	30 medium-sized Chicago area hospitals	Cost index based on cost per unit of output per day over seven nonmedical departments	Severity-adjusted death rate (SADR), Roemer et al. (1968) JCAH index Expert evaluation	Correlations with SADR were contradictory, negative for cost index and positive for the man-hour index, and statistically insignificant. Correlations with the other two measures were negative

a number of these studies suffer from the use of questionable indicators and small samples. The empirical studies of cost and quality are summarized in Table 6.

Morey, Fine, Loree, Retzlaff-Roberts, and Tsubakitani (1992) studied 300 non-federal, short-term hospitals in an effort to determine the impact on hospital-wide costs if quality of care levels were varied. The quality of care measure used for this study was the ratio of actual deaths in the hospital for the year (1983) in question to the forecasted number of deaths for the hospital. The hospital mortality forecaster had been built earlier from analyses of 6 million discharge abstracts, and took into account each hospital's actual individual admissions, including key patient descriptors for each admission. The authors utilized an economic construct of allocative efficiency relying on "best practices" concepts and peer groupings, built using the "envelopment" philosophy of Data Envelopment Analysis and Pareto efficiency. These analytical techniques estimated the efficiently delivered costs required to meet prespecified levels of quality. The result indicated that a 1% increase in the level of quality of care delivered was estimated to increase hospital cost by an average of 1.34%.

Fleming (1991) assessed the relationship between quality and the cost of hospital care using data on 657 hospitals. A variable cost function was estimated using data from the American Hospital Association (AHA) File, Medicare Provider Analysis (MEDPAR) file, and discharge abstracts. Two classes of outcome indicators (mortality and readmission indices) were developed and included in the variable cost estimations. The results indicated a significant relationship between a readmission index and variable cost. With separate medical and surgical quality measures included in the cost function, medical and surgical readmission and surgical mortality were significant determinants of variable cost. Interestingly, the relationship between quality and cost for each of the other measures was nonlinear and cubic. Derived marginal cost curves were convex, with higher costs at low and high ranges of quality. Additionally, there appeared to be a region of quality within which higher levels of quality were associated with lower costs.

Neuhauser (1971) studied 30 medium-sized Chicago area hospitals in an effort to examine the relationship between administrative activities and performance measures of cost-efficiency and quality of care. The cost variables in this study were indices of cost and man-hours per patient, developed from cost data on nonmedical departments (dietary, housekeeping, laundry, medical records, pharmacy, x-ray, and laboratory). The quality measures were ratings by expert evaluators, an index developed from data from the Joint Commission on Accreditation of Hospitals (JCAH), the percentage of active medical staff who were board-certified specialists, and the index of severity-adjusted death rates (SADR) developed by Roemer et al. (1968). Neuhauser correlated both cost and manpower indexes with three of the quality measures (excluding the percentage of board-certified specialists). Correlations with the adjusted death rates were contradictory, negative for cost index and positive for the man-hour index. All other correlations were negative. However, the overall results did not indicate a significant relationship between cost and quality, with the correlation between the man-hours index and expert evaluation being significant at the .05 level. These results did not support the hypothesis that the more efficient hospitals (those with lower costs and workforce indexes) are associated with a higher level of quality.

Longest (1978) employed measures similar to those used in 1971 by Neuhauser to study 10 medium-sized, short-term community hospitals in Georgia. Efficiency indices of average cost and number of work-hours per output unit (e.g., radiology examinations, laboratory tests) were correlated to the four measures of quality: outside expert of the hospital evaluation, severity-adjusted death rate (SADR); developed by Roemer et al. (1968), the percentage of active medical staff who are board-certified specialists, and medical staff self-evaluation. Statistically significant negative correlations ($p<.05$) were reported between efficiency index and all of the quality measures except medical staff self-evaluation. The results are therefore contradictory regarding the relationship between cost and quality. Decreasing costs will result in increased death rates but will improve the quality of the medical staff.

Scott et al. (1976) used 1973 data collected from 17 hospitals that participated in the Stanford Institutional Differences Intensive Study to analyze the relationship between hospital structure and postoperative mortality and morbidity. Death within 40 days of surgery or severe morbidity at the 7th day (or at discharge if earlier) was the focus for the analysis. Unlike the Neuhauser (1971) and Longest (1978) studies, this study made several adjustments in the quality measure for differences in case mix and severity. The quantity measure was calculated as the ratio of actual to expected mortality or morbidity, with the probability of the adverse event being based on numerous variables related to the patients condition, including age, preoperative health status, stress level, and stage of surgical disease. The results of this study were supportive of the finding by Neuhauser that higher costs were associated with lower mortality rates. The other measures of quality employed by Neuhauser, however, were negatively correlated with the cost measures.

Shortell et al. (1976) examined the effects of management practices on both hospital cost-efficiency and quality of care. Data from 1971-1972 were collected for 42 short-term, nonprofit hospitals in Massachusetts. Hospital cost-efficiency was assessed as direct costs per patient day in three nonmedical support departments (dietary, house-keeping, and medical records), direct costs per day in four medical support departments (laboratory, nursing services, pharmacy, and radiology), and overall cost per case. Quality of care was measured by the medical-surgical in-hospital death rate and the in-hospital postoperative complication rate following clean surgery, while controlling for case-mix severity. The results of this study showed that managerial variables such as regularly meeting among nurses, radiology, and laboratory staff, as well as department head participation in hospital-wide decision making, had significant impact on both cost-efficiency and quality of care. Additionally, overall cost per case was a significant determinant of medical-surgical death rates, with higher costs related with higher death rates. This suggests that increasing hospital cost-efficiency would have potential benefits for quality of care.

Flood et al. (1979) used the data from the same 17 hospitals employed by Scott et al. (1976) to assess the relationships between service intensity, length of stay, and in-hospital mortality. Service intensity measures were calculated over the entire hospital stay--number of blood tests, number of operative procedures, administration of blood, number of radiographic procedures, number of drug classes, physical therapy, and use of intensive care. In addition, a composite service intensity measure was used which was based on the mix, amount, and relative costliness of seven measures of service. Linear regression techniques were employed to estimate equations for services, length of stay, and mortality. These equations were used to develop actual/expected ratios for each of these measures. In-hospital mortality was negatively correlated with service intensity but positively correlated with length of stay. If service intensity is considered a proxy for average cost, then one can infer that greater cost per case is positively related to better than expected outcome of care. These results are consistent with those found by Scott et al. (1976) using the same data and the same quality measures.

Garber et al. (1984) compared the costs and outcome of care for patients admitted and treated by faculty and community physicians at the Stanford University Hospital. For 3 out of 12 different diagnosis-related groups (DRGs), the care provided to patients in the faculty service was more costly but produced better outcomes (as measured by in-house survival); that is, the cost-quality relationship was positive. For five other DRGs, the faculty service had lower mortality rates, although the average cost of care was almost the same as for patients in the community service. With the remaining four DRGs, the higher cost of faculty services was not associated with better outcomes. Thus, for 9 out of 12 DRGs there was no observable relationship between cost and quality.

Summary

There are many areas in the preceding literature review that indicate a need for the current study. First, most of the empirical work predates the implementation of PPS, price competition, the growth of managed care, and so on, that make the generalizability of the results to the current health care environment questionable. In addition, there is a scarcity of studies in the health care industry which examine the effects of market structure/concentration on organizational performance, as operationalized by cost-efficiency and quality of health care. There is a similar scarcity of empirical work that examines health care organizational performance in the two interrelated domains of cost-efficiency and quality of health care. By integrating all of these concepts into a single study, the results of the present study will make a significant contribution to the body of knowledge on health care organizational performance.

CHAPTER 3

EMPIRICAL DEVELOPMENT

This chapter provides a theoretical framework derived and modified from the structure-conduct-performance paradigm discussed in chapter 1. This modified framework facilitated empirical testing of the hypotheses. Figure 3 divides the constructs that affect health care organizational performance into characteristics of the environment and characteristics of the organization.

The main theses of this study were the following: (a) the relationship between market structure and health care organizational performance, defined as cost eficiency and quality of care, and (b) the relationship between cost eficiency and quality of care in the hospital sector. The hypotheses arising from these theses are developed in this chapter. This chapter provides operational definitions of cost eficiency, market structure, and quality of care to be used in this study.

In addition to the variables of market structure and health care organizational performance which were the focus of this study, it is necessary to control for those variables that are known or believed to be potentially confounding or intervening variables that are important characteristics of hospitals, such as technological sophistication, size, staffing intensity, skill mix, ownership, occupancy rate, teaching status, physician characteristics, acuity, system affiliation, and payor mix. The measurement of these control variables is also discussed in this chapter.

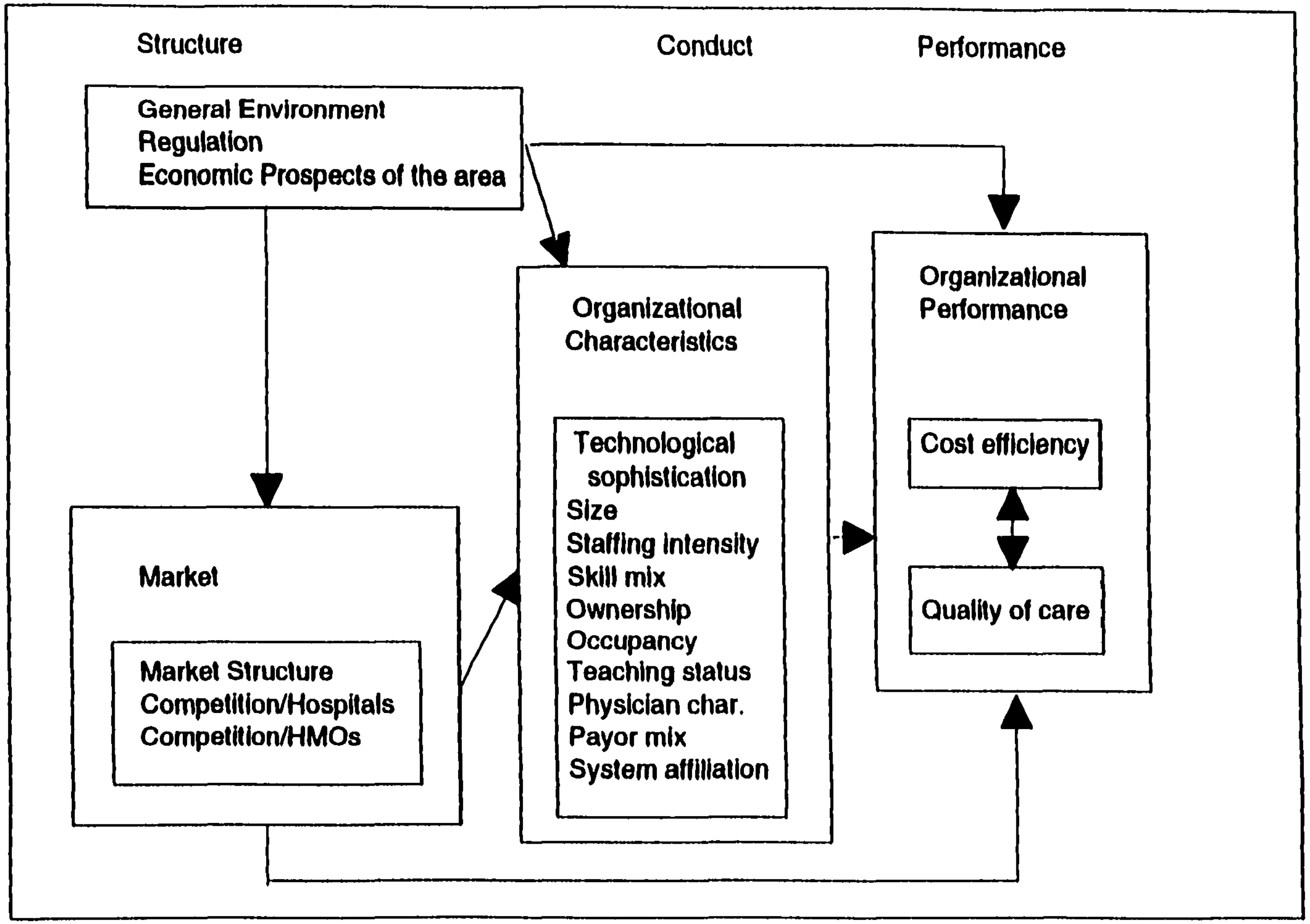


Figure 3. Modified S-C-P framework for analysis

Research Design

This study investigated the effects of market structure on health care organizational performance, with the hospital as the unit of analysis. A correlational, cross-sectional design was used to investigate these relationships. Correlational designs are nonexperimental in nature, as there is no intervention or experimental treatment. In this study, data were examined using a cross-sectional data structure (Kmenta, 1986).

A major advantage of correlational designs is the ability to investigate the relationships among many variables in a single study. Several competing hypotheses about the relationships among variables can be tested at once. The major shortcoming of this study design is that causality cannot be assumed from the demonstrated relationships (Grady & Wallston, 1988; Spector, 1981). However, in spite of this disadvantage, correlational studies provide valuable information, particularly in studies such as the current one where the establishment of relationships was the focus of the research questions.

In this cross-sectional design, data which corresponded to the 1991 time frame were used in this study. The 1991 time frame was selected for this study because it extended far enough into the Medicare prospective payment system (PPS) period. From this period, the effects of this policy were taken into account when studying the relationship between market structure and health care organizational performance.

Analytical Models and Specification

This study used a two-equation model in which the quality of care variable (MORT) was assumed to be jointly and simultaneously determined with the cost efficiency for hospital *i*. Such a model should eliminate the simultaneity bias present in earlier estimates of both the MORT effect on cost-efficiency and the effects of cost-efficiency on MORT. The following models represent the relationship between cost-efficiency and MORT:

$$COST_{it} = aMORT_{it} + B_{it}X_{it} + U_{it} \quad (1)$$

$$MORT_{it} = bCOST_{it} + D_{it}Z_{it} + V_{it} \quad (2)$$

where *i* denotes the *i*th hospital in the MSA, and *t* denotes time. COST is (Tx1) vector of the endogenous variable measuring cost-efficiency, MORT is a (Tx1) vector of the endogenous variable measuring quality of care, and X_{it} is a (TxK) matrix of the predetermined, or exogenous, determinants of COST. Z_{it} is a (TxN) matrix of the predetermined, or exogenous, determinants of MORT, and U and V are (Tx1) vectors of the disturbances in these equations with mean zero and a common variance δ^2. An ordinary least squares (OLS) estimation of Equation 1 yields a biased coefficient of "a." The same bias will hold in an OLS estimation of "b," the effect of COST on MORT in Equation 2.

Estimating the above equation system will allow for an analysis and interpretation of the relationships between COST and MORT while providing consistent and unbiased estimators. There are several ways to estimate systems of equations. The simplest estimation procedure, and the one used in this study, is two-stage least squares (2SLS) estimation procedure. Equation 1 is estimated first by predicting the value of the endogenous variable MORT based on the set of exogenous variables in the system and then regressing COST on the predicted value of MORT and the specific exogenous variables X to obtain an unbiased estimate of the effect of MORT on COST. The same procedure is applied to Equation 2.

As indicated earlier, an array of economic, demographic, and political factors determine both cost-efficiency and quality of care in the market. In order to isolate the impact of quality of care on cost-efficiency and to correctly specify the model, those factors must be identified. In the literature, three general factors have been used to represent the determinants of cost-efficiency and quality of care: (a) population characteristics, (b) health care delivery characteristics, and (c) legal restrictions.

Based on the existing literature, the following model was estimated:

COST = f (MORT, HHI1, HHI2, HPEN, HHI2 x HPEN, HITECH, BED, OCC, FPROFIT, COTH, STAFFIN, SKMIX, BCERT, MWAGE, MEC, MEDI, CMI, INCOME, DRS, PDNSTY, NONWHITE, CONSTATE, CONLOW) (3)

MORT = g (COST, HHI1, HHI2, HPEN, HHI2 x HPEN, HITECH, BED, OCC, FPROFIT, COTH, STAFFIN, SKMIX, RESDNTS, BCERT, MEC, MEDI, SYAFF, CMI, INCOME, DRS, CONSTATE, CONLOW) (4)

The variables are specified in Table 7. Equation 3 included the main variable of interest, MORT, and the following other market characteristics which affect cost-efficiency: Competitor factors--the structure of the hospital market (HHI1, HHI2, HPEN, HHI2 x HPEN)--have been measured at the MSA level and were included in the model, as were sociodemographic or environmental factors thought to influence the type and quantity of hospital services demanded (INCOME, PDNSTY, NONWHITE), and health care market variables that could affect both the supply and demand of hospital services (DRS) and the pricing of those services (CONSTATE, CONLOW). In addition, hospital or organizational characteristics variables (BED, FPROFIT, HITECH, OCC, COTH, STAFFIN, SKMIX, MWAGE, BCERT, MEC, MEDI, CMI) believed to influence cost-efficiency were controlled for in this study. This set of variables was consistent with the

Table 7

Operational Definitions of Variables

Dependent Variable	Code	Operational Definitions
Health care cost efficiency	COST	Cost per adjusted admission: operating expense or costs divided by adjusted admissions
Health care quality of care	MORT	Ratio of observed to predicted mortality rates for all cases
	MHRT	Ratio of observed to predicted mortality rates for heart disease cases
	MHFT	Ratio of observed to predicted mortality rates for hip fracture cases
	MCVA	Ratio of observed to predicted mortality rates for cerebrovascular accident cases

Independent Variables: Market Structure	Code	Operational Definitions
Competition among hospitals	HHI1	Herfindahl-Hirshman Index calculated with market shares based on distribution of adjusted admissions in the hospital market (MSA) (i.e., one minus the sum of squared adjusted admission shares)
Competition among HMOs	HHI2	Herfindahl-Hirshman Index (HHI) calculated with market shares based on distribution of enrollees within MSA (i.e., one minus the value of HMO HHI).

Table 7 (Continued)

Independent Variables: Market Structure	Code	Operational Definitions
HMO market penetration	HPEN	The proportion of the total market population (MSA) enrolled in HMOs
Simultaneous effect of competition among HMOs and HMO market penetration	HHPEN	Multiplication of HHI2 and HPEN
Control Variables: Organizational Characteristics	**Code**	**Operational Definitions**
Size	BED	Average number of beds set up and staffed
Ownership	FPROFIT	Dummy variable, 1 for profit, 0 otherwise
Technological sophistication	HITECH	The proportion of selected high technology services (e.g., open heart surgery, organ transplant, kidney transplant, magnetic resonance imaging, extracorporeal shockwave lithotripter, stereotactic radiosurgery, computer-tomographer scanner, and positron emission tomography) listed in the AHA Annual Survey that were provided by a given hospital (Kuhn, Hartz, Gottlieb, & Rimm, 1991)
Occupancy rate	OCC	[Inpatient days/365 x total bed days available] x 100

Table 7 (Continued)

Control Variables: Organizational Characteristics	Code	Operational Definitions
Teaching status	COTH	Dummy variable, 1 for member of Council of Teaching Hospitals, 0 otherwise
Residents	RESDNTS	Number of hospital interns and residents per bed
Staffing intensity	STAFFIN	Health care workers full-time equivalents (FTEs) per 1000 adjusted patient days
Skill mix	SKMIX	Ratio of RNs to LPNs
Physician characteristics	BCERT	The percentage of physicians who are board certified
Medicare wage index	MWAGE	Cost of health care labor (i.e., ratio of adjusted average hourly wage to mean of adjusted average hourly wage)
Payor mix	MEC	The percentage of inpatient days attributable to Medicare patients
	MEDI	The percentage of inpatient days attributable to Medicaid patients
System affiliation	SYAFF	Dummy variable, 1 for system membership, 0 otherwise
Medicare case-mix	CMI	Overall acuity level of the patients being treated

Table 7 (Continued)

Control Variables: Environmental Characteristics	Code	Operational Definitions
Per capita income for MSA	INCOME	Personal income/population
Population density for the MSA	PDNSTY	Population/square mile
Physicians per capita	DRS	MDs per 1000 population in the hospital market
Race	NONWHITE	The percentage of nonwhite population in hospital market
Certificate-of-need	CONSTATE	1 if MSA is located in state that has CON law, 0 otherwise
	CONLOW	Dollar limit of CON regulation: 1=500,000 or less, 0 otherwise (Hartley, Moscovice, & Christianson, 1996)

variables selected by earlier researchers (Coelen & Sullivan, 1981; Farley, 1985; Fottler, 1987; McLaughlin, Merrill, & Freed, 1984; McLaughlin, 1987; Merrill & McLaughlin, 1986; Robinson & Luft, 1985; Salkever, 1979; Sloan, 1981; Sloan & Steinwald, 1980; Wilson & Jadlow, 1982;).

Likewise, Equation 4 was essentially the same as Equation 3. Instead of the quality of care variable (MORT), COST was included in Equation 4. The variables included in both equations reflected the exogenous variables known to influence cost-efficiency and quality of hospital care (Fottler, 1987). Before one or more of the structural equations could be estimated, the identification problem was solved. Equation identification could be attained if one or more variables were excluded from each of the equations in a system, allowing some functions to shift when others do not (Lardaro, 1993). Based on the order condition, both Equations 3 and 4 were identified. Equation 4 included two variables (BCERT, SYAFF) which were excluded from Equation 3. Equation 4 excluded three variables (PDNSTY, NONWHITE, MWAGE) which differentiate it from Equation 3, allowing its identification. The two models were similar in the completeness of their specification because most of the variables needed to explain variation in cost-efficiency and quality of hospital care have been documented and available through published sources.

Data Sources

There were six major sources of data used in this study. The first source was the 1991 American Hospital Association (AHA) Annual Survey of Hospitals, which contained information voluntarily reported to the AHA on various hospital characteristics. This database was used in this study to derive or obtain data for most of the organizational control variables, the health care organizational performance cost-efficiency variables, and market structure variable of competition among hospitals.

The second source of data was derived from the 1991 Health Care Financing Administration (HCFA) data files, purchased through the Commission on Professional and Hospital Activities (CPHA). These data files provided control organizational variable case-mix index (CMI). The case-mix index was based on the intensity of resources (labor and nonlabor) used in patient care. A score of 1.0 indicated a case-mix equal to the average for all hospitals in the MEDPAR file. A score above 1.0 indicated a more severe case-mix, while a score below 1.0 indicated a less severe case-mix.

The third source of data was obtained from the 1991 Medicare Hospital Mortality Information, released by HCFA. These data contained an overall and procedure specific observed and predicted mortality rates according to hospital for all Medicare patients. The observed mortality rate was the number of Medicare patients who died within 30 days of admission that resulted in the last occurring discharge of patients for 1991. The data used to derive the predicted hospital mortality rates included the patient's dates of admission and discharge; principal discharge diagnosis; up to four secondary diagnoses, the patient's age, sex, race, and date of death; and whether the patient was admitted from another hospital. Also, the health care organizational performance quality of care variable was extracted from these data.

The fourth source of data for this study was from the 1991 National Directory of HMOs, published annually by the Group Health Association of America (GHAA), provided by Professor Baker of Stanford University. This data source provided market structure concentration variables measuring competition among HMOs, as well as HMO market penetration, defined as the proportion of the total market population (MSA) enrolled in HMOs.

The fifth source of data was taken from various issues of the U.S. Bureau of Health Professions' Area Resource File (ARF) System, which provided 1991 information on economic conditions and population characteristics. Data for all the environmental control variables in this study were in MSA.

The sixth source of data was from the 1992 American Hospital Association, State Issues Forum, Monograph Number 8. This data source provided state certificate-of-need laws summarized in a monograph and was used to measure environmental control CON regulation variables.

The final source of data employed in this study was from the 1991 patient file, compiled by the Health Care Financing Administration (HCFA). The HCFA data comprised nearly 6 million patient discharges and was used to develop the measure of Medicare wage index. Although all hospitals were self-selected, those that comprise the 6-million-patient sample file were selected with the goal of national representation. Table 8 summarized the data sources to be used in this study and the time period.

Sample

The hospitals included in this study were 1967 American Hospital Association (AHA) registered general, acute care hospitals operating continuously in Metropolitan Statistical Areas (MSAs) during 1991. Subsets of this sample were used in selected analyses to control for such factors as state regulatory stringency and fluctuations in the economic cycle.

Table 8

Summary of Data Sources

Data Source	Time Period of Extracted Data	Variables
American Hospital Association (AHA) Annual Survey of Hospitals	1991	All organizational control variables, health care organizational performance cost-efficiency variables, and market structure variable competition among hospitals
Health Care Financing Administration (HCFA), purchased through Commission on Professional and Hospital Activities (CPHA)	1991	Organizational control variable case-mix index (CMI)
Medicare Hospital Mortality Information Reports	1991	Health care organizational performance variable quality of care
National Directory of HMOs (Group Health Association of America [GHAA]), provided by Dr. Baker of Stanford University	1991	Market concentration variables HMO market penetration and competition among HMOs
U.S. Bureau of Health Professions' Area Resource File (ARF) System	1991	All environmental control variables
Health Care Financing Administration (HCFA) Public Data Files	1991	Organizational control variable Medicare wage index
American Hospital Association (AHA) "Certificate of Need (CON): Back to the Future"	1992	CON regulation variables

The use of only those hospitals operating in MSAs was appropriate because the definitions of hospital markets and HMO markets were reasonably clear, thus enhancing the validity of hospital and HMO competition measures. The time frame chosen was particularly advantageous since there were significant changes in both the number of HMOs and enrollment in HMOs during this period. The time frame selected was also important in that by 1991, the effects of Medicare's PPS should have been stabilized and minimized extraneous sources of variation.

Measurement of the Variables

The operational definitions of the variables were summarized in Table 7. This table includes a list of dependent variables, independent variables, control variables, and the proposed measurement or operational definitions. This section includes a more detailed discussion of the variables. It contains the definitions and rationale for the inclusion of each variable in the equation.

Dependent Variables: Health Care Organizational Performance

For health care, the criterion for cost-efficiency consisted basically of cost per day or cost per case; in some cases, both of these types of indicators have been used widely in the health care industry studies (Robinson & Luft, 1985; Farley, 1985; Anderson & Lave, 1986; Nguyen & Madamba, 1988; Thorpe, 1988). In this study, cost per adjusted admission (COST) was used to measure hospital care cost-efficiency. Since the expense data on the AHA Annual Survey included both inpatient and outpatient expenses, the admission was adjusted to summarize inpatient and outpatient use into a single utilization measure. The AHA calculated adjusted admissions attributed to outpatient services by multiplying admissions by the ratio of outpatient revenue to inpatient revenue. COST was calculated in this study as operating expense or costs divided by adjusted admissions. This choice of variable was conceptually consistent with the goals of hospitals in the environment of increasing dominance of fixed payment reimbursement. Fixed payment reimbursement caused hospitals to have as their objective the minimization of the cost per episode of care. Operational expense or costs were calculated as the total facility expense minus nonoperating expenses including depreciation, interest, and other nonoperating losses (Robertson, Dowd, & Hassan, 1997).

Health care quality of care for this study was measured by risk-adjusted mortality rates (i.e., ratio of the observed mortality rate to the predicted rate) from HCFA hospital reports. For 7 years, HCFA had reported the observed and predicted mortality rates for a set of broad diagnosis and procedure categories that were defined by ICD-9-CM codes. This is a commonly used measure of a major facet of the quality of care (e.g., Hartz et al., 1989; Shortell & Hughes, 1988; Zalkind & Eastaugh, 1997). Historically, most quality of care assessment research in the past 2 decades has stressed process of care evaluations and levels of the technical quality of care. In recent years, emphasis has shifted to evaluation of patient outcomes as indicators of quality of care, in part due to growing concerns about the effects of cost containment and patient well-being (Garnick, DeLong, & Luft, 1995; Iezzoni et al., 1996; Lohr, 1988).

In addition, traditional methods of assessing patient outcomes that involved case by case reviews have been supplemented with the development of computerized case abstract reports that made it possible to easily examine the information for all patients at an individual hospital, as well as from large numbers of hospitals. HCFA has employed these large databases to release annual Medicare hospital mortality rates in an attempt to scan for possible quality problems.

There have been a number of criticisms concerning the HCFA hospital profiles, mostly with respect to methodological limitations. Some have argued that HCFA's prediction model does not adequately account for patient severity (Kenlel, 1988), and a study by Green, Wintfield, Sharkey, & Passman (1990) demonstrated that the addition of severity to the HCFA prediction model resulted in an eightfold increase in the R^2 of the model, and reduced some cases of higher than expected mortality to chance levels. However, a review by Hartz et al. (1984) of a HCFA study (Krakauer, H:, unpublished data) evaluated the adequacy of the HCFA method of adjusting the hospital mortality rate by comparing their adjusted rate with mortality rate adjusted on the basis of clinical information on each patient. The correlation between the two adjusted rates was 0.91, suggesting that the HCFA method of adjustment was adequate to study variations in the quality of care.

Another criticism of using numbers derived from case abstract data was that it may be misleading in identifying individual hospitals as having good or bad outcomes due to relatively low rates of adverse outcomes and small numbers of patients with a particular diagnosis or procedure in any one hospital. However, in studies such as this one that examined outcomes across large numbers of hospitals to investigate general patterns of organizational performance, the use of case abstract data can be justified (Luft & Hunt, 1986).

Although there was controversy over the use of mortality rates as a quality of care indicator, this study used the HCFA mortality reports as a measure of health care quality of care because it was readily available and it allowed comparisons with the results of many previous health care industry studies that have used mortality rates as a patient outcome measure. Specifically, the quality measures for each hospital in this study were the ratio of observed to predicted mortality rates for overall cases (MORT) and surgical procedure specific mortality rate for severe heart disease (MHRT), hip fracture (MHFT), and cerebrovascular accident (MCVA) cases (Farley & Ozminkowski, 1992).

Independent Variables: Market Structure

When investigating hospital markets, the first concern was that of defining what the boundaries of the market would be. Several researchers have gone about this in different ways. Farley (1985) used county boundaries as the market measure, while others (Noether, 1988; Joskow, 1980) argued that county boundaries were too narrow and used the MSA instead. Elzinga and Hogarty (1973) proposed that an appropriately defined geographic market would have only small percentages of patients flowing in or out of the market area. Luft et al. (1986) defined hospital market as the 15-mile radius around the hospital, based on the assumptions that hospitals competed for physicians rather than directly for patients, and that 15 miles was about the maximum distance physicians would be willing to travel between hospitals.

For the purposes of this study, the hospital market was defined as metropolitan statistical area (MSA). Although this definition has some limitations, it has the advantages of being practical and comparable (Garnick et al., 1987). The "county" definition used by Farley (1985) will have a tendency to over-represent oligopoly and monopoly markets. For a better test of the current model, the market definition needed to expand in order to obtain a better representation of all different forms of competitive markets (i.e., monopoly, pure competition, and oligopoly). Unlike other definitions such as that used by Luft et al. (1986), MSAs were constructed with consideration of natural geographic boundaries and existing population centers and the fact that in metropolitan areas the extent of the market may be smaller than in less densely populated areas (Noether, 1988).

Market structure and competition were measured by four variables in this study: a Herfindahl index for each hospital market (HHI1); a weighted Herfindahl index for each HMO market (HHI2); HMO market penetration (HPEN), defined as the proportion of the total market population (MSA) enrolled in HMOs; and simultaneous effect of HHI2 and HPEN. The Hirschman-Herfindahl index (HHI) has become popular among industrial economists. Unlike the concentration ratio, it takes account of all points on the concentration curve. To see the influence of competitiveness more clearly, it is calculated as one minus sum of squared market shares of the firms in the industry. A value equals 0 when one competitor is in the market and approaches unity when there are large numbers of equally sized hospitals in a market.

There are four commonly used measures of market share in the health care industry--available beds, adjusted admissions, inpatient days, and net revenue. Net revenue is probably the best measure of a hospital's influence in the market. However, since revenue was not available in the data, another commonly used measure, adjusted admissions, was applied to the calculation of the Herfindahl Index in this study.

In the case of competition among HMOs, the measures of HMO enrollment and market share for 1991 were calculated in the following manner (Baker, 1995):

$$a_{ij} = (P_j \;/\; \sum_{K=1}^{N_i} P_k)\, E_i \qquad (5)$$

Consider HMO_i, which has E_i enrollees and serves N_i counties. For each $county_j$ in the service area, this method assigns enrollment $a_{i,j}$, where P_j is the population in the county $_j$. This method provides a good estimate of market share (Baker, 1995).

Data for the HMO Herfindahl Index in this study were derived by aggregating the county data to MSA level--a weighted average of the HHI2 was calculated for each MSA. For example, in 1991 Metropolitan Areas and Their Components (as defined by the U.S. Bureau of Health Profession's Area Resource File [ARF] System), Birmingham, AL, MSA comprised Blount, Jefferson, St. Clair, Shelby, and Walker counties, with the following HMO Herfindahl Index: 0.280547, 0.2810107, 0.2802525, 0.2805965, and 0.2811529, respectively (numbers obtained directly from Dr. Baker of Stanford University). Averages were calculated, weighted by the population of each county. To see the influence of competitiveness more clearly, one is subtracted from the value of the HMO Herfindahl index so that the market structure variable (HHI2) equals zero when only one competitor is in the market and approaches unity when there is a large number of equally sized HMOs in the market.

Data for the HMO market penetration (HPEN) in this study were also derived by aggregating the county data to MSA level- a weighted average of HPEN was calculated for each MSA. The numbers used in the calculation of HPEN also came directly from Dr. Baker of Stanford University. Averages of HPEN were calculated, weighted by the population of each county.

Control Variables: Organizational and Environmental

Any characteristics of a hospital that could influence its behavior in the marketplace were included as controls. The following characteristics of a hospital are important in distinguishing the facilities. These characteristics could affect either health care costs or quality of care. These variables are discussed below.

Of the size measures often used, the number of set up and staffed hospital beds (BED) was selected as a control variable because this was a common and meaningful measure of size in hospitals. There are various types of ownership of hospitals (e.g., church, state government, local government, county government, proprietary, non-government, community, and for-profit corporation). Because of this variety of types of ownership in the hospital sector, it was important to control for this variable. A dummy variable, FPROFIT, taking the value of one if the hospital is investor owned and a value of zero otherwise, was included to control for ownership of the hospital. The extent to which hospital capacity was utilized throughout the year (OCC) was measured as the average occupancy of the hospital. The use of high technology services measure (HITECH) was the proportion of selected high technology services (e.g., open heart surgery, organ transplant, kidney transplant, magnetic resonance imaging, extracorporeal shockwave lithotripter, stereotactic radiosurgery, computer-tomographer scanner, and positron emission tomography) listed in the AHA Annual Survey that are provided by a given hospital (Kuhn et al., 1991).

The health care coverage of the patients served by the hospital (i.e., payor mix) is represented by two variables: the percentage of inpatient days attributable to Medicare patients (MEC) and the percentage of inpatient days attributable to Medicaid patients

(MEDI). A dummy variable, COTH, taking on the value of one if the hospital was a member of the Council of Teaching Hospitals and a value of zero otherwise, was included to control for the teaching mission of the hospital. Physician characteristics were controlled for by the use of the percentage of physicians who are board certified (BCERT). A variable was included to control for the effects of overall acuity in the quality of care equation: the Medicare Case Mix Index for the hospital (CMI). Other organizational variables such as the number of interns and residents per bed (RESDNTS), staffing intensity (STAFFIN), skill mix (SKMIX), Medicare Wage Index (MWAGE), and system affiliation (SYAFF) were included in this study.

In addition, there were a number of environmental variables that accounted for differences across geographical areas in consumer and physician demand for health care services (Luft et al., 1986) and thereby moderated the effects of market structure on health care organizational performance. The source of the variables is the 1991 U.S. Bureau of Health Profession's Area Resource File (ARF) System.

Per capita income for MSA (INCOME) is defined as personal income per resident population. Population density for the MSA (PDNSTY) was the population per square mile. Physicians per capita in the MSA (DRS) was the MDs per 1000 population in the hospital market. The race variable (NONWHITE) for the MSA was the percentage of nonwhite population in hospital market.

A dummy variable for state CON laws would capture any state-level characteristics; CON variables were used as control variables. The MSA located in states that have any such laws (CONSTATE) in effect in 1991 received values of one and zero otherwise. The dollar limits of state CON laws were used to create a second dummy variable (CONLOW). MSA located in states with no CON law or with dollar limits exceeding $500,000 received a value of zero. The MSA located in states with dollar limits of $500,000 or less received a value of one (Hartley et al., 1996).

The number of nonfederal, short-term general care hospitals used in determining the market structure of the MSAs is 1967. Table 9 contains the descriptive statistics of the variables used in the model, and the correlation matrix is shown in Appendix A.

Hypotheses Development

Based on the theoretical discussion in chapter 1 and empirical results from the literature, general hypotheses were developed regarding the relationships between market structure and health care organizational performance.

Literature on the relationship between market concentration and cost-efficiency has indicated contradictory results. However, if these results are interpreted with consideration of the time period of the studies, these discrepancies can be explained. Studies conducted during the era of retrospective cost-plus reimbursement or charge-based reimbursement indicate that market concentration is positively associated with cost efficiency. This could be due to the fact that hospitals were reimbursed on a retrospective cost-plus basis during this time frame and were, therefore, able to compete on a nonprice basis. Expensive and sophisticated equipment and services were freely added in an attempt to attract physicians (and, therefore, patients). The introduction of fixed payment, competitive bidding made this type of nonprice competition much more costly and less attractive to hospitals, which began to compete more on the basis of price.
In order to lower prices, hospitals had to become more cost efficient. This assumption is supported by the post-PPS study by Robinson and Luft (1988), which indicated that

Table 9

Descriptive Statistics of the Sample

Variable	M	SD
Endogenous Variables: Organizational Performance		
COST	4,635.73	1,762.27
MORT	1.009	0.166
MHRT	0.983	0.218
MHFT	1.042	0.675
MCVA	0.977	0.312
Independent Variables: Market Structure		
HHI1	0.803	0.198
HHI2	0.666	0.214
HPEN	0.147	0.105
Control Variables: Organizational		
BED	255.028	185.887
FPROFIT	0.171	0.376
HITECH	0.276	0.126
OCC%	63.411	23.273
COTH	0.097	0.295
RESDNTS	0.086	0.610
STAFFIN	11.862	2.969
SKMIX	8.556	28.429
BCERT%	74.048	13.233
MWAGE	1.000	0.173
MEC%	49.802	12.546
MEDI%	10.944	9.140
SYAFF	0.409	0.492
CMI	1.339	0.202

Table 9 (Continued)

Variable	M	SD
Control Variables: Environmental		
INCOME	19,722.99	3558.59
PDNSTY	881.236	1481.640
DRS	2.662	1.043
NONWHITE%	19.427	11.461
CONSTATE	0.737	0.440
CONLOW	0.888	0.315

Variable ranges and the correlation matrix appear in Appendix A

decreased concentration was associated with decreased costs. Therefore, since this study was also conducted in a post-PPS environment, the following hypothesis was tested:

Hypothesis 1: Increased hospital competition leads to lower hospital costs.

Competition advocates like Alain Enthoven and Paul Ellwood have argued that the growth of health maintenance organizations (HMOs) will create health care price competition and thereby provide the missing brake on escalating health care costs (Zwanziger & Melnick, 1996). These advocates have hypothesized that as HMOs gain large market shares, hospitals will be forced to become more price conscious and cost effective. The HMOs reduce costs through fixed budget financing, reduced inpatient utilization by keeping patients out of hospitals and using fewer resources once a patient is admitted and controlling significant amounts of patient volume. An analysis of the competitive impact of HMOs might concentrate on health care costs, therefore the following hypotheses were tested:

Hypothesis 2a: Increased HMO competition leads to lower hospital costs.

Hypothesis 2b: A higher level of HMO market penetration leads to lower hospital costs.

Hypothesis 2c: The simultaneous effect of higher levels of HMO competition and HMO penetration leads to lower hospital costs.

There is little evidence on the relationship between market concentration and health care quality of care. If hospital competition can be defined as the interaction or competition among hospitals for the best and latest technology or resources that will give them the competitive edge over another hospital or help them maintain their leadership in the market for that segment of the population served by them, and if hospital quality of care is defined as the avoidance of death or the increase in a good outcome (such as a decrease in mortality rates) because the hospital has the best technology or other resources, then it follows that as hospitals actively engage in competition with each other, quality of care will result. With this in mind, the following hypothesis was tested:

Hypothesis 3: Increased hospital competition leads to higher hospital quality of care.

There are a few empirical studies which directly have examined the relationship between competition among HMOs or HMO market penetration and quality of care. This assumes that health care markets with high levels of HMO competition or HMO market penetration should exhibit higher quality of care. The ability of hospitals to compete for patients on the basis of price has motivated them to focus on nonprice, quality-oriented strategies (Luft et al., 1986). Increased HMO competition or HMO market penetration could stimulate nonprice competition among hospitals. Then, the following hypotheses were tested:

Hypothesis 4a: Increased HMO competition leads to higher hospital quality of care.

Hypothesis 4b: A higher level of HMO market penetration leads to higher hospital quality of care.

Hypothesis 4c: The simultaneous effect of higher levels of HMO competition and HMO market penetration leads to higher hospital quality of care.

Many empirical studies have posited simple, linear relationships between cost and quality (Fleming, 1991; Flood et al., 1994). A more realistic assumption, which has been embodied in the theoretical work of Donabedian et al. (1982), is that marginal cost may vary over the range of quality. The current study postulates that a positive relationship would indicate that quality and cost move in the same direction, an increase in quality being associated with an increase in cost. Therefore, the following hypothesis was tested:

Hypothesis 5: Higher hospital costs will have a positive effect on hospital quality of care.

Limitations and Delimitations

There are a number of limitations inherent in this study that bear discussion. Like other studies which have had to define hospital and HMO markets in the research process (e.g., Chirikos & White, 1987; Wholey et al., 1995; Wholey, Feldman, Christianson, & Engberg, 1996), this study has had to compromise. Without a doubt, some competing hospitals and HMOs will operate outside of the MSA and will not be measured.

However, the use of MSA as the market will be superior to the common use of county as the hospital market. Organizational strategy is another limiting factor in this study; by using a geographic definition of market, this study will tend to overestimate the competitiveness of markets if segmentation is a popular market strategy; hospitals and HMOs may be located in the MSA yet, due to market segmentation, not compete with each other since they cater to different populations (e.g., young families versus older adults, white collar versus blue collar). Another issue is that rural hospitals will be under represented in this study due to the focus on MSAs. However, it is reasonable to assume that competition for patients, as in the case of hospitals, and for enrollees, as in the case of HMOs, is centered in urban areas.

There are some issues that may be of concern but have not been addressed in the design of this study. Mortality data were not reported by HCFA after 1991. HMO enrollment data do not delineate which portion of the enrollees is located within the MSA. The data do include the total number of enrollees and the service area (usually by county) of the HMO, requiring that the enrollment for HMOs with service areas overlapping MSA and non-MSA counties be overestimated.

In addition, limitations must be set on the study in order to focus on the major points of interest and to make the study manageable. Although there are some important factors not accounted for this study, their presence is known. First, the quality of care was squared in the analyses. Second, for the timing of the data, this study used 1991 data. Maybe using data from a later period would be appropriate to investigate the effects of market structure on cost and quality of care in hospitals, when there are greater incentives on the part of hospitals to contain costs. This would be especially important in terms of cost and quality trade-off issue. Third, this study, like all cross-sectional studies. demonstrated only association and leaves open the question of causality. Fourth, in defining a market at the MSA level, only a fraction of the available sample was used, since the rest of the hospitals were located outside of defined MSAs. This biased the sample toward urban area and larger hospital (Noether, 1988). Fifth, of the hospitals studied, the mean of the Medicare case-mix index is 1.34. This figure contrasts poorly with the nation as a whole, with a mean of 1.00. There is some concern that this difference could introduce significant bias into the results of this study.

Summary

The model estimated in this study treats the health care organizational performance (i.e., cost-efficiency and quality of hospital care) as a function of market structure, technological sophistication, staffing intensity, hospital size, occupancy rate, ownership, teaching status, per capita income, population density, number of MDs, payor mix, Medicare Wage Index, Medicare Case-Mix Index, system affiliation, and certificate-of-need. Next, this chapter described the model used in this study and defined the variables to be used in the equations, as well as their sources. The data sources are identified and summarized in Table 8. The variables are defined in Table 7. The chapter also discussed the rationale for the control variables and the time period to be used in this study. Finally, the sample was identified and described. Descriptive statistics of the sample are presented in Table 9.

CHAPTER 4

RESULTS

This chapter presents the empirical results of data analysis. First, descriptive information on the markets used in the study is presented. This is followed by an examination of the effect of market structure on hospital cost per adjusted admission. Next, the effect of market structure on overall hospital adjusted mortality rates is examined. Then the cost-quality relationship is explored. Finally, single-equation OLS model results are presented for diagnostic and comparative purposes.

Descriptive Information on the Markets

There are 301 markets in the data set with hospital Hirschman-Herfindahl Index (HHI1), ranging from 0.000 (least competitive) to 0.983 (most competitive). Appendix B shows the MSAs and their corresponding HHI1. In addition, the data present the number of hospitals, the mean of COST, and the mean of overall mortality rates for the hospitals in each MSA using the 1967 hospitals that are in the final sample. The number of hospitals ranges from one (Anniston, AL, MSA; Athens, GA, MSA; Bellingham, WA, MSA; Bloomington, IN, MSA; Boulder-Longmont, CO, PMSA; Bremerton, WA, MSA; Casper, WY, MSA; Champaign-Urbana, IL, MSA; Charlottesville, VA, MSA; Cheyenne, WY, MSA; Danville, VA, MSA; Decatur, AL, MSA; Dover, DE, MSA; Elkhart-Goshen, IN, MSA; Fayetteville, NC, MSA; Fort Collins-Loveland, CO, MSA; Goldsboro, NC, MSA; Greeley, CO, MSA; Hagerstown, MD, PMSA; Hattiesburg, MS, MSA; Iowa City, IA, MSA; Jackson, MI, MSA; Kenosha, WI, MSA; Kokomo, IN, MSA; Muncie, IN. MSA; Naples, FL, MSA; Ocala, FL, MSA; Odessa-Midland, TX, MSA; Owensboro. KY, MSA; Panama City, FL, MSA; Pine Bluff, AR, MSA; Richland-Kennewick-Pasco, WA, MSA; Rocky Mount, NC, MSA; Salinas, CA, MSA; Santa Fe, NM, MSA; Sioux City, IA-NE, MSA; St. Cloud, MN, MSA; St. Joseph, MO, MSA; State College, PA, MSA; Sumter, SC, MSA; Wausau, WI, MSA; Visalia-Tulare-Porterville, CA, MSA; Yuma, AZ. MSA) to 69 (Chicago, IL, PMSA). The mean of COST variable for each MSA ranges from $2,559.04 to $10,069.26, giving an indication that COST does vary with the market. The MSA mean for quality of care variable (MORT) ranges from a low of 0.59 for Rochester, MN, MSA to a high of 1.467 for Visalia-Tulare-Porterville, CA. MSA, the sample mean is 1.009.

Regression Results

Since quality of care, in addition to being a determinant of cost-efficiency, is also determined by cost-efficiency, a system of simultaneous equations with quality of care and cost-efficiency as endogenous variables was used. The cost efficiency and quality of care functions were estimated using two-stage least square (2SLS). Chapter 3 contains additional information on the research design and a detailed discussion on the empirical methods.

Effects of Market Structure on Cost Efficiency

Hypothesis 1 predicts that increased hospital competition leads to lower hospital costs. In other words, those hospitals in areas of greater competition (high HHI1) will be associated with lower hospital costs.

To gain information on the nature of the effect of market structure on cost efficiency in hospitals, two separate regressions are run on two groups. One of the groups (Group A) contains all the hospitals in MSAs in the sample and the other group (Group B) contains hospitals in MSAs with predicted mortalities of greater than five. Model 3a uses HHI1, HHI2, HPEN, and HHPEN (simultaneous effect of HHI2 and HPEN) variables for the market structure variables. The regressions of the grouped data use Model 3a.

$$\begin{aligned} LCOST = \; & a_0 + b_1 LMORT + b_2 HHI1 + b_3 HHI2 + b_4 HPEN \\ & + b_5 HHPEN + b_6 HITECH + b_7 BED + b_8 OCC + b_9 FPROFIT \\ & + b_{10} COTH + b_{11} STAFFIN + b_{12} SKMIX + b_{13} BCERT \\ & + b_{14} MWAGE + b_{15} CMI + b_{16} INCOME + b_{17} DRS \\ & + b_{18} MEC + b_{19} MEDI + b_{20} PDNSTY + b_{21} NONWHITE \\ & + b_{22} CONSTATE + b_{23} CONLOW + \epsilon \end{aligned} \tag{3a}$$

The dependent variable used in the regressions was LCOST (the natural logarithm of cost per adjusted admission). The natural logarithm (LCOST) form was used to provide normal distributions of that variable in order to meet the normality assumption of regression (Neter, Wasserman, & Kutner, 1989). The results of the analysis of the market structure on organizational performance cost-efficiency of hospitals equation are discussed below. The estimates of the coefficients and standard errors from the 2SLS results of the group regressions are presented in Table 10, and the full 2SLS regression results, including the estimates of the coefficients and standard errors for the first stage, are found in Appendix C.

The results indicate that Group A ($F = 74.4$; $p = 0.0001$) and Group B ($F = 34.0$; $p = 0.0001$) result in overall significant regression equations. The adjusted R^2 for Group A was 0.463 and for Group B was 0.281. From Model 3a it appears that the market

Table 10

Two-Stage Least Square Regression Results, Testing The Nature of the LCOST-Market Structure Relationship

Dependent Variable = LCOST	Group A	Group B
Variable	Coefficient (SE)	Coefficient (SE)
Intercept	6.581*** (0.211)	7.199*** (0.509)
Quality		
LMORT	0.435 (0.727)	-2.119 (1.862)
Market Structure		
HHI1	0.024 (0.046)	-0.082 (0.087)
HHI2	-0.022 (0.034)	-0.022 (0.051)
HPEN	-0.210 (0.261)	-0.055 (0.405)
HHPEN	0.405 (0.363)	0.113 (0.579)
Organizational		
HITECH	-0.054 (0.052)	-0.019 (0.079)
BED	0.0002*** (0.00008)	-0.00004 (0.0002)
OCC	-0.0009*** (0.0003)	-0.001** (0.0005)
FPROFIT	0.016 (0.024)	-0.047 (0.053)
COTH	0.130*** (0.027)	0.077 (0.049)
STAFFIN	0.007*** (0.002)	0.005 (0.004)

Table 10 (Continued)

Dependent Variable = LCOST

Variable	Group A Coefficient (SE)	Group B Coefficient (SE)
SKMIX	0.0004 (0.0003)	-0.0003 (0.0006)
BCERT	-0.0003 (0.0005)	-0.001 (0.0009)
MWAGE	0.509*** (0.058)	0.409*** (0.103)
MEC	0.003*** (0.0008)	0.0004 (0.002)
MEDI	0.002*** (0.0007)	0.003*** (0.001)
CMI	0.629*** (0.043)	0.625*** (0.059)
Environmental		
INCOME	0.000004 (0.000003)	0.000007 (0.000004)
DRS	0.022 (0.021)	-0.047 (0.051)
PDNSTY	-0.0000001 (0.000007)	-0.00002 (0.00001)
NONWHITE	0.003*** (0.001)	0.005*** (0.002)
CONSTATE	0.057* (0.033)	-0.046 (0.079)
CONLOW	-0.013 (0.025)	0.041 (0.049)
N	1957	1941
Adjusted R-squared	0.463	0.281
Model F-value	74.425	34.007

* Significant at the 0.10 level
** Significant at the 0.05 level
*** Significant at the 0.01 level

structure variable (HHI1) in Group A was not significantly associated with cost per adjusted admission (LCOST). The estimated coefficient for the HHI1 variable in Group A (all the hospitals in MSAs in the sample) was +0.024. The positive sign indicates that all else being equal, hospital cost increases as market structure becomes more competitive This would seemingly contradict the conventional wisdom of the structure-conduct-performance paradigm. As is evident from the Table 10, Hypothesis 1 was not supported. For Group B (hospitals in MSAs with predicted mortalities greater than five) the estimated coefficient for the HHI1 variable was -0.082 and insignificant. Hypothesis 2(a) states that increased HMO competition leads to lower hospital costs. The results of the group regression model in Table 10 did not support Hypothesis 2a. HMO competition variables (HHI2) in Groups A and B were not found to have a statistically significant relationship with LCOST. The estimated coefficient for each of the HHI2 variable was -0.022, although it should be noted that the regression coefficient for HHI2 was in the hypothesized direction. The negative sign indicates that all else being equal, hospital cost increases as the market structure becomes more competitive. This is consistent with the structure-conduct-performance paradigm.

Hypothesis 2b predict that a higher level of HMO market penetration leads to lower hospital costs. As Table 10 shows, HMO penetration (HPEN) in both groups had a negative, statistically insignificant effect on cost per adjusted admission for both groups. Thus, other things being equal, market areas with higher HMO penetration rates regression model did not support Hypothesis 2(b). This result is consistent with a study experienced lower costs but not enough to have an impact. The results of the group reported by Weil (1996), who reported that higher HMO market penetration simply does not per se result in lower hospital costs as supporters of the competitive approach now sometimes espouse.

Hypothesis 2c stated that the simultaneous effect of higher levels of HMO competition and HMO market penetration lead to lower lower costs. Analysis of interaction terms assessing the simultaneous effect of the HMO competition and HMO market penetration (HHPEN) for both groups revealed positive and statistically insignificant associations with hospital cost per adjusted admission (LCOST). The results of the regression did not support Hypothesis 2c.

There were several instrumental variables which had a significant impact on modeling LCOST. In Group A, higher costs were found to be associated with hospitals with strong teaching functions (COTH), larger hospitals (BED), hospitals located in the states that have certificate-of-need laws (CONSTATE), and hospitals with more health care worker full-time equivalents (FTEs) per 1000 patient days (STAFFIN).

In Groups A and B, hospitals operating in MSAs with higher payor mix variables (MEC and MEDI), hospitals with higher payroll expense per employee (MWAGE), hospitals with more severe case-mix indices (CMI), and hospitals operating in MSAs with the higher percentage of nonwhite population (NONWHITE) reported significantly higher costs. Hospitals with higher occupancy rates (OCC) in both groups have lower cost per adjusted admission.

Effects of Market Structure on Quality of Care

Hypothesis 3 states that increased hospital competition leads to higher hospital quality of care. In other words, those hospitals located in areas of greater competition (high HHI1) will be associated with lower overall adjusted mortality rates or higher quality of care.

To gain information on the nature of the effect of market structure on quality of care in hospitals, two separate regressions were run on two groups. One of the groups (Group A) contained all the hospitals in MSAs in the sample, and the other group (Group B) contained hospitals in MSAs with predicted mortalities of greater than five. Model 4a uses HHI1, HHI2, HPEN, and HHPEN (simultaneous effect of HHI2 and HPEN) variables for the market structure variables. The regressions of the grouped data used Model 4a.

$$\begin{aligned} LMORT = \; & a_0 + b_1 LCOST + b_2 HHI1 + b_3 HHI2 + b_4 HPEN \\ & + b_5 HHPEN + b_6 HITECH + b_7 BED + b_8 OCC + b_9 FPROFIT \\ & + b_{10} COTH + b_{11} STAFFIN + b_{12} SKMIX + b_{13} RESDNTS \\ & + b_{14} BCERT + b_{15} SYAFF + b_{16} CMI + b_{17} MEC \\ & + b_{18} MEDI + b_{19} INCOME + b2_{20} DRS + b_{21} CONSTATE \\ & + b_{22} CONLOW + \epsilon \end{aligned} \qquad (4a)$$

The dependent variable used in the regressions was LMORT (the natural logarithm of overall adjusted mortality rates). The natural logarithm (LMORT) form was used to provide normal distributions of that variable in order to meet the normality assumption of regression (Neter et al., 1989). The results of the analysis of the market structure on organizational performance hospital quality of care equation are discussed below. The estimates of the coefficients and standard errors from the 2SLS results of the group regressions are presented in Table 11; the full 2SLS regression results, including the estimates of the coefficients and standard errors for the first stage, are found in Appendix C.

The results indicate that Group A ($F = 13.9$; $p = 0.0001$) and Group B ($F = 15.4$; $p = 0.0001$) yield in overall significant regression equations. The adjusted R^2 for Group

A was 0.127 and for Group B was 0.140. It was expected that market structure (competition among hospitals) would have a positive relationship with hospital quality of care. The estimated coefficient for the HHI1 variable was -0.036 and significant at the 0.10 level. This suggests that when other variables are equal, mortality rates decreases when market structure becomes more competitive. It supports Hypothesis 3 and suggests that increased competition among hospitals leads to higher quality of care. For Group B (hospitals in MSAs with mortalities greater than five) the estimated coefficient for the HHI1 variable was -0.034 and also significant.

Hypothesis 4a predicts that increased competition leads to higher hospital quality of care. As the results in Table 11 show, HMO competition (HHI2) in both groups had positive, statistically insignificant associations with overall adjusted mortality rates (LMORT). Thus, other things being equal, market areas with greater HMO competition experienced higher overall adjusted mortality rates or lower quality of care. The results of group regression model did not support Hypothesis 4a.

Hypothesis 4b states that a higher level of HMO market penetration leads to higher hospital quality of care. The results of the group regression analysis indicate that the relationship between HMO market penetration (HPEN) in both groups and overall adjusted mortality rates (LMORT) is not significant. The estimated coefficients for the HPEN variable were 0.019 (Group A) and 0.033 (Group B). The positive sign indicates that all else being equal, higher HMO market penetration is associated with higher overall adjusted mortality rates or lower quality of care. The results of the group regression model did not support Hypothesis 4b.

Table 11

Two-Stage Least Square Regression Results. Testing The Nature of the LMORT-Market Structure Relationship

Dependent Variable = LMORT

Variable	Group A Coefficient (SE)	Group B Coefficient (SE)
Intercept	0.506 (0.323)	0.550* (0.307)
Efficiency		
LCOST	-0.034 (0.047)	-0.041 (0.045)
Market Structure		
HHI1	-0.036* (0.020)	-0.034* (0.019)
HHI2	0.003 (0.019)	0.005 (0.019)
HPEN	0.019 (0.149)	0.033 (0.144)
HHPEN	-0.070 (0.205)	- 0.083 (0.198)
Organizational		
HITECH	0.013 (0.029)	0.009 (0.028)
BED	-0.00009*** (0.00003)	-0.0001*** (0.00002)
OCC	-0.0003* (0.0002)	-0.0003* (0.0001)
FPROFIT	-0.022** (0.009)	-0.024** (0.009)
COTH	-0.015 (0.015)	-0.015 (0.015)
STAFFIN	-0.0003 (0.001)	-0.0009** (0.001)
SKMIX	-0.0003** (0.0001)	-0.0003** (0.0001)

Table 11 (Continued)

Dependent Variable = LMORT

Variable	Group A Coefficient (SE)	Group B Coefficient (SE)
RESNDTS	0.013** (0.006)	0.007 (0.006)
BCERT	-0.0003 (0.0003)	-0.0004 (0.0003)
MEC	-0.0009*** (0.0003)	- 0.001*** (0.0003)
MEDI	- 0.00002 (0.0004)	0.0002 (0.0004)
SYAFF	-0.002 (0.007)	-0.002 (0.006)
CMI	-0.002 (0.038)	0.024 (0.037)
Environmental		
INCOME	0.0000005 (0.000001)	0.0000004 (0.000001)
DRS	-0.025*** (0.004)	-0.026*** (0.004)
CONSTATE	-0.044*** (0.009)	-0.044*** (0.008)
CONLOW	0.024** (0.011)	0.023 (0.011)
N	1957	1941
Adjusted R-squared	0.127	0.140
Model F-value	13.893	15.384

* Significant at the 0.10 level
** Significant at the 0.05 level
*** Significant at the 0.01 level

Hypothesis 4c predicts that the simultaneous effect of higher levels of HMO competition and HMO market penetration leads to higher hospital quality of care. Analysis of interaction terms assessing the simultaneous effect of the HMO competition and HMO market penetration (HHPEN) in both groups revealed negative and statistically insignificant associations with overall adjusted mortality rates (LMORT). The results of the group regression model did not support Hypothesis 4c.

There are several variables which were found to have a significant impact on mortality rates. In Groups A and B, lower mortality rates were found in hospitals with higher occupancy rates (OCC), larger hospitals (BED), hospitals with higher RNs/LPNs ratio (SKMIX), hospitals in MSAs with more physicians per 1000 population (DRS), hospitals in MSAs located in the states that have certificate-of-need laws (CONSTATE), hospitals with higher payor mix variable (MEC), and for-profit (FPROFIT) hospitals. Higher mortality rates were found to be associated with hospitals with higher numbers of interns and residents per bed (RESDNTS) and with hospitals in MSAs in the states with dollar limits of certificate-of need regulation of $500,000 or less (CONLOW) in only Group A.

To examine the results in greater detail, this study tested the effects of market structure on three procedure specific mortality rates (LMCVA, LMHFT, and LMHRT). The estimates of the coefficients and standard errors from the 2SLS LMCVA, LMHFT, and LMHRT models are presented in Table 12, and full 2SLS regression results, including the estimates and standard errors for the first stage, are found in Appendix C.

The results indicate that the LMCVA model ($F = 2.64$; $p = 0.0001$) results in an overall significant regression equation. The adjusted R^2 is 0.0187. As shown in Table 12, only one of the market structure variables (HHI1) was found to be associated with cerebrovascular accident mortality rates (LMCVA). The results indicate that the MHFT model ($F = 2.58$; $p = 0.0001$) results in overall significant regression equation. The adjusted R^2 is 0.019. As shown in Table 12, none of the market structure variables were

Table 12

Two-Stage Least Square Regression Results, Testing the Nature of the LMCVA, MHFT, and LMHRT-Market Structure Relationship

Dependent Variable(s)	LMCVA	LMHFT	LMHRT
Variable	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)
Intercept	0.989 (0.721)	1.314 (1.394)	2.334*** (0.884)
Efficiency			
LCOST	-0.122 (0.106)	-0.208 (0.208)	-0.288** (0.128)
Market Structure			
HHI1	-0.104** (0.047)	-0.101 (0.087)	0.080 (0.059)
HHI2	-0.034 (0.046)	0.042 (0.087)	0.053 (0.047)
HPEN	0.056 (0347)	1.004 (0.648)	0.354 (0.372)
HHPEN	0.025 (0.025)	-1.024 (0.894)	-0.698 (0.502)
Organizational			
HITECH	0.027 (0.068)	0.099 (0.127)	-0.0005 (0.072)
BED	-0.00006 (0.00006)	-0.0002 (0.0001)	-0.0001** (0.00005)
OCC	0.0003 (0.0003)	-0.0007 (0.0007)	-0.005* (0.0003)
FPROFIT	-0.045* (0.023)	0.089* (0.044)	-0.035 (0.028)
COTH	-0.012 (0.035)	0.062 (0.065)	0.009 (0.031)
STAFFIN	0.002 (0.003)	0.004 (0.006)	0.002 (0.005)
SKMIX	-0.0003 (0.0002)	-0.0002 (0.0004)	-0.0002 (0.0002)

Table 12 (Continued)

Dependent Variable(s)	LMCVA	LMHFT	LMHRT
Variable	Coefficient (SE)	Coefficient (SE)	Coefficient (SE)
RESDNTS	0.003 (0.015)	-0.018 (0.037)	-0.016 (0.044)
BCERT	0.0008 (0.0006)	-0.001 (0.001)	-0.0009 (0.0008)
MEC	-0.001 (0.0007)	-0.0007 (0.002)	-0.0001 (0.001)
MEDI	-0.0004 (0.0009)	0.002 (0.002)	0.004** (0.001)
SYAFF	0.003 (0.015)	0.035 (0.029)	-0.009 (0.017)
CMI	0.0002 (0.090)	0.363* (0.178)	0.104 (0.070)
Environmental			
INCOME	0.000004 (0.000003)	0.000002 (0.000006)	-0.0000006 (0.000004)
DRS	-0.018** (0.009)	-0.047*** (0.016)	0.001 (0.008)
CONSTATE	-0.040** (0.020)	0.013 (0.038)	-0.064*** (0.020)
CONLOW	0.011 (0.025)	0.060 (0.047)	0.029 (0.029)
N	1942	1846	592
Adjusted R-squared	0.018	0.019	0.113
F-value	2.638	2.581	4.432

* Significant at the 0.10 level
** Significant at the 0.05 level
*** Significant at the 0.01 level

found to be associated with hip fracture mortality rates (LMHFT). The results indicate that the LMHRT model ($F = 4.58$; $p = 0.0001$) resulted in an overall significant regression equation. The results of the LMHRT model indicate none of the market structure variables (HHI1, HHI2, HPEN) were found to be significantly associated with heart disease mortality rates.

Cost-Quality Relationship

Hypothesis 5 predicts that higher hospital costs will have a positive effect on hospital quality of care. Two models were used for testing cost-quality relationship. Models 3a used the MORT variable for quality of care variable. The model is

$$\begin{aligned} LCOST = {} & a_0 + b_1 MORT + b_2 HHI1 + b_3 HHI2 + b_4 HPEN + b_5 HHPEN \\ & + b_6 HITECH + b_7 BED + b_8 OCC + b_9 FPROFIT + b_{10} COTH \\ & + b_{11} STAFFIN + b_{12} SKMIX + b_{13} BCERT + b_{14} MWAGE + b_{15} CMI \\ & + b_{16} INCOME + b_{17} DRS + b_{18} MEC + b_{19} MEDI + b_{20} PDNSTY \\ & + b_{21} NONWHITE + b_{22} CONSTATE + b_{23} CONLOW + \epsilon \end{aligned} \tag{3a}$$

To test for curvilinearity for the cost-quality relationship a second model, Model 3b uses both a quality of care term (MORT) and a squared quality of care term (MORT2) for the quality of care variable. Model 3b is

$$\begin{aligned} LCOST = {} & a_0 + b_1 MORT + b_2 MORT2 + b_3 HHI1 + b_4 HHI2 + b_5 HPEN \\ & + b_6 HHPEN + b_7 HITECH + b_8 BED + b_9 OCC + b_{10} FPROFIT \\ & + b_{11} COTH + b_{12} STAFFIN + b_{13} SKMIX + b_{14} BCERT \\ & + b_{15} MWAGE + b_{16} CMI + b_{17} INCOME + b_{18} DRS \\ & + b_{19} MEC + b_{20} MEDI + b_{21} PDNSTY + b_{22} NONWHITE \\ & + b_{23} CONSTATE + b_{24} CONLOW + \epsilon \end{aligned} \tag{3b}$$

The results of the analysis of the cost-quality relationship equation are discussed below. The estimates of the ordinary least squares (OLS) cost equation are presented in Table 13 and the full OLS regression results, including the estimates of the coefficients and standard errors for other quality of care variables, are found in Appendix D. The

Table 13

Ordinary Least Square (OLS) Regression Results, Testing the Nature of Cost-Quality Relationship

Dependent Variable = LCOST		
	Model 3a	Model 3b
Variable	Coefficient (SE)	Coefficient (SE)
Intercept	6.823*** (0.089)	7.055 (0.101)
Quality		
MORT	-0.102*** (0.034)	-0.664*** (0.125)
MORT2		0.274*** (0.059)
Market Structure		
HHI1	0.002 (0.033)	-0.003 (0.033)
HHI2	-0.023 (0.032)	-0.021 (0.032)
HPEN	-0.176 (0.245)	-0.156 (0.244)
HHPEN	0.336 (0.334)	0.333 (0.332)
Organizational		
HITECH	-0.037 (0.046)	-0.022 (0.045)
BED	0.0002* (0.00004)	0.0002** (0.00004)
OCC	-0.0009** (0.0003)	-0.0009*** (0.0003)
FPROFIT	0.002 (0.016)	0.003 (0.016)
COTH	0.122*** (0.023)	0.116*** (0.023)
STAFFIN	0.007*** (0.002)	0.006** (0.002)

Table 13 (Continued)

Dependent Variable = LCOST		
	Model 3a	Model 3b
Variable	Coefficient (SE)	Coefficient (SE)
SKMIX	0.0003 (0.0002)	0.0003 (0.0002
BCERT	-0.0005 (0.0004)	-0.0005 (0.0004)
MWAGE	0.486*** (0.047)	0.482*** (0.047)
MEC	0.002*** (0.0005)	0.003*** (0.0005)
MEDI	0.002*** (0.0006)	0.002*** (0.0006)
CMI	0.613*** (0.036)	0.636*** (0.037)
Environmental		
INCOME	0.00004* (0.000002)	0.000005** (0.000002)
DRS	0.008 (0.006)	0.006 (0.006)
PDNSTY	-0.000004 (0.000004)	-0.000004 (0.000004)
NONWHITE	0.003*** (0.0006)	0.003*** (0.0005)
CONSTATE	0.035 (0.015)	0.033 (0.015)
CONLOW	-0.002 (0.018)	-0.001 (0.018)
N	1957	1957
Adjusted R-squared	0.486	0.491
F-value	81.356	79.714

* Significant at the 0.10 level
** Significant at the 0.05 level
*** Significant at the 0.01 level

results indicate that both Model 3a ($F = 81.356$; $p = 0.0001$) and Model 3b ($F = 79.714$; $p = 0.0001$) yield overall significant regression results. From Model 3a it appears that there was a relationship between cost and quality. MORT was significant at $p < 0.002$. MORT affects cost both linearly and nonlinearly. The estimated coefficient for the MORT was negative and highly significant, suggesting that all else being equal, a high quality of care increases a hospital's costs. The significant squared term indicates that cost-quality relationship is a curvilinear or U-shaped function.

The signs of the coefficients show that the stationary point is a minimum. The point where the derivative of LCOST with respect to MORT is equal to zero is an estimate of that minimum:

$$\frac{\partial(LCOST)}{\partial(MORT)} = 0. \tag{6}$$

The level of the value of mortality where the LCOST is minimum is 1.21. Thus, it appears that cost decreases as MORT increases until reaching a minimum stationary point, when cost begins to increase as MORT increases.

The correlation matrix (summarized in Table 14 and shown in detail in Appendix A) shows a negative significant relationship between cost per adjusted admission (LCOST) and overall adjusted mortality rates (LMORT), a negative significant relationship between cost per adjusted admission (LCOST) and heart disease mortality rates (LMHRT), a negative significant relationship between cost per adjusted admission (LCOST) and cerebrovascular accident mortality rates (LMCVA), and no relationship between cost per adjusted admission (LCOST) and hip fracture mortality rates (LMHFT). The signs of the coefficients show that the stationary point is a minimum. In other words,

Table 14

Correlation Matrix

	LCOST	LMORT	LMCVA	LMHFT	LMHRT	MORT2	MCVA2
LCOST	1.00000						
LMORT	-0.17516***	1.00000					
LMCVA	-0.11905***	0.38928***	1.00000				
LMHFT	-0.01325	0.21406***	0.07347***	1.00000			
LMHRT	-0.22328***	0.56957***	0.17647***	0.16159***	1.00000		
MORT2	-0.17490***	0.92171***	0.38034***	0.21254***	0.57032***	1.00000	
MCVA2	-0.13279***	0.27647***	0.67825***	0.07377***	0.18535***	0.29201***	1.00000
MHFT2	-0.02928	0.13424***	0.00483	0.46408***	0.22201***	0.14355***	0.02095
MHRT2	-0.15292***	0.41057***	-0.00284	0.12376***	0.82382***	0.42254***	0.05869
HHI1	-0.18240***	-0.13742***	-0.08436***	-0.06565***	-0.12869***	-0.11751***	-0.05296**
HHI2	-0.09106***	-0.04133*	-0.03909*	-0.02363	-0.00239	-0.03587	-0.02331
HPEN	-0.19047***	-0.05981***	-0.00340	-0.00026	-0.10140**	-0.05263**	-0.01110
HHPEN	-0.20296***	-0.06905***	-0.01364	-0.01178	-0.10428**	-0.05856***	-0.01966
HITECH	-0.18131***	-0.03605	-0.00433	-0.01240	-0.05689	-0.04995**	-0.02211
BED	-0.47489***	-0.21086***	-0.08268***	-0.05507**	-0.23272***	-0.20792***	-0.14463***
OCC	-0.15140***	-0.15140***	-0.01051	-0.05211**	-0.05499	-0.20792 ***	-0.07215***

	MHFT2	MHRT2	HHI1	HHI2	HPEN	HHPEN	HITECH
MHFT2	1.00000						
MHRT2	0.34895***	1.00000					
HHI1	-0.01598	-0.08495**	1.00000				
HHI2	-0.02150	0.04944	0.29443***	1.00000			
HPEN	-0.00644	-0.09241**	0.34725***	0.19801***	1.00000		
HHPEN	-0.00348	-0.08657**	0.41228***	0.34874***	0.96625***	1.00000	
HITECH	-0.01497	-0.04621	-0.03923***	0.02279	0.34940	0.04752**	1.00000
BED	-0.06432***	-0.20449***	0.10203***	0.01863	-0.02602	-0.01684	0.33000***
OCC	-0.07015***	-0.08427**	0.11559***	0.04051 *	0.02488	0.02657	0.07017***

Table 14 (Continued)

	BED	OCC	FPROFIT	COTH	STAFFIN	SKMIX	RESDNTS
BED	1.00000						
OCC	0.28846***	1.00000					
FPROFIT	-0.21223***	-0.24517***	1.00000				
COTH	0.58276***	0.22082***	-0.14384***	1.00000			
STAFFIN	0.19544***	-0.03708	-0.03511	0.23610***	1.00000		
SKMIX	0.11795***	0.06156***	-0.05782**	0.14286***	0.13762***	1.00000	
RESDNTS	-0.09581***	-0.06750***	0.02606	-0.02966	0.03128	-0.01215	1.00000
BCERT	0.16929***	0.07890***	-0.09753***	0.10807***	0.11980***	0.08520***	-0.03793*
MWAGE	0.28599***	0.20026***	0.09739***	0.27114***	0.08962***	0.09980***	-0.02371
MEC	-0.18310***	-0.00845***	-0.05020**	-0.18760***	-0.21332***	-0.05959***	-0.02299
MEDI	0.04286*	0.05563**	-0.08614***	0.14249***	-0.02384	-0.03609	0.01973
SYAFF	-0.07882***	-0.04042*	0.06777***	-0.07933***	-0.00221	-0.01806	0.01678
CMI	0.58813***	0.23480	-0.01057	0.36221***	0.36221***	0.14056***	-0.11714***
INCOME	0.15690***	0.18959***	-0.10588***	-0.07683***	-0.07683***	0.09364***	-0.03500
DRS	0.19053***	0.13480***	-0.06267***	0.18070***	-0.04178*	0.07545***	-0.04666**
PDNSTY	0.19158***	0.19761***	-0.04879**	0.14214***	-0.14982***	0.03792*	-0.03088
NONWHITE	0.11838***	0.11838**	0.14928***	0.10016***	-0.00027	0.00526	-0.01401
CONSTATE	0.11031***	0.11031***	-0.22411***	0.10068***	-0.18240***	0.01870	-0.02017
CONLOW	0.01688	0.01688**	0.08416***	-0.02667	0.03555	-0.02697	0.01119

	BCERT	MWAGE	MEC	MEDI	SYAFF	CMI	INCOME
BCERT	1.00000						
MWAGE	0.06655***	1.00000					
MEC	0.00479	-0.18393***	1.00000				
MEDI	-0.19203***	0.04621**	-0.34709***	1.00000			
SYAFF	-0.05173**	0.02562	-0.01002	-0.02293	1.00000		
CMI	0.19943***	0.28345***	-0.12618***	-0.02562	-0.00626	1.00000	
INCOME	0.01046	0.55352***	-0.04625**	-0.02964	-0.01570	0.01291	1.00000
DRS	0.06440***	0.32582***	-0.00944	-0.02687	-0.01336	0.07957***	0.53513***
PDNSTY	-0.12734***	0.48568***	-0.04785**	0.12342***	-0.03048	0.00130	0.42247***
NONWHITE	-0.12626***	0.37508***	-0.18926***	0.13157***	0.03163	0.07114***	0.24447***
CONSTATE	0.07313***	-0.12280***	0.17526***	-0.04865**	-0.10431***	-0.12689***	0.17921***
CONLOW	-0.03159	0.08360***	-0.07868***	0.04579**	-0.00720	0.04111*	-0.04859**

* Significant at the 0.10 level
** Significant at the 0.05 level
***Significant at the 0.01 level

The complete correlation matrix, including the Pearson correlation coefficients, is shown in Appendix A.

cost decreases as quality increases until a minimum cost value is reached, and then cost increases as quality of care increases. The analysis of the OLS and the correlation matrix support Hypothesis 5. Hospitals with higher cost per adjusted admission are more likely to have very low mortality rates or high quality of care.

Single-Equation Model

For comparison and diagnostic purposes the equations were also estimated by ordinary least squares (OLS). Table 15 compares the 2SLS and OLS results for Model 3a. The results of the OLS single model equation are similar to those for the 2SLS simultaneous equations discussed above. The signs of all the coefficients are almost the same.

There are, however, two variables that are not significant in the 2SLS equation that are significant in the OLS equation. In the single equation model the coefficients of DRS and INCOME are positive and significant at 0.01 level. These variables fell just short of the conventional level of significance in the simultaneous system result probability of 0.13 and 0.22, respectively. Additional testing of this variable is warranted.

The variance inflation factors (VIF) were analyzed for evidence of multi-collinearity. The largest VIF of all the independent variables is used to indicate the existence of multicollinearity: If the largest VIF is greater than 10, the effect of multicollinearity is considered to be influential (Neter et al.,1989, p. 409). Table 15 shows that the largest is 2.40 for the entire sample, using Model 3a. This indicates the existence of multicollinearity in the model could be negligible in influencing the least squares estimates. The regressions for Model 3a were also estimated by ordinary least

Table 15

Comparison of 2SLS and OLS Regression Results of Model 3a with VIF Factors

Dependent Variable = LCOST

	2SLS	OLS	
Variable	Coefficient (SE)	Coefficient (SE)	Variance Inflation
Intercept	6.581*** (0.211)	6.691*** (0.077)	0.000
Independent			
LMORT	0.435 (0.729)	-0.039 (0.037)	1.164
HHI1	0.024 (0.046)	0.012 (0.033)	1.511
HHI2	-0.022 (0.034)	-0.003 (0.026)	1.152
HPEN	-0.210 (0.261)	0.064 (0.064)	1.630
Organizational			
HITECH	-0.054 (0.052)	-0.037 (0.046)	1.197
BED	0.0002*** (0.00008)	0.0002*** (0.00004)	2.407
OCC	-0.0009*** (0.0003)	-0.0009 (0.0003)	1.240
FPROFIT	0.016 (0.024)	0.005 (0.016)	1.339
COTH	0.130*** (0.027)	0.122*** (0.023)	1.662
STAFFIN	0.007*** (0.002)	0.007*** (0.002)	1.324
SKMIX	0.0004 (0.0003)	0.0003 (0.0002)	1.058
BCERT	-0.0003 (0.0005)	-0.0004 (0.0004)	1.159

Table 15 (Continued)

Dependent Variable = LCOST

Variable	2SLS Coefficient (SE)	OLS Coefficient (SE)	Variance Inflation
MWAGE	0.509*** (0.058)	0.489*** (0.047)	2.392
MEC	0.003*** (0.0008)	0.002*** (0.0004)	1.323
MEDI	0.002*** (0.0007)	0.002*** (0.0007)	1.279
CMI	0.629*** (0.043)	0.614*** (0.036)	1.961
<u>Environmental</u>			
INCOME	0.000004 (0.000003)	0.000004*** (0.000002)	2.329
DRS	0.022 (0.021)	0.009*** (0.006)	1.532
PDNSTY	-0.0000001 (0.000007)	-0.000003 (0.000005)	1.810
NONWHITE	0.003*** (0.001)	0.003*** (0.0006)	1.643
CONSTATE	0.057** (0.033)	0.038*** (0.015)	1.504
CONLOW	-0.013 (0.025)	-0.004 (0.018)	1.149
N	1957	1957	
Adjusted R-squared	0.463	0.484	
Model F-value	74.425	84.280	

** Significant at the 0.05 level
*** Significant at the 0.01 level

squares (OLS) and the VIFs analyzed. The results are shown in Appendix D. For Model 4a the largest VIF is 2.33 (see Appendix D). For the MHRT model the largest VIF is 1.80. For the LMHFT model the largest VIF is 2.25. For the LMCVA model the largest VIF is 2.33. The large VIF (if a maximum VIF value exceeds 10) indicates the presence of multicollinearity but above VIF shows little or no multicollinearity.

One possible reason which might explain nonsignificant relationships found for most of hypotheses is that the MSA is not adequate proxy for the market for general acute inpatient services. The definition of the market is subject to debate. Markets have been defined in the literature geographically, by travel distance, or by patient origin. This study used MSA as the measurement of the market (i.e., a geographical definition).

Summary of Results

The results of this study associated with the following discussion are summarized in Table 16. The empirical results show a statistically insignificant relationship between market structure variable (HHI1) and cost per adjusted admission. Hypothesis 1 was not supported.

The empirical results did not support a relationship between market structure variable (HHI2) and cost per adjusted admission. The estimated coefficient for HHI2 variable was negative, which indicated that as cost per adjusted admission decreases market structure (HHI2) becomes more competitive. The empirical results show a statistically insignificant relationship between HMO market penetration (HPEN) and cost per adjusted admission. Analysis of interaction terms assessing the simultaneous effect of HMO and HPEN (HHPEN) revealed positive and statistically insignificant associations with cost per adjusted admission. The results on other variables show a

Table 16

Summary of Results of Research

Research Question	Hypothesis	Result	Rationale
What is the effect of market on cost-efficiency and quality of care in hospitals?	1. Increased hospital competition leads to lower hospital costs	Not supported	MSA is not an adequate proxy for the market for general acute care inpatient services
	2a. Increased HMO competition leads to lower hospital costs	Not supported	Governmental efforts to stimulate competition in the hospital market, if focused on promoting HMOs, are not likely to produce cost-containing results quickly
	2b. A higher level of HMO market penetration leads to lower hospital costs	Not supported	Same as 2a
	2c. The simultaneous effect of higher levels of HMO competition and HMO market penetration leads to lower hospital costs	Not supported	Same as 2a
	3. Increased hospital competition leads to higher hospital quality of care	Supported	Hospitals' active engagement in competition (for the best technology and other resources) with each other results in reducing their mortality rates

Table 16 (Continued)

Research Question	Hypothesis	Result	Rationale
	4a. Increased HMO competition leads to higher hospital quality of care	Not supported	Intensely competitive markets, characterized by a high degree of managed care programs, may have no significant effect on quality of care
	4b. A higher level of HMO market penetration leads to higher hospital quality of care	Not supported	Same as 4a
	4c. The simultaneous effect of higher levels of HMO competition and HMO market penetration leads to higher hospital quality of care	Not supported	Same as 4b
What is the nature of the relationship between cost-efficiency and quality of care in hospitals?	5. Higher hospital costs will have a positive effect on hospital quality of care	Supported	The relationship between cost and quality is U shaped

positive, significant relationship between COTH hospitals and cost per adjusted admission (LCOST); a positive, significant relationship between cost of health care labor (MWAGE) and cost per adjusted admission (LCOST); a positive, significant relationship between case-mix index (CMI) and cost per adjusted admission (LCOST); a positive, significant relationship between larger hospitals (BED) and cost per adjusted admission (LCOST); and a negative, significant relationship between occupancy rate (OCC) and cost per adjusted admission (LCOST).

The empirical results show a negative, statistically significant effects between market structure variable (HHI1) and overall adjusted mortality rates (LMORT), but no associations were found between market structure variables (HHI2, HPEN) and overall adjusted mortality rates (LMORT). Also, analysis of interaction terms assessing the simultaneous effect of HHI2 and HPEN (HHPEN) revealed no associations with overall adjusted mortality rates (LMORT). The results of other variables show a negative, significant relationship between occupancy rate (OCC) and overall adjusted mortality rates (LMORT); a negative, significant relationship between hospitals in MSAs with physicians per 1000 population (DRS) and overall adjusted mortality rates (LMORT); a negative, significant relationship between hospitals in MSAs located in the states that have certificate-of-need laws (CONSTATE) and overall adjusted mortality rates (LMORT); a negative, significant relationship between for-profit (FPROFIT) hospitals and overall adjusted mortality rates (LMORT); a negative, significant relationship between larger hospitals (BED) and overall adjusted mortality rates (LMORT); a positive, significant relationship between number of interns and residents per bed (RESDNTS) and overall adjusted mortality rates (LMORT); and a positive, significant relationship between hospitals in MSAs in states with dollar limits of certificate-of-need regulation of $500,000 or less (CONLOW) and overall adjusted mortality rates (LMORT). The empirical results support a negative relationship between cost and quality.

CHAPTER 5

CONCLUSIONS AND IMPLICATIONS

The purpose of this study was twofold. The first purpose was to investigate the effects of market structure on health care organizational performance, as measured by cost-efficiency and quality of care in hospitals. The second purpose was to investigate the relationship between cost-efficiency and quality of care in hospitals. In particular, this study was to examine whether trade-offs occur between these two domains of health care organizational performance and to determine if they are compatible in the health care industry.

Previous health services research in this area has tended to use data that predates the implementation of PPS, which makes the generalizability of the results to the current health care environment questionable. Additionally, there are very few published studies that have examined the simultaneous effects of cost and quality of care on market structure to assess health care organizational performance.

This study went beyond previous research in a number of ways. The application of a modified structure-conduct-performance paradigm to the health care industry allowed the market structure effects in studying organizational performance. In addition, this study also included both efficiency measures (cost) and quality of care (mortality rates) of organizational performance, so that the differential effect of market structure on these two organizational performance domains could be analyzed. Last, the model is tested on 1991 data from 1,967 American Hospital Association (AHA) registered general, acute care hospitals in 301 Metropolitan Statistical Areas (MSAs), using a single-equation model and a simultaneous model approach incorporating cost-efficiency and quality of care as endogenous variables. The results are presented in chapter 4. This chapter discusses the findings and implications for policy and reimbursement issues. The chapter concludes with a section on directions for future research.

Discussion and Implications for Theory and Practice

In efforts to control rising costs of health care, state and federal governments have recently experimented with market-oriented or competitive strategies. The success of introducing market-oriented strategies into the hospital markets ultimately depends on the effect competition has in health care markets. But the effect of competition in hospital markets is subject to controversy. In an effort to shed some light on the nature of hospital competition, this study examined the effect of market structure on organizational performance of hospitals. The conclusions are discussed below.

Past research done prior to the implementation of PPS has found market competition to be positively associated with cost due to the existence of extensive non-price competition to attract physicians to admit patients to a particular hospital. It was expected that the introduction of prospective reimbursement would encourage hospitals to compete on the basis of price and that this would also necessitate controlling costs more strictly in order to maintain profits. This study therefore hypothesized a negative relationship between market concentration and cost. However, the results of this study did not support the contention that some mechanisms for enhancing competition may have a beneficial impact on cost. For example, there is no association between market structure variable (i.e., competition among hospitals, calculated using Hirschman-Herfindahl Index [HHI1]) and hospital costs per adjusted admission. As was expected, the coefficients for the market structure variables (HHI2 and HPEN) are negative, thus proving that hospital competition follows (a) the structure-conduct-performance paradigm and (b) the traditional economic theory that cost decreases as competition increases. The findings of this study are consistent with those of the study by Hadley and Swartz (1989), who examined the impact of competition proxies on hospital costs using a generalized multipayer cost function applied to data from 43 SMSAs (1,293 hospitals) for 1980 through 1984. They found that although competition mattered, it did not matter very much.

One possible reason which might explain the nonsignificant relationship between market structure variable (i.e., competition among hospitals, calculated using Hirschman-Herfindahl Index) and hospital cost per adjusted admission is that the MSA is not an adequate proxy for the market for general acute care inpatient services. The definition of the market is subject to debate. Markets have been defined in the literature geographically, by travel distance, or by patient origin. This study used the MSA as the measurement of the market (i.e., a geographical definition). There is evidence that patients bypass rural hospitals (Bronstein & Morrisey, 1991), and it is possible that patients bypass hospitals in small MSAs, as well. Small MSA markets may behave more like rural markets than urban markets. If this is true, the HHI1 of the smaller MSAs may understate the degree of competition in the market. In that case, alternative market definitions would show a higher HHI1 or more competitive market than that used in this study. Additional research using alternative market definitions is warranted.

The findings of this study suggest that there is no relationship between HMO competition and hospital costs per adjusted admission. The important message here is that governmental efforts to stimulate competition in the hospital market, if focused on promoting HMOs, are not likely to produce cost-containing results quickly. However, if HMO competition is to succeed, it must encompass more than HMOs. While HMOs may be important, they are only one segment in the market. Thus, public policy created to induce competition in hospital market must go beyond the simple stimulus of HMO growth. These findings are consistent with McLaughlin's (1987) study. McLaughlin (1987) estimated a two-equation simultaneous equations model in which HMO market share and hospital utilization and costs were endogenously determined. The study employed pooled cross-section time-series data for 25 SMSAs observed during the 1972-1982 period. McLaughlin found that growth in HMO share induced higher average costs per admission and per patient day. These findings are also consistent with what Johnson and Aquilina (1986) found in their studies of the Twin-Cities market.

What about the results that HMO market penetration is not associated with hospital costs per adjusted admission, although the beta coefficient for HMO market penetration variable is negative? It would be easy to interpret as a negative consequence of managed competition. However, this interpretation would be incorrect. Since the positive coefficient of HMO market penetration represents selection diseconomies, it does not imply that hospital costs per adjusted admission in a MSA are increasing. Instead, it suggests that higher-cost individuals move from indemnity insurers to HMOs as HMOs' market penetration increases. Some policy analysts (Jones, 1990) have argued that enrolling higher-cost individuals in HMOs is a desirable goal, since managed care is likely to have a proportionately greater cost incurred by these individuals. Some authors have also examined the effects of HMO market penetration. These findings are consistent with the study by Woolhandler, Himmelstein, & Lewontin (1993). Using Medicare accounting data for 6,400 hospitals, Woolhandler et al. (1993) compared the average administrative costs of hospitals in 1990 in states with significant HMO penetration with those in states with less HMO penetration. They found that hospitals in states with greater HMO penetration have slightly higher average administrative costs.

Further, there was no association between interaction terms assessing the simultaneous effects of HMO competition and HMO market penetration and hospital costs per adjusted admission. To HMO advocates these results are disappointing, since they suggest that the HMO market-driven-type measures in America's 1991 health care environment experienced difficulties in achieving significantly improved hospital economies. Enthoven (1993) offers an explanation for why managed care has not been able to contain health care costs. Enthoven argues that certain factors, including employer coverage practices, the existing tax code, and the number of standardized coverage options per purchasing group, reduce the purchaser's sensitivity to price differences among plans and thereby decrease the plans' incentives to cut health care costs.

Health policy experts might more appropriately agree that more competition or more regulation results in its own different set of compromises (Anderson, Heyssel & Dickler, 1993; Robinson & Luft, 1988; Weil, 1996). On the other hand, a more market-driven approach usually adds barriers to accessibility and to the use of services, and limits choice of physician and hospital--all strategies to improve the providers' and insurers' bottom lines. On the other hand, a statutory approach often engenders difficulties in appropriately setting eligibility for benefits, causes inequities among providers when setting reimbursement rates, and embodies the inefficiencies of government-controlled approaches.

It should be pointed out that the purpose of this study was to examine at the overall impact in a market area. While HMOs might be highly successful in controlling their costs, they do not appear to have the spillover effects on market-wide total hospital costs per adjusted admission that could be generalized to support a competitive solution. Further, these results do not imply that competitive programs are not successful as a means of controlling hospital costs in a given market; rather they suggest that, across these 301 MSAs, the programs were not generally successful. Depending on the nature, extent, and age of such programs in an MSA--and the interaction with other, unmeasured market factors--some programs may be effective. However, such individual successes are not generalizable to other communities.

This study finds a statistically or quantitatively strong relationship between market structure variable (i.e., competition among hospitals [HHI1]) and overall adjusted mortality rates. This finding suggests that when faced with intense competition, hospitals may respond in ways associated with reducing their mortality rates. Shortell and Hughes (1988) argued that when hospitals are faced with intense competition, they may attempt to cut costs through reduction in staff (as reductions in the number of nurses assigned to the intensive care unit), elimination of selected services, consolidation of services, and postponement of capital improvements. Hospitals may also forgo the development of new programs and services that could improve the quality of care. Some of these initiatives, undertaken in the name of efficiency, could have a negative impact on patient care, which, in turn, could lead to poorer outcomes for patients (Shortell & Hughes, 1988). Joskow (1980) also found a relationship between hospital competition and greater risk of poor outcomes. Given consumers' relative lack of knowledge and information about the quality of health care, such hospitals may compete more by offering lower prices and more amenities than by improving their performance on outcome-oriented technical measures of quality (Farley, 1985).

The findings of this study also indicate no associations between overall mortality rates and three types of market structure variables: HMO market competition, HMO market penetration, and interaction terms assessing the simultaneous effect of HMO market competition and HMO market penetration. These results suggest that in more intensely competitive markets, characterized by a high degree of managed care programs, may have no significant impact on quality of care. Additional measures of competition will be needed as future research hospitals' responses to competition and the implications of these responses for quality of care and patients' outcome. These findings are inconsistent with the study by Shortell and Hughes (1988), which examined records of Medicare patients in 981 hospitals in 45 states and found that HMO market penetration was significantly and positively associated with higher mortality rates.

This study used a single measure of mortality rates to indicate quality of care. Farley and Ozminkowski (1992) suggest that outcome measures should capture the effectiveness of treatment decisions more generally. Multiple indicators, including information on areas such as complications of treatment, readmissions, and health status, are preferable to a single indicator. However, more comprehensive measures require information that is either unreliable or generally unavailable from discharge abstract data. In addition, the mortality rates used in this study are compiled only for Medicare patients, and may not be generalizable to all patients to the extent that Medicare and non-Medicare patients have differing characteristics. Finally, the data used for this analysis are cross-sectional rather than longitudinal, so that causal antecedents cannot be established.

The results indicate that organizational (hospital) characteristics and the environmental characteristics of the hospital influence costs. Higher costs occur in hospitals with higher case-mix indexes and in those with strong teaching functions. The percentages of inpatient days represented by Medicare and Medicaid patients generally have positive signs when they are statistically significant, indicating that larger shares of Medicare or Medicaid patients lead to higher costs. These variables are likely to reflect unmeasured case-mix differences or intensity of care provided to patients covered by different payors. Larger hospitals and those hospitals with more health care worker full-time equivalents (FTEs) per 1000 adjusted patient days have higher costs. Hospitals operating in MSAs with higher payroll expense per employee report significantly higher costs. Hospitals operating in MSAs with higher percentage of nonwhite population and those in MSAs in the states that have a certificate-of-need law have higher costs. Hospitals with higher occupancy rates have lower costs.

The results also suggest that hospitals with certain characteristics provide higher quality of care or lower mortality rates. These characteristics include a higher occupancy rate, a larger hospital, a higher percentages of patients who are covered by Medicare, a for-profit hospital, and a higher RNs/LPNs ratio. Also, the environmental characteristics of the hospital tend to exert influence on quality of care. Hospitals located in MSAs with physicians per 1000 population and those located in the states that have certificate-of-need laws have higher quality of care. Hospitals located in MSAs in states with dollar limits of certificate-of-need regulation of $500,000 or less are associated with lower quality of care.

One difference between the results of this study and those of previous studies is that this study found that for-profit hospitals had lower overall adjusted mortality rates. Neither of the two previous studies found a relationship between the type of hospital ownership and the mortality rates. Shortell and Hughes (1988) found no relationship between the mortality rate for patients with 16 conditions and the types of hospital ownership (for-profit, not-for-profit, or public). Using data from 1975 to 1981, Gaumer (1986) found that for-profit and not-for-profit hospitals had similar rates of mortality and readmission for eight types of elective surgery. These previous studies differ from this present study in that they used mortality rates from certain selected conditions rather than all mortality rates as the outcome variables. The reason for-profit hospitals have higher quality of care is that they have access to capital to acquire the best technology and hire well-qualified staff.

As stated earlier, one of the main hypotheses of this study was that costs cannot be contained without adversely affecting the quality of care. The results of the OLS regression model support this hypothesis. The relationship was significant and indicated cost per adjusted admission had an impact on overall mortality rates. When procedure specific mortality rates were added to the model, cost per adjusted admission was found to have a significant relationship with almost all of them, which provided further support for the hypothesis that costs cannot be contained without adversely affecting quality of care. The results of this study were supportive of the finding by Neuhauser (1971) that higher costs were associated with lower mortality rates and lower costs associated with higher mortality rates.

The results of this study demonstrate that containing costs while maintaining the quality of health care is a complex and challenging undertaking and requires a coordinating policy approach. An adequate level of reimbursement is a necessary but is not a sufficient condition for cost and quality: We also need to encourage competition in the market for health services and to develop public payment mechanisms that provide direct incentives for increasing or maintaining quality or reducing costs of health care.

The issues of cost-containment and quality of care will continue to be relevant in the future of health care provision. This study has attempted to give understanding to the complex relationship of market structure and organizational performance, measured by cost-efficiency and quality of health care in hospitals, and has indicated the importance of continued research in this area.

To explore the effects of market structure (i.e., hospital competition) on hospital costs further, data were compiled for the 29 largest MSAs. To gain information on the nature of the effect of hospital competition on hospital costs, two separate regressions are run on two groups. One of the groups (Group A) contains all the hospitals in MSAs in the sample, and the other group (Group B) contains hospitals in MSAs with predicted mortalities of greater than five. The results indicate that Group A (F = 61.652; p = 0.0001) and Group B (F = 65.274; p = 0.0001) yield overall significant regression equations. Competition variables (HHI1) in Groups A and B was found to have a positive statistically significant association with cost per adjusted admission (See

Appendix E). The positive sign indicates that all else being equal, hospital cost increases as the market becomes more competitive.

Implications for Health Care Executives

This study is of particular interest to health care executives. Hospital chief executive officers in a competitive environment will find new, innovative ways to maximize their facility's total reimbursement. Perhaps the simplest answer when evaluating the efficacy of HMOs to curtail hospital expenditures could to be consider these points: (a) In those MSAs where managed care is relatively mature, admissions to hospitals are already curtailed; (b) the annual cost of hospital care per person is probably more dependent on reducing the number of paid hours per average discharge (i.e., keeping on top of the basics of minimizing expenses and centralizing sophisticated services) rather than on whether the facility is located in a competitive environment.

The findings of this study suggest that more-competitive hospital markets, more-competitive HMO markets, and higher levels of HMO market penetration do not per se result in lower hospital costs as supporters of the competitive approach now sometimes espouse. Health care executives should understand that a more market-driven approach usually adds barriers to accessibility and to the use of services and limits choice of physician and hospital--all strategies to improve the providers' and insurers' bottom lines.

Hospital executives will be interested to know that certain hospital and environmental characteristics such as a higher occupancy rate, a larger hospital, a for-profit hospital, a higher percentage of inpatient days represented by Medicare patients, hospitals in MSAs with more physicians per 1000 population, and those in MSAs located in the states that have certificate-of-need laws may be a marker for a hospital's economic well-being at a time when many hospitals are struggling to main an adequate patient census. If they are, then the results of this study suggest that greater financial stability may be associated with improved quality. A higher RNs/LPNs ratio, another characteristic associated with a lower mortality rate or higher quality of care, may also indicate the economic well-being of the hospital. It may also suggest that a hospital assigns a high priority to maintaining adequate staff.

From this study, it was noted that higher costs occur in larger hospitals, hospitals with higher case-mix indexes, hospitals with strong teaching functions, hospitals with more health care worker full-time equivalents (FTEs) per 1000 adjusted patient days, and hospitals with higher payroll per employee. Medicare and Medicaid did prove to be detrimental to a hospital's financial well-being; in fact, it was significantly positive with cost per adjusted admission. This findings make the hotly debated Medicaid and Medicare even more questionable. Hospital executives need to be concerned about where their hospitals are located because the findings also suggest that hospitals operating in MSAs with a higher percentage of nonwhite population and those in MSAs in the states that have certificate-of-need laws have higher cost per adjusted admission. Higher occupancy rates tend to have lower costs.

Finally, the implication of this study's finding that lower costs do seem to affect quality adversely is that health care executives can perhaps be less aggressive in their cost-containment efforts. Careful monitoring of all areas of quality will continue to be needed to ensure that hospitals do not respond to competition or regulation by attempting to cut costs in areas which may have a negative impact on patient care.

Suggestions for Future Research

A number of research opportunities arise out of this study. These include the following:

First, the singular use of mortality rates as a quality of care indicator leaves a great deal to be desired. Mortality rate is only one of many possible proxies for quality of care. Wan (1992) demonstrated the development of a measurement model of adverse outcomes that used multiple indicators. The study confirmed the value of using multiple indicators to investigate quality problems; therefore, the development and use of multiple indicators to measure various aspects of quality of care should be integrated into future research. In addition, the relationship between market structure variable (i.e., competition among hospitals) and higher mortality rates merits further study.

Second, a follow-up study using data from a later time period would be appropriate to investigate the effects of market structure on organizational performance, cost efficiency, and quality of care of hospitals in the later phases of PPS, when there are greater incentives on the part of hospitals to contain costs. This would be especially important in terms of cost and quality trade-off issue.

Third, the nonsignificant relationship between cost per adjusted admission and HHI1 should be explored in future studies. It is possible that the result is a function of poor market definition. In other words, MSA may not be the appropriate measure for these smaller markets. Additional research using alternate market definitions is warranted.

Fourth, because there have been so many dramatic changes in hospital reimbursement, it would interesting to apply the structure-conduct-performance paradigm to the health care industry using a longitudinal study design.

Summary

In this chapter the various conclusions and implications drawn from this study were discussed. This study shows that hospitals are not exempt from the traditional structure-conduct-performance paradigm of economics. Competitive forces in the hospital markets do have a negative impact on cost-efficiency and also a positive impact on quality of care. Policy-makers should be familiar with effect and cost-quality relationship when developing market-oriented strategies. Finally, the suggestions for future research were discussed.

LIST OF REFERENCES

Altman, S. H., & Rodwin, M. A. (1988). Halfway competitive markets and ineffective regulation: The American health care system. Journal of Health Politics, Policy and Law, 13(2), 323-339.

American Hospital Association. (1992). Certificate of Need (CON): Back to the future. (Monograph Number 8). Washington, DC: State Issues Forum.

Anderson, G., Heyssel, R., & Dickler, R. (1993). Competition versus regulation: Its effect on hospitals. Health Affairs, 12(1), 70-80.

Anderson, G. A., & Lave, J. R. (1986). Financing graduate medical education. Inquiry, 23(3), 322-336.

Bain, J. S. (1968). Industrial organization (2nd ed.). New York: John Wiley & Sons.

Bain, J. S. (1956). Barriers to new competition. Cambridge, MA: Harvard University Press.

Baker, L. C. (1995). County-level estimates of HMO enrollment and market share. (Working Paper). Department of Health Research and Policy, Stanford University School of Medicine.

Bronstein, J., & Morrisey, M. A. (1991). Bypassing rural hospitals for obstetrics care. Journal of Health Politics, Policy and Law, 16, 87-118.

Caves, R. (1967). American industry: Structure, conduct, performance. Englewood Cliffs, NJ: Prentice-Hall.

Chelimsky, E. (1993). The political debate about health care: Are we losing sight of quality? Science, 262, 526-528.

Chirikos, T. H., & White, S. L. (1987). Competition in health care markets and the development of alternative forms of service delivery. Health Policy, 8, 325-338.

Christianson, J. B., Wholey, D. R., & Sanchez, S. (1991). State responses to HMO failures. Health Affairs, 10, 78-92.

Clarke, R. (1985). Industrial economics. Oxford, England: Basil Blackwell.

Craig, A. M., & Molek, M. (1995). Market structure and conduct in the pharmaceutical industry. Pharmacology and Therapeutics, 66, 301-337.

Donabedian, A. (1966). Evaluating the quality of medical care. Milbank Memorial Fund Quarterly, 44(2), 166-206.

Donabedian, A., Wheeler, J. R., & Wyszewianski, L. (1982). Quality, cost, and health: An integrative model. Medical Care, 10, 975-990.

Dranove, D., Shanley, M., & Simon, C. (1992). Is hospital competition wasteful? Rand Journal of Economics, 23, 247-262.

Dranove, D., Shanley, M., & White, W. D. (1993). Price and concentration in hospital markets: The switch from patient-driven competition. Journal of Law & Economics, 36, 690-696.

Ellwood, P. M., Anderson, N. N., Billings, J. E., Carlson, R. J., Hoagberg, E. J., & McClure, W. (1971). Health maintenance strategy. Medical Care, 9, 291-298.

Elzinga, K. G., & Hogarty, T. F. (1973). The problem of geographic market delineation in anti-merger suits. Antitrust Bulletin, 18, 45-81.

Enthoven, A. C. (1993). Why managed care has failed to contain health costs. Health Affairs, 12(4), 27-43.

Farley, D. E. (1985). Competition among hospitals: Market structure and its relation to utilization, costs, and financial position. Research Note 7, (Hospital Studies Program, DHHS Publication No. (PHS) 85-3353). Washington, DC: U.S. Department of Health and Human Services, National Center for Health Services Research and Health Care Technology Assessment.

Farley, D. E., & Ozminkowski, R. J. (1992). Volume-outcome relationships and inhospital mortality: The effects of changes in volume over time. Medical Care, 30(1), 77-94.

Feldman, R., Wisner, C. L., Dowd, B., & Christianson, J. (1993). An empirical test of competition in the Medicare HMO market, In Arnould, R.J. (ed.). Competitive Approaches to Health Care Reform. Washington, DC: Urban Institute Press.

Fischer, S. & Dornbusch, R. (1983). Economics. London: McGraw-Hill.

Fleming, S. T. (1991). The relationship between quality and cost: pure and simple? Inquiry, 28, 29-38.

Flood, A. B., Ewy, W., Scott, W. R., Forrest, W. H., Jr., & Brown, B. W., Jr. (1979). The relationship between intensity and duration of medical services and outcomes for hospitalized patients. Medical Care, 17(11), 1088-1102.

Flood, A. B., Shortell, S. M., & Scott, W. R. (1994). Organizational performance: managing for efficiency and effectiveness. In S.M. Shortell & A. D. Kaluzny (eds.), Health management. Albany, NY: Delmar Publishers.

Fottler, M. D. (1987). Health care organizational performance: Present and future research. Journal of Management, 13(2), 367-391.

Garber, A. M., Fuchs, V. R. & Silverman, J. F. (1984). Case-mix, costs, and outcomes: Differences between faculty and community hospital. New England Journal of Medicine, 310(19), 1231-1237.

Garnick, D. W., DeLong, E. R., & Luft, H. S. (1995). Measuring hospital mortality rates: Are 30-day data enough? Health Services Research, 29(6), 679-695.

Garnick, D. W., Luft, H. S., Robinson, J. C. & Tetreault, J. (1987). Appropriate measures of hospital market areas. Health Services Research, 22(1), 69-90.

Gaumer, G. (1986). Medicare patient outcomes and hospital organization mission: For-profit enterprise in health care. (pp. 354-372). Washington, DC: National Academy Press.

Goldberg, L. G., & Greenberg, W. (1980). The competitive response to Blue Cross to the health maintenance. Economic Inquiry, 18, 57-72.

Grady, K. E., & Wallston, B. S. (1988). Research in health care settings. Newbury Park, CA: Sage Publications.

Green, J. G., Wintfield, N., Sharkey, P., & Passman, L. J. (1990). The importance of severity of illness in assessing hospital mortality. Journal of the American Medical Association, 263(2), 241-249.

Greer, D. F. (1980). Industrial organization and public policy. New York: Macmillan Publishing.

Group Health Association of America (1995). HMO industry profile: 1995 Edition. (Vol. 1, pp. 20073-0612). Washington, DC: GHAA Publications.

Gruber, L. R., Shadle, M. & Polich, C. L. (1988). From movement to industry: The growth of HMOs. Health Affairs, 7, 197-208.

Hadley, J., & Swartz, K. (1989). The impacts on hospital costs between 1980 and 1984 of hospital rate regulation, competition, and changes in health insurance coverage. Inquiry, 35, 26-36.

Hannah, E., & Kay, J. (1977). Concentration in modern industry. London: Humanities Press.

Hartley, D., Moscovice, I., & Christianson, J. (1996). Mobile technology in rural hospitals: The case of the CT scanner. Health Services Research, 31(2), 213-234.

Hartz, A. J., Krakauer, H., Kuhn, E. M., Young, M., Jacobson, S. J., & Greer, G. (1989). Hospital characteristics and mortality rates. New England Journal of Medicine, 321, 1720-1725.

Henry, W. R. & Haynes, W. W. (1978). Managerial economics: Analysis and cases. (4th ed.).Dallas, TX: Business Publications.

Hersch, P. L. (1984). Competition and the performance of hospital markets. Review of Industrial Organization, 1(4), 7-14.

Higgins, C. W. (1989). Competitive reform and nonprice competition: Implications for the industry. Health Care Management Review, 14(4), 57-66.

Iezzoni, L. I., Ash, A. S., Schwartz, M., Daley, J., Hughes, J. S., & Mackierman, Y. D. (1996). Judging hospitals by severity-adjusted mortality rates: The influence of severity-adjustment method. American Journal of Public Health, 86(10), 1379-1387.

Interstudy. (1994). Update report. Excelsior, MN: Interstudy.

Johnson, A. N., & Aquilina, D. (1986). The impact of health maintenance organizations and competition on hospitals in Minneapolis/St. Paul. Journal of Health Politics, Policy and Law, 10(4),659-674.

Jones, S. B. (1990). Multiple choice health insurance: The lessons and challenge to private insurers. Inquiry, 27, 161-166.

Joskow, P. L. (1980). The effects of competition and regulation on hospital bed supply and the reservation quality of the hospital. Bell Journal of Economics, 11, 421-447.

Kenlel, P. (1988). Hospitals balk at mortality report results. Modern Healthcare, January, 5-6.

Klarman, H. E. (1965). The economics of health. New York: Columbia University Press.

Kmenta, J. (1986). Elements of econometrics. New York: Macmillan Publishing.

Kopit, W. G., & McCann, R. W. (1988). Toward a definitive antitrust standard for non-profit hospital mergers. Journal of Health Politics, Policy and Law, 13(4), 635-662.

Kuhn, E. M., Hartz, A. J., Gottlieb, M. S., & Rimm, A. A. (1991). The relationship of hospital characteristics and the results of peer review in six large states. Medical Care, 29(10), 1028-1037.

Lardaro, L. (1993). Applied econometrics. New York, NY: Harper Collins College.

Lazenby, H. C., & Letsch, S. W. (1990). National expenditures, 1989. Health Care Financing Review, 12(2), 1-9.

Lee, M. L. (1971, July). A conspicuous production theory of hospital behavior. Southern Economic Journal, 38, 48-58.

Levit, K. R., Sensenig, A. L., Cowan, C. A., Lazenby, H. C., McDonnell, P. A., Won, D. K., Sivarajan, L., Stiller, J. M., Donham, C. S., & Stewart, M. S. (1994). National health expenditures, 1993. Health Care Financing Review, 16(1), 247-294.

Lohr, K. N. (1988) Outcome measurement: Concepts and questions. Inquiry, 25, 37-50.

Longest, B. B. (1978). An empirical analysis of the quality/cost relationship. Hospital & Health Services Administration, 23(4), 20-35.

Luft, H. S., & Hunt, S. S. (1986). Evaluating individual hospital quality through outcome statistics. Journal of the American Medical Association, 255(20), 2780-2784.

Luft, H. S., Robinson, J. C., Garnick, D., Maeki, S. C. & McPhee, S. J. (1986). The role of specialized clinical services in competition among hospitals. Inquiry, 23, 83-94.

Mason, E. S. (1939). Price and production policies of large scale. American Economic Review, (Suppl.29), 61-74.

McGee, J. S. (1988). Industrial organization. Englewood Cliffs, NJ: Prentice-Hall.

McLaughlin, C. G. (1987). HMO growth and hospital expenses and use: A simultaneous-equation approach. Health Services Research, 22(2), 183-205.

McLaughlin, C. G., Merrill, J. C., & Freed, A. J. (1984). The impact of HMO growth on hospital costs and utilization. In R. M. Scheffler & L. Rossiter (Eds.), Advances in Health Economics and Health Services Research, 5, 57-93.

Melnick, G., & Zwanziger, J. (1988). Hospital behavior under competition and cost-containment policies: The California experience 1980 to 1985. Journal of the American Medical Association, 260(18), 2669-2675.

Melnick, G., Zwanziger, J., Bamezai, A., & Pattison, R. (1992). The effects of market structure and bargaining position on hospital prices. Journal of Health Economics, 11, 217-233.

Miles, R. E., & Snow, C. C. (1981). Toward a synthesis in organization theory. In M. Jelinek, J. Litterer, & R. E. Miles (Eds.), Organizational design. Dallas, TX: BPI.

Morey, R., Fine, D., Loree, S., Retzlaff-Roberts, D., & Tsubakitani, E. (1992). The trade-off between hospital cost and quality of care: An exploratory empirical analysis. Medical Care, 30(8), 677-698.

Neter, J., Wasserman, W., & Kutner, M. H. (1989). Applied linear regression models. Boston, MA: Irwin.

Neuhauser, D. (1971). The relationship between administrative activities and hospital performance. (Research Series No. 28). Chicago: University of Chicago, Center for Health Administration Studies.

Newhouse, J. P. (1971, March). Toward a theory of non-profit institutions: An economic model of a hospital. American Economic Review, 60, 64-74.

Nguyen, N. X., & Madamba, H. R. (1988). Estimating the impacts of various reimbursement factors on the Medicare operating cost per case in the third year of PPS. (Research Note). Washington, DC: Consolidated Consulting Group.

Noether, M. (1988). Competition among hospitals. Journal of Health Economics, 7, 259-284.

Pauly, M. V. (1987). Non-profit firms in medical markets. American Economic Review, 77, 257-262.

Pauly, M. V. & Redisch, M. (1973, March). The Nonprofit hospital as a physician's co-operative. American Economic Review, 63, 87-100.

Porter, M. (1980). Competitive Strategy. New York: The Free Press.

Prescott, J. E. (1983). Competitive environments, strategic types, and business performance: An empirical analysis. Unpublished doctoral dissertation, Pennsylvania State University.

Robertson, R. H., Dowd, S. B., Hassan, M. (1997). Skill-specific intensity and the cost of hospital care. Health Care Management Review (In press).

Robinson, J. C. (1991). HMO penetration and hospital cost inflation in California. Journal of American Medical Association, 266(19), 2719-2723.

Robinson, J. C., Garnick, D. W., & McPhee, S. J. (1987). Market and regulatory influences on the availability of coronary and angioplasty and bypass surgery in the U.S. hospitals. New England Journal of Medicine, 317(3), 85-90.

Robinson, J. C., & Luft, H. S. (1985). The impact of hospital market structure on patient volume, average length of stay, and the cost of care. Journal of Health Economics, 4(4), 333-356.

Robinson, J. C., & Luft, H. S. (1987). Competition and the cost of hospital care 1972 to 1982. Journal of the American Medical Association, 257, 3241-3245.

Robinson, J. C., & Luft, H. S. (1988). Competition, regulation, and hospital costs, 1982 to 1986. Journal of the American Medical Association, 260, 2676-2681.

Robinson, J. C., Luft, H. S., McPhee, S. J., & Hunt, S. S. (1988). Hospital competition and surgical length of stay. Journal of the American Medical Association, 259, 696-700.

Robinson, J. C., & Phibbs, C. (1989). An evaluation of Medicaid selective contracting in California. Journal of Health Economics, 8, 437-450.

Roemer, M. I., Moustafa, A. T., & Hopkins, C. E. (1968). A proposed hospital quality index: Hospital death rates adjusted for case severity. Health Services Research, 3, 96-118.

Salkever, D. S. (1979). Hospital sector inflation. Lexington, MA: Lexington Books, DC Heath.

Samuelson, P. A. (1965). Foundations of economic analysis. Valley Forge, MA: Atheneum.

Scherer, F. M. (1980). Industrial market structure and economic performance. Boston: Houghton Mifflin.

Scott, W. R., & Flood, A. B. (1984). Cost and quality of hospital care: A review of the literature. Medical Care Review, 41(4), 213-261.

Scott, W. R., Forrest, W. H., & Brown, B. W. (1976). Hospital structure and postoperative mortality and morbidity. In S.M. Shortell & M. Brown (Eds.), Organizational research in hospitals. Chicago: Inquiry Books, Blue Cross Association.

Shapiro, D. W., Lasker, R. D., Bindman, A. B., & Lee, P. R. (1993). Containing costs while improving quality of care: The role of profiling and practice guidelines. In G. S. Omenn, J. E. Fielding, & L. B. Lave (Eds.), Annual Reviews of Public Health: Vol. 14, pp.219-241 Palo Alto, CA: Annual Reviews.

Shortell, S. M., Becker, S. W., & Neuhauser, D. (1976). The effects of management practices on hospital efficiency and quality of care. In S. M. Shortell & M. Brown (Eds.), Organizational research in hospitals. Chicago: Blue Cross.

Shortell, S. M., & Hughes, E. F. X. (1988). The effects of regulation, competition and ownership on mortality rates among hospital inpatients. New England Journal of Medicine, 318(17), 1098-1107.

Shortell, S. M., & Kaluzny, A. D. (1988). Health care management (2nd ed.). New York: John Wiley & Sons.

Shortell, S. M., Morrison, E. M., & Friedman, B. (1990). Strategic choices for America's hospitals. San Francisco: Jossey-Bass.

Sloan, F. (1981). Regulation and the rising cost of hospital care. Review of Economics and Statistics, 63(4), 479-487.

Sloan, F. & Steinwald, B. (1980). Insurance, Regulation, and Hospital Costs. Lexington, MA: Lexington Books.

Spector, P. E. (1981). Research designs. Beverly Hills, CA: Sage Publications.

Starkweather, D. B., & Carman, J. M. (1988). The limits of power in hospital markets. Medical Care Review, 45(10), 5-48.

Stigler, G. J. (1968). The organization of industry. Homewood, IL: R. D. Irwin.

Thorpe, K. E. (1988). The use of regression analysis to determine hospital payment: The case of Medicare's indirect teaching adjustment. Inquiry, 25(2), 116-125.

U.S. Department of Justice. (1984). Merger Guidelines, Federal Register, (49), 26284.

Vincenzino, J.V. (1995) Health care costs: Market forces and reform. Statistical Bulletin, 76 (1), 31-40.

Wan, T. T. (1992). Hospital variations in adverse patient outcomes. Utilization Review and Quality Assurance, 7(2), 50-53.

Weil, T. P. (1996). Competition versus regulation: Constraining hospital discharge costs. Journal of Health Care Finance, 22(3), 62-74.

Wholey, D., & Burns, L. R. (1993). Organizational transitions: From changes by health maintenance organizations. In S. Bacharach (Ed.), Research in the sociology of organizations, 11, 257-293.

Wholey, D., Feldman, R., & Christianson, J. (1995). The effect of market structure on HMO premiums. Journal of Health Economics, 14, 81-105.

Wholey, D., Feldman, R., Christianson, J., & Engberg, J. (1996). Scale and scope economies among health maintenance organizations. Journal of Health Economics, 15(6), 657-684.

Wilson, G. W., & Jadlow, J. M. (1982). Competition, profit incentives, and technical efficiency in the provision of nuclear medicine services. Bell Journal of Economics, 13, 472-482.

Woolhandler, S., Himmelstein, D. U., & Lewontin, J. P. (1993). Administrative costs in U.S. Hospitals. New England Journal of Medicine of Medicine, 329(6),400-403.

Zalkind, D. L., & Eastaugh, S. R. (1997). Mortality rates as an indicator of hospital quality. Hospital & Health Services Administration, 42(1), 3-15.

Zwanziger, J., & Melnick, G. A. (1988). The effects of hospital competition and the Medicare PPS program on hospital cost behavior in California. Journal of Health Economics, 7, 301-320.

Zwanziger, J., & Melnick, G. A. (1996). Can managed care plans control health care costs. Health Affairs, 15(2), 189-199.

APPENDIX A

CORRELATION ANALYSIS RESULTS

SAS

Simple Statistics

Variable	N	Mean	Std Dev	Sum	Minimum	Maximum
LCOST	1967	8.38610	0.32347	16495	6.46322	10.26103
LMORT	1967	0.0000201	0.15193	0.03949	-0.86659	0.95753
LMCVA	1952	-0.06932	0.33280	-135.31659	-3.89328	1.67131
LMHFT	1856	-0.07458	0.60315	-138.42162	-4.22391	2.40770
LMHRT	595	-0.03844	0.20375	-22.87389	-0.84273	1.18838
MORT2	1967	1.04473	0.35491	2055	0	6.78740
MCVA2	1952	1.05145	0.90396	2052	0	28.29335
MHFT2	1856	1.54025	3.54166	2859	0	123.39507
MHRT2	595	1.01373	0.59196	603.16837	0.18536	10.76992
HHI1	1967	0.80265	0.19777	1579	0	0.98303
HHI2	1967	0.66638	0.21379	1311	0	1.00000
HPEN	1967	0.14656	0.10534	288.27719	0	0.49989
HHPEN	1967	0.10212	0.08192	200.86921	0	0.33416
HITECH	1967	0.27635	0.12614	543.57813	0.04688	0.81250
BED	1967	255.02847	185.88666	501641	17.00000	1573
OCC	1967	63.41141	23.27319	124730	0.66076	628.58447
FPROFIT	1967	0.17082	0.37645	336.00000	0	1.00000
COTH	1967	0.09659	0.29548	190.00000	0	1.00000
STAFFIN	1967	11.86158	2.96886	23332	0.64561	30.57176
SKMIX	1967	8.55559	29.42880	16829	0	917.00000
RESDNTS	1967	0.08607	0.61078	169.29858	0	14.68000
BCERT	1967	74.04775	13.23297	145652	0	100.00000
MWAGE	1967	1.00001	0.17340	1967	0.47664	1.65153
MEC	1967	49.80238	12.54620	97961	0.09346	99.10959
MEDI	1967	10.94441	9.14036	21528	0	82.33349
SYAFF	1967	0.40874	0.49173	804.00000	0	1.00000
CMI	1967	1.33973	0.20208	2635	0.64120	2.15890
INCOME	1967	19723	3559	38795112	9230	33160
DRS	1967	2.66167	1.04394	5235	0.20000	18.50000
PDNSTY	1967	881.23554	1482	1733390	1.00000	11778
NONWHITE	1967	19.42735	11.46059	38214	0.30000	68.40000
CONSTATE	1958	0.73749	0.44011	1444	0	1.00000
CONLOW	1958	0.88815	0.31526	1739	0	1.00000

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	LCOST	LMORT	LMCVA	LMHFT	LMHRT	MORT2	MCVA2
LCOST	1.00000	-0.17516	-0.11905	-0.01325	-0.22328	-0.17490	-0.13279
	0.0	0.0001	0.0001	0.5684	0.0001	0.0001	0.0001
	1967	1967	1952	1856	595	1967	1952
LMORT	-0.17516	1.00000	0.38928	0.21406	0.56957	0.92171	0.27647
	0.0001	0.0	0.0001	0.0001	0.0001	0.0001	0.0001
	1967	1967	1952	1856	595	1967	1952
LMCVA	-0.11905	0.38928	1.00000	0.07347	0.17674	0.38034	0.67825
	0.0001	0.0001	0.0	0.0015	0.0001	0.0001	0.0001
	1952	1952	1952	1855	595	1952	1952
LMHFT	-0.01325	0.21406	0.07347	1.00000	0.16159	0.21254	0.07377
	0.5684	0.0001	0.0015	0.0	0.0001	0.0001	0.0015
	1856	1856	1855	1856	591	1856	1855
LMHRT	-0.22328	0.56957	0.17674	0.16159	1.00000	0.57032	0.18535
	0.0001	0.0001	0.0001	0.0001	0.0	0.0001	0.0001
	595	595	595	591	595	595	595
MORT2	-0.17490	0.92171	0.38034	0.21254	0.57032	1.00000	0.29201
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0	0.0001
	1967	1967	1952	1856	595	1967	1952
MCVA2	-0.13279	0.27647	0.67825	0.07377	0.18535	0.29201	1.00000
	0.0001	0.0001	0.0001	0.0015	0.0001	0.0001	0.0
	1952	1952	1952	1855	595	1952	1952
MHFT2	0.02928	0.13424	0.00483	0.46408	0.22201	0.14355	0.02095
	0.2074	0.0001	0.8353	0.0001	0.0001	0.0001	0.3671
	1856	1856	1855	1856	591	1856	1855
MHRT2	-0.15292	0.41057	-0.00284	0.12376	0.82382	0.42254	0.05869
	0.0002	0.0001	0.9450	0.0026	0.0001	0.0001	0.1527
	595	595	595	591	595	595	595
HHI1	0.18240	-0.13742	-0.08436	-0.06565	-0.12869	-0.11751	-0.05296
	0.0001	0.0001	0.0002	0.0047	0.0017	0.0001	0.0193
	1967	1967	1952	1856	595	1967	1952
HHI2	0.09106	-0.04133	-0.03909	-0.02363	-0.00239	-0.03587	-0.02331
	0.0001	0.0669	0.0842	0.3090	0.9535	0.1117	0.3032
	1967	1967	1952	1856	595	1967	1952
HPEN	0.19047	-0.05981	-0.00340	-0.00026	-0.10140	-0.05263	-0.01110
	0.0001	0.0080	0.8807	0.9910	0.0133	0.0196	0.6241
	1967	1967	1952	1856	595	1967	1952
HHPEN	0.20296	-0.06905	-0.01364	-0.01178	-0.10428	-0.05856	-0.01966
	0.0001	0.0022	0.5469	0.6120	0.0109	0.0094	0.3854
	1967	1967	1952	1856	595	1967	1952

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	LCOST	LMORT	LMCVA	LMHFT	LMHRT	MORT2	MCVA2
HITECH	0.18131	-0.03605	-0.00433	0.01240	-0.05689	-0.04995	-0.02211
	0.0001	0.1100	0.8483	0.5933	0.1658	0.0267	0.3290
	1967	1967	1952	1856	595	1967	1952
BED	0.47489	-0.21086	-0.08268	-0.05507	-0.23272	-0.20792	-0.14463
	0.0001	0.0001	0.0003	0.0177	0.0001	0.0001	0.0001
	1967	1967	1952	1856	595	1967	1952
OCC	0.15140	-0.12608	-0.01051	-0.05211	-0.05499	-0.13233	-0.07215
	0.0001	0.0001	0.6425	0.0248	0.1804	0.0001	0.0014
	1967	1967	1952	1856	595	1967	1952
FPROFIT	-0.00701	0.03707	-0.03623	0.07005	0.06259	0.02866	0.00844
	0.7559	0.1002	0.1096	0.0025	0.1272	0.2038	0.7093
	1967	1967	1952	1856	595	1967	1952
COTH	0.41618	-0.17332	-0.07304	-0.02108	-0.22650	-0.14662	-0.07910
	0.0001	0.0001	0.0012	0.3642	0.0001	0.0001	0.0005
	1967	1967	1952	1856	595	1967	1952
STAFFIN	0.23820	-0.00697	0.00608	0.03573	-0.09483	0.01407	-0.02512
	0.0001	0.7574	0.7884	0.1238	0.0207	0.5328	0.2673
	1967	1967	1952	1856	595	1967	1952
SKMIX	0.13918	-0.09777	-0.04284	-0.02445	-0.11285	-0.07966	-0.03829
	0.0001	0.0001	0.0584	0.2924	0.0059	0.0004	0.0908
	1967	1967	1952	1856	595	1967	1952
RESDNTS	-0.05538	0.08598	0.02273	0.00347	0.00009	0.09222	0.15737
	0.0140	0.0001	0.3155	0.8812	0.9983	0.0001	0.0001
	1967	1967	1952	1856	595	1967	1952
BCERT	0.09103	-0.08312	0.01710	-0.03556	-0.10944	-0.08860	-0.04720
	0.0001	0.0002	0.4502	0.1257	0.0075	0.0001	0.0371
	1967	1967	1952	1856	595	1967	1952
MWAGE	0.48854	-0.15989	-0.05683	-0.03940	-0.24309	-0.14489	-0.07410
	0.0001	0.0001	0.0120	0.0897	0.0001	0.0001	0.0011
	1967	1967	1952	1856	595	1967	1952
MEC	-0.09580	-0.05489	-0.02863	-0.03907	0.01253	-0.04291	-0.05875
	0.0001	0.0149	0.2060	0.0924	0.7603	0.0571	0.0094
	1967	1967	1952	1856	595	1967	1952
MEDI	0.05609	0.03442	-0.00298	0.03699	0.04757	0.03594	0.03514
	0.0128	0.1270	0.8953	0.1112	0.2466	0.1111	0.1207
	1967	1967	1952	1856	595	1967	1952
SYAFF	0.00568	0.02075	0.01012	0.04010	-0.00265	0.01155	0.00249
	0.8014	0.3576	0.6550	0.0842	0.9486	0.6086	0.9124
	1967	1967	1952	1856	595	1967	1952

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	LCOST	LMORT	LMCVA	LMHFT	LMHRT	MORT2	MCVA2
CMI	0.55901	-0.13436	-0.06745	0.03029	-0.09688	-0.15159	-0.14274
	0.0001	0.0001	0.0029	0.1920	0.0181	0.0001	0.0001
	1967	1967	1952	1856	595	1967	1952
INCOME	0.27357	-0.18456	-0.05157	-0.08220	-0.23821	-0.16734	-0.04128
	0.0001	0.0001	0.0227	0.0004	0.0001	0.0001	0.0682
	1967	1967	1952	1856	595	1967	1952
DRS	0.23841	-0.25821	-0.08375	-0.10862	-0.16060	-0.20821	-0.07634
	0.0001	0.0001	0.0002	0.0001	0.0001	0.0001	0.0007
	1967	1967	1952	1856	595	1967	1952
PDNSTY	0.22807	-0.15202	-0.06080	-0.05015	-0.16482	-0.12904	-0.03721
	0.0001	0.0001	0.0072	0.0307	0.0001	0.0001	0.1003
	1967	1967	1952	1856	595	1967	1952
NONWHITE	0.26311	-0.00429	-0.06168	-0.01439	0.01083	0.01973	-0.01942
	0.0001	0.8492	0.0064	0.5356	0.7921	0.3819	0.3911
	1967	1967	1952	1856	595	1967	1952
CONSTATE	-0.02860	-0.18280	-0.06102	-0.06452	-0.19955	-0.17549	-0.04425
	0.2059	0.0001	0.0071	0.0055	0.0001	0.0001	0.0512
	1958	1958	1943	1847	593	1958	1943
CONLOW	0.03061	0.08825	0.01531	0.03723	0.09202	0.07247	0.01173
	0.1758	0.0001	0.5000	0.1097	0.0250	0.0013	0.6055
	1958	1958	1943	1847	593	1958	1943

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	MHFT2	MHRT2	HHI1	HHI2	HPEN	HHPEN	HITECH
LCOST	0.02928	-0.15292	0.18240	0.09106	0.19047	0.20296	0.18131
	0.2074	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
	1856	595	1967	1967	1967	1967	1967
LMORT	0.13424	0.41057	-0.13742	-0.04133	-0.05981	-0.06905	-0.03605
	0.0001	0.0001	0.0001	0.0669	0.0080	0.0022	0.1100
	1856	595	1967	1967	1967	1967	1967
LMCVA	0.00483	-0.00284	-0.08436	-0.03909	-0.00340	-0.01364	-0.00433
	0.8353	0.9450	0.0002	0.0842	0.8807	0.5469	0.8483
	1855	595	1952	1952	1952	1952	1952
LMHFT	0.46408	0.12376	-0.06565	-0.02363	-0.00026	-0.01178	0.01240
	0.0001	0.0026	0.0047	0.3090	0.9910	0.6120	0.5933
	1856	591	1856	1856	1856	1856	1856
LMHRT	0.22201	0.82382	-0.12869	-0.00239	-0.10140	-0.10428	-0.05689
	0.0001	0.0001	0.0017	0.9535	0.0133	0.0109	0.1658
	591	595	595	595	595	595	595
MORT2	0.14355	0.42254	-0.11751	-0.03587	-0.05263	-0.05856	-0.04995
	0.0001	0.0001	0.0001	0.1117	0.0196	0.0094	0.0267
	1856	595	1967	1967	1967	1967	1967
MCVA2	0.02095	0.05869	-0.05296	-0.02331	-0.01110	-0.01966	-0.02211
	0.3671	0.1527	0.0193	0.3032	0.6241	0.3854	0.3290
	1855	595	1952	1952	1952	1952	1952
MHFT2	1.00000	0.34895	-0.01598	-0.02150	0.00644	-0.00348	0.01497
	0.0	0.0001	0.4914	0.3546	0.7815	0.8810	0.5192
	1856	591	1856	1856	1856	1856	1856
MHRT2	0.34895	1.00000	-0.08495	0.04944	-0.09241	-0.08657	-0.04621
	0.0001	0.0	0.0383	0.2285	0.0242	0.0348	0.2604
	591	595	595	595	595	595	595
HHI1	-0.01598	-0.08495	1.00000	0.29443	0.34725	0.41228	-0.03923
	0.4914	0.0383	0.0	0.0001	0.0001	0.0001	0.0819
	1856	595	1967	1967	1967	1967	1967
HHI2	-0.02150	0.04944	0.29443	1.00000	0.19801	0.34874	0.02279
	0.3546	0.2285	0.0001	0.0	0.0001	0.0001	0.3124
	1856	595	1967	1967	1967	1967	1967
HPEN	0.00644	-0.09241	0.34725	0.19801	1.00000	0.96625	0.03494
	0.7815	0.0242	0.0001	0.0001	0.0	0.0001	0.1213
	1856	595	1967	1967	1967	1967	1967
HHPEN	-0.00348	-0.08657	0.41228	0.34874	0.96625	1.00000	0.04752
	0.8810	0.0348	0.0001	0.0001	0.0001	0.0	0.0351
	1856	595	1967	1967	1967	1967	1967

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	MHFT2	MHRT2	HHI1	HHI2	HPEN	HHPEN	HITECH
HITECH	0.01497	-0.04621	-0.03923	0.02279	0.03494	0.04752	1.00000
	0.5192	0.2604	0.0819	0.3124	0.1213	0.0351	0.0
	1856	595	1967	1967	1967	1967	1967
BED	-0.06432	-0.20449	0.10203	0.01863	-0.02602	-0.01684	0.33000
	0.0056	0.0001	0.0001	0.4088	0.2487	0.4553	0.0001
	1856	595	1967	1967	1967	1967	1967
OCC	-0.07015	-0.08427	0.11559	0.04051	0.02488	0.02657	0.07017
	0.0025	0.0399	0.0001	0.0724	0.2701	0.2388	0.0018
	1856	595	1967	1967	1967	1967	1967
FPROFIT	0.09834	0.14305	-0.01406	0.01649	-0.08091	-0.05796	-0.04161
	0.0001	0.0005	0.5330	0.4647	0.0003	0.0101	0.0650
	1856	595	1967	1967	1967	1967	1967
COTH	-0.02380	-0.17113	0.13857	0.05746	0.06760	0.07178	0.18778
	0.3054	0.0001	0.0001	0.0108	0.0027	0.0014	0.0001
	1856	595	1967	1967	1967	1967	1967
STAFFIN	0.00984	-0.05519	-0.04705	0.02214	0.02139	0.02920	0.17625
	0.6720	0.1788	0.0369	0.3264	0.3430	0.1955	0.0001
	1856	595	1967	1967	1967	1967	1967
SKMIX	-0.00824	-0.07688	0.06228	-0.00090	0.05023	0.05891	0.05324
	0.7228	0.0609	0.0057	0.9682	0.0259	0.0090	0.0182
	1856	595	1967	1967	1967	1967	1967
RESDNTS	-0.01005	0.00960	-0.02430	-0.02160	-0.02184	-0.02997	0.19190
	0.6652	0.8152	0.2813	0.3384	0.3331	0.1840	0.0001
	1856	595	1967	1967	1967	1967	1967
BCERT	-0.03199	-0.11708	-0.05451	-0.01562	-0.00853	-0.01359	0.12508
	0.1684	0.0042	0.0156	0.4887	0.7052	0.5470	0.0001
	1856	595	1967	1967	1967	1967	1967
MWAGE	-0.01005	-0.19906	0.31176	0.16295	0.44777	0.45523	0.11518
	0.6651	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	1856	595	1967	1967	1967	1967	1967
MEC	-0.09642	-0.05274	-0.04711	-0.04809	-0.12129	-0.12986	-0.10755
	0.0001	0.1989	0.0367	0.0329	0.0001	0.0001	0.0001
	1856	595	1967	1967	1967	1967	1967
MEDI	0.02046	0.04985	0.00102	0.01707	0.06967	0.06024	-0.02069
	0.3784	0.2247	0.9640	0.4494	0.0020	0.0075	0.3591
	1856	595	1967	1967	1967	1967	1967
SYAFF	0.05410	-0.00379	-0.01041	0.03942	0.05357	0.05876	0.06281
	0.0198	0.9264	0.6444	0.0805	0.0175	0.0091	0.0053
	1856	595	1967	1967	1967	1967	1967

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	MHFT2	MHRT2	HHI1	HHI2	HPEN	HHPEN	HITECH
CMI	0.02050	-0.12327	0.01336	0.01037	0.02748	0.02863	0.30540
	0.3774	0.0026	0.5537	0.6458	0.2231	0.2043	0.0001
	1856	595	1967	1967	1967	1967	1967
INCOME	-0.01502	-0.17520	0.47234	0.20007	0.38483	0.40221	-0.02274
	0.5178	0.0001	0.0001	0.0001	0.0001	0.0001	0.3135
	1856	595	1967	1967	1967	1967	1967
DRS	-0.02309	-0.09657	0.25543	0.12591	0.23874	0.24596	0.05424
	0.3202	0.0185	0.0001	0.0001	0.0001	0.0001	0.0161
	1856	595	1967	1967	1967	1967	1967
PDNSTY	-0.03247	-0.10636	0.32246	0.12477	0.20411	0.23005	-0.04216
	0.1621	0.0094	0.0001	0.0001	0.0001	0.0001	0.0616
	1856	595	1967	1967	1967	1967	1967
NONWHITE	0.01606	0.04807	0.30931	0.24543	0.24237	0.29366	0.01427
	0.4892	0.2417	0.0001	0.0001	0.0001	0.0001	0.5270
	1856	595	1967	1967	1967	1967	1967
CONSTATE	-0.06256	-0.18516	0.08379	-0.07344	-0.19863	-0.19769	-0.08913
	0.0072	0.0001	0.0002	0.0011	0.0001	0.0001	0.0001
	1847	593	1958	1958	1958	1958	1958
CONLOW	0.02799	0.07785	0.02294	-0.02409	-0.09997	-0.11488	-0.04809
	0.2292	0.0581	0.3102	0.2867	0.0001	0.0001	0.0334
	1847	593	1958	1958	1958	1958	1958

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	BED	OCC	FPROFIT	COTH	STAFFIN	SKMIX	RESDNTS
LCOST	0.47489	0.15140	-0.00701	0.41618	0.23820	0.13918	-0.05538
	0.0001	0.0001	0.7559	0.0001	0.0001	0.0001	0.0140
	1967	1967	1967	1967	1967	1967	1967
LMORT	-0.21086	-0.12608	0.03707	-0.17332	-0.00697	-0.09777	0.08598
	0.0001	0.0001	0.1002	0.0001	0.7574	0.0001	0.0001
	1967	1967	1967	1967	1967	1967	1967
LMCVA	-0.08268	-0.01051	-0.03623	-0.07304	0.00608	-0.04284	0.02273
	0.0003	0.6425	0.1096	0.0012	0.7884	0.0584	0.3155
	1952	1952	1952	1952	1952	1952	1952
LMHFT	-0.05507	-0.05211	0.07005	-0.02108	0.03573	-0.02445	0.00347
	0.0177	0.0248	0.0025	0.3642	0.1238	0.2924	0.8812
	1856	1856	1856	1856	1856	1856	1856
LMHRT	-0.23272	-0.05499	0.06259	-0.22650	-0.09483	-0.11285	0.00009
	0.0001	0.1804	0.1272	0.0001	0.0207	0.0059	0.9983
	595	595	595	595	595	595	595
MORT2	-0.20792	-0.13233	0.02866	-0.14662	0.01407	-0.07966	0.09222
	0.0001	0.0001	0.2038	0.0001	0.5328	0.0004	0.0001
	1967	1967	1967	1967	1967	1967	1967
MCVA2	-0.14463	-0.07215	0.00844	-0.07910	-0.02512	-0.03829	0.15737
	0.0001	0.0014	0.7093	0.0005	0.2673	0.0908	0.0001
	1952	1952	1952	1952	1952	1952	1952
MHFT2	-0.06432	-0.07015	0.09834	-0.02380	0.00984	-0.00824	-0.01005
	0.0056	0.0025	0.0001	0.3054	0.6720	0.7228	0.6652
	1856	1856	1856	1856	1856	1856	1856
MHRT2	-0.20449	-0.08427	0.14305	-0.17113	-0.05519	-0.07688	0.00960
	0.0001	0.0399	0.0005	0.0001	0.1788	0.0609	0.8152
	595	595	595	595	595	595	595
HHI1	0.10203	0.11559	-0.01406	0.13857	-0.04705	0.06228	-0.02430
	0.0001	0.0001	0.5330	0.0001	0.0369	0.0057	0.2813
	1967	1967	1967	1967	1967	1967	1967
HHI2	0.01863	0.04051	0.01649	0.05746	0.02214	-0.00090	-0.02160
	0.4088	0.0724	0.4647	0.0108	0.3264	0.9682	0.3384
	1967	1967	1967	1967	1967	1967	1967
HPEN	-0.02602	0.02488	-0.08091	0.06760	0.02139	0.05023	-0.02184
	0.2487	0.2701	0.0003	0.0027	0.3430	0.0259	0.3331
	1967	1967	1967	1967	1967	1967	1967
HHPEN	-0.01684	0.02657	-0.05796	0.07178	0.02920	0.05891	-0.02997
	0.4553	0.2388	0.0101	0.0014	0.1955	0.0090	0.1840
	1967	1967	1967	1967	1967	1967	1967

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	BED	OCC	FPROFIT	COTH	STAFFIN	SKMIX	RESDNTS
HITECH	0.33000	0.07017	-0.04161	0.18778	0.17625	0.05324	0.19190
	0.0001	0.0018	0.0650	0.0001	0.0001	0.0182	0.0001
	1967	1967	1967	1967	1967	1967	1967
BED	1.00000	0.28846	-0.21223	0.58276	0.19544	0.11795	-0.09581
	0.0	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	1967	1967	1967	1967	1967	1967	1967
OCC	0.28846	1.00000	-0.24517	0.22082	-0.03708	0.06156	-0.06750
	0.0001	0.0	0.0001	0.0001	0.1002	0.0063	0.0027
	1967	1967	1967	1967	1967	1967	1967
FPROFIT	-0.21223	-0.24517	1.00000	-0.14384	-0.03511	-0.05782	0.02606
	0.0001	0.0001	0.0	0.0001	0.1195	0.0103	0.2480
	1967	1967	1967	1967	1967	1967	1967
COTH	0.58276	0.22082	-0.14384	1.00000	0.23610	0.14286	-0.02966
	0.0001	0.0001	0.0001	0.0	0.0001	0.0001	0.1885
	1967	1967	1967	1967	1967	1967	1967
STAFFIN	0.19544	-0.03708	-0.03511	0.23610	1.00000	0.13762	0.03128
	0.0001	0.1002	0.1195	0.0001	0.0	0.0001	0.1655
	1967	1967	1967	1967	1967	1967	1967
SKMIX	0.11795	0.06156	-0.05782	0.14286	0.13762	1.00000	-0.01215
	0.0001	0.0063	0.0103	0.0001	0.0001	0.0	0.5903
	1967	1967	1967	1967	1967	1967	1967
RESDNTS	-0.09581	-0.06750	0.02606	-0.02966	0.03128	-0.01215	1.00000
	0.0001	0.0027	0.2480	0.1885	0.1655	0.5903	0.0
	1967	1967	1967	1967	1967	1967	1967
BCERT	0.16929	0.07890	-0.09753	0.10807	0.11980	0.08520	-0.03793
	0.0001	0.0005	0.0001	0.0001	0.0001	0.0002	0.0926
	1967	1967	1967	1967	1967	1967	1967
MWAGE	0.28599	0.20026	0.09739	0.27114	0.08962	0.09980	-0.02371
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.2933
	1967	1967	1967	1967	1967	1967	1967
MEC	-0.18310	-0.00845	-0.05020	-0.18760	-0.21332	-0.05959	-0.02299
	0.0001	0.7081	0.0260	0.0001	0.0001	0.0082	0.3080
	1967	1967	1967	1967	1967	1967	1967
MEDI	0.04286	0.05563	-0.08614	0.14249	-0.02384	-0.03609	0.01973
	0.0573	0.0136	0.0001	0.0001	0.2906	0.1096	0.3818
	1967	1967	1967	1967	1967	1967	1967
SYAFF	-0.07882	-0.04042	0.06777	-0.07933	-0.00221	-0.01806	0.01678
	0.0005	0.0731	0.0026	0.0004	0.9219	0.4233	0.4570
	1967	1967	1967	1967	1967	1967	1967

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	BED	OCC	FPROFIT	COTH	STAFFIN	SKMIX	RESDNTS
CMI	0.58813	0.23480	-0.01057	0.39407	0.36221	0.14056	-0.11714
	0.0001	0.0001	0.6394	0.0001	0.0001	0.0001	0.0001
	1967	1967	1967	1967	1967	1967	1967
INCOME	0.15690	0.18959	-0.10588	0.18081	-0.07683	0.09364	-0.03500
	0.0001	0.0001	0.0001	0.0001	0.0006	0.0001	0.1207
	1967	1967	1967	1967	1967	1967	1967
DRS	0.19053	0.13480	-0.06267	0.18070	-0.04178	0.07545	-0.04666
	0.0001	0.0001	0.0054	0.0001	0.0640	0.0008	0.0385
	1967	1967	1967	1967	1967	1967	1967
PDNSTY	0.19158	0.19761	-0.04879	0.14214	-0.14982	0.03792	-0.03088
	0.0001	0.0001	0.0305	0.0001	0.0001	0.0927	0.1710
	1967	1967	1967	1967	1967	1967	1967
NONWHITE	0.11838	0.05495	0.14928	0.10016	-0.00027	0.00526	-0.01401
	0.0001	0.0148	0.0001	0.0001	0.9905	0.8157	0.5347
	1967	1967	1967	1967	1967	1967	1967
CONSTATE	0.11031	0.12774	-0.22411	0.10068	-0.18240	0.01870	-0.02017
	0.0001	0.0001	0.0001	0.0001	0.0001	0.4082	0.3724
	1958	1958	1958	1958	1958	1958	1958
CONLOW	0.01688	0.04499	0.08416	-0.02667	0.03555	-0.02697	0.01119
	0.4555	0.0465	0.0002	0.2382	0.1158	0.2329	0.6207
	1958	1958	1958	1958	1958	1958	1958

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	BCERT	MWAGE	MEC	MEDI	SYAFF	CMI	INCOME
LCOST	0.09103	0.48854	-0.09580	0.05609	0.00568	0.55901	0.27357
	0.0001	0.0001	0.0001	0.0128	0.8014	0.0001	0.0001
	1967	1967	1967	1967	1967	1967	1967
LMORT	-0.08312	-0.15989	-0.05489	0.03442	0.02075	-0.13436	-0.18456
	0.0002	0.0001	0.0149	0.1270	0.3576	0.0001	0.0001
	1967	1967	1967	1967	1967	1967	1967
LMCVA	0.01710	-0.05683	-0.02863	-0.00298	0.01012	-0.06745	-0.05157
	0.4502	0.0120	0.2060	0.8953	0.6550	0.0029	0.0227
	1952	1952	1952	1952	1952	1952	1952
LMHFT	-0.03556	-0.03940	-0.03907	0.03699	0.04010	0.03029	-0.08220
	0.1257	0.0897	0.0924	0.1112	0.0842	0.1920	0.0004
	1856	1856	1856	1856	1856	1856	1856
LMHRT	-0.10944	-0.24309	0.01253	0.04757	-0.00265	-0.09688	-0.23821
	0.0075	0.0001	0.7603	0.2466	0.9486	0.0181	0.0001
	595	595	595	595	595	595	595
MORT2	-0.08860	-0.14489	-0.04291	0.03594	0.01155	-0.15159	-0.16734
	0.0001	0.0001	0.0571	0.1111	0.6086	0.0001	0.0001
	1967	1967	1967	1967	1967	1967	1967
MCVA2	-0.04720	-0.07410	-0.05875	0.03514	0.00249	-0.14274	-0.04128
	0.0371	0.0011	0.0094	0.1207	0.9124	0.0001	0.0682
	1952	1952	1952	1952	1952	1952	1952
MHFT2	-0.03199	-0.01005	-0.09642	0.02046	0.05410	0.02050	-0.01502
	0.1684	0.6651	0.0001	0.3784	0.0198	0.3774	0.5178
	1856	1856	1856	1856	1856	1856	1856
MHRT2	-0.11708	-0.19906	-0.05274	0.04985	-0.00379	-0.12327	-0.17520
	0.0042	0.0001	0.1989	0.2247	0.9264	0.0026	0.0001
	595	595	595	595	595	595	595
HHI1	-0.05451	0.31176	-0.04711	0.00102	-0.01041	0.01336	0.47234
	0.0156	0.0001	0.0367	0.9640	0.6444	0.5537	0.0001
	1967	1967	1967	1967	1967	1967	1967
HHI2	-0.01562	0.16295	-0.04809	0.01707	0.03942	0.01037	0.20007
	0.4887	0.0001	0.0329	0.4494	0.0805	0.6458	0.0001
	1967	1967	1967	1967	1967	1967	1967
HPEN	-0.00853	0.44777	-0.12129	0.06967	0.05357	0.02748	0.38483
	0.7052	0.0001	0.0001	0.0020	0.0175	0.2231	0.0001
	1967	1967	1967	1967	1967	1967	1967
HHPEN	-0.01359	0.45523	-0.12986	0.06024	0.05876	0.02863	0.40221
	0.5470	0.0001	0.0001	0.0075	0.0091	0.2043	0.0001
	1967	1967	1967	1967	1967	1967	1967

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	BCERT	MWAGE	MEC	MEDI	SYAFF	CMI	INCOME
HITECH	0.12508	0.11518	-0.10755	-0.02069	0.06281	0.30540	-0.02274
	0.0001	0.0001	0.0001	0.3591	0.0053	0.0001	0.3135
	1967	1967	1967	1967	1967	1967	1967
BED	0.16929	0.28599	-0.18310	0.04286	-0.07882	0.58813	0.15690
	0.0001	0.0001	0.0001	0.0573	0.0005	0.0001	0.0001
	1967	1967	1967	1967	1967	1967	1967
OCC	0.07890	0.20026	-0.00845	0.05563	-0.04042	0.23480	0.18959
	0.0005	0.0001	0.7081	0.0136	0.0731	0.0001	0.0001
	1967	1967	1967	1967	1967	1967	1967
FPROFIT	-0.09753	0.09739	-0.05020	-0.08614	0.06777	-0.01057	-0.10588
	0.0001	0.0001	0.0260	0.0001	0.0026	0.6394	0.0001
	1967	1967	1967	1967	1967	1967	1967
COTH	0.10807	0.27114	-0.18760	0.14249	-0.07933	0.39407	0.18081
	0.0001	0.0001	0.0001	0.0001	0.0004	0.0001	0.0001
	1967	1967	1967	1967	1967	1967	1967
STAFFIN	0.11980	0.08962	-0.21332	-0.02384	-0.00221	0.36221	-0.07683
	0.0001	0.0001	0.0001	0.2906	0.9219	0.0001	0.0006
	1967	1967	1967	1967	1967	1967	1967
SKMIX	0.08520	0.09980	-0.05959	-0.03609	-0.01806	0.14056	0.09364
	0.0002	0.0001	0.0082	0.1096	0.4233	0.0001	0.0001
	1967	1967	1967	1967	1967	1967	1967
RESDNTS	-0.03793	-0.02371	-0.02299	0.01973	0.01678	-0.11714	-0.03500
	0.0926	0.2933	0.3080	0.3818	0.4570	0.0001	0.1207
	1967	1967	1967	1967	1967	1967	1967
BCERT	1.00000	0.06655	0.00479	-0.19203	-0.05173	0.19943	0.01046
	0.0	0.0031	0.8318	0.0001	0.0218	0.0001	0.6428
	1967	1967	1967	1967	1967	1967	1967
MWAGE	0.06655	1.00000	-0.18393	0.04621	0.02562	0.28345	0.55352
	0.0031	0.0	0.0001	0.0405	0.2562	0.0001	0.0001
	1967	1967	1967	1967	1967	1967	1967
MEC	0.00479	-0.18393	1.00000	-0.34709	-0.01002	-0.12618	-0.04625
	0.8318	0.0001	0.0	0.0001	0.6568	0.0001	0.0403
	1967	1967	1967	1967	1967	1967	1967
MEDI	-0.19203	0.04621	-0.34709	1.00000	-0.02293	-0.02562	-0.02964
	0.0001	0.0405	0.0001	0.0	0.3095	0.2560	0.1889
	1967	1967	1967	1967	1967	1967	1967
SYAFF	-0.05173	0.02562	-0.01002	-0.02293	1.00000	-0.00626	-0.01570
	0.0218	0.2562	0.6568	0.3095	0.0	0.7813	0.4864
	1967	1967	1967	1967	1967	1967	1967

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	BCERT	MWAGE	MEC	MEDI	SYAFF	CMI	INCOME
CMI	0.19943	0.28345	-0.12618	-0.02562	-0.00626	1.00000	0.01291
	0.0001	0.0001	0.0001	0.2560	0.7813	0.0	0.5671
	1967	1967	1967	1967	1967	1967	1967
INCOME	0.01046	0.55352	-0.04625	-0.02964	-0.01570	0.01291	1.00000
	0.6428	0.0001	0.0403	0.1889	0.4864	0.5671	0.0
	1967	1967	1967	1967	1967	1967	1967
DRS	0.06440	0.32582	-0.00944	-0.02687	-0.01336	0.07957	0.53513
	0.0043	0.0001	0.6757	0.2336	0.5538	0.0004	0.0001
	1967	1967	1967	1967	1967	1967	1967
PDNSTY	-0.12734	0.48568	-0.04765	0.12342	-0.03048	0.00130	0.42247
	0.0001	0.0001	0.0338	0.0001	0.1766	0.9542	0.0001
	1967	1967	1967	1967	1967	1967	1967
NONWHITE	-0.12626	0.37508	-0.18926	0.13157	0.03163	0.07114	0.24447
	0.0001	0.0001	0.0001	0.0001	0.1609	0.0016	0.0001
	1967	1967	1967	1967	1967	1967	1967
CONSTATE	0.07313	-0.12280	0.17526	-0.04865	-0.10431	-0.12689	0.17921
	0.0012	0.0001	0.0001	0.0313	0.0001	0.0001	0.0001
	1958	1958	1958	1958	1958	1958	1958
CONLOW	-0.03159	0.08360	-0.07868	0.04579	-0.00720	0.04111	-0.04859
	0.1623	0.0002	0.0005	0.0428	0.7502	0.0690	0.0316
	1958	1958	1958	1958	1958	1958	1958

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	DRS	PDNSTY	NONWHITE	CONSTATE	CONLOW
LCOST	0.23841	0.22807	0.26311	-0.02860	0.03061
	0.0001	0.0001	0.0001	0.2059	0.1758
	1967	1967	1967	1958	1958
LMORT	-0.25821	-0.15202	-0.00429	-0.18280	0.08825
	0.0001	0.0001	0.8492	0.0001	0.0001
	1967	1967	1967	1958	1958
LMCVA	-0.08375	-0.06080	-0.06168	-0.06102	0.01531
	0.0002	0.0072	0.0064	0.0071	0.5000
	1952	1952	1952	1943	1943
LMHFT	-0.10862	-0.05015	-0.01439	-0.06452	0.03723
	0.0001	0.0307	0.5356	0.0055	0.1097
	1856	1856	1856	1847	1847
LMHRT	-0.16060	-0.16482	0.01083	-0.19955	0.09202
	0.0001	0.0001	0.7921	0.0001	0.0250
	595	595	595	593	593
MORT2	-0.20821	-0.12904	0.01973	-0.17549	0.07247
	0.0001	0.0001	0.3819	0.0001	0.0013
	1967	1967	1967	1958	1958
MCVA2	-0.07634	-0.03721	-0.01942	-0.04425	0.01173
	0.0007	0.1003	0.3911	0.0512	0.6055
	1952	1952	1952	1943	1943
MHFT2	-0.02309	-0.03247	0.01606	-0.06256	0.02799
	0.3202	0.1621	0.4892	0.0072	0.2292
	1856	1856	1856	1847	1847
MHRT2	-0.09657	-0.10636	0.04807	-0.18516	0.07785
	0.0185	0.0094	0.2417	0.0001	0.0581
	595	595	595	593	593
HHI1	0.25543	0.32246	0.30931	0.08379	0.02294
	0.0001	0.0001	0.0001	0.0002	0.3102
	1967	1967	1967	1958	1958
HHI2	0.12591	0.12477	0.24543	-0.07344	-0.02409
	0.0001	0.0001	0.0001	0.0011	0.2867
	1967	1967	1967	1958	1958
HPEN	0.23874	0.20411	0.24237	-0.19863	-0.09997
	0.0001	0.0001	0.0001	0.0001	0.0001
	1967	1967	1967	1958	1958
HHPEN	0.24596	0.23005	0.29366	-0.19769	-0.11488
	0.0001	0.0001	0.0001	0.0001	0.0001
	1967	1967	1967	1958	1958

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	DRS	PDNSTY	NONWHITE	CONSTATE	CONLOW
HITECH	0.05424	-0.04216	0.01427	-0.08913	-0.04809
	0.0161	0.0616	0.5270	0.0001	0.0334
	1967	1967	1967	1958	1958
BED	0.19053	0.19158	0.11838	0.11031	0.01688
	0.0001	0.0001	0.0001	0.0001	0.4555
	1967	1967	1967	1958	1958
OCC	0.13480	0.19761	0.05495	0.12774	0.04499
	0.0001	0.0001	0.0148	0.0001	0.0465
	1967	1967	1967	1958	1958
FPROFIT	-0.06267	-0.04879	0.14928	-0.22411	0.08416
	0.0054	0.0305	0.0001	0.0001	0.0002
	1967	1967	1967	1958	1958
COTH	0.18070	0.14214	0.10016	0.10068	-0.02667
	0.0001	0.0001	0.0001	0.0001	0.2382
	1967	1967	1967	1958	1958
STAFFIN	-0.04178	-0.14982	-0.00027	-0.18240	0.03555
	0.0640	0.0001	0.9905	0.0001	0.1158
	1967	1967	1967	1958	1958
SKMIX	0.07545	0.03792	0.00526	0.01870	-0.02697
	0.0008	0.0927	0.8157	0.4082	0.2329
	1967	1967	1967	1958	1958
RESDNTS	-0.04666	-0.03088	-0.01401	-0.02017	0.01119
	0.0385	0.1710	0.5347	0.3724	0.6207
	1967	1967	1967	1958	1958
BCERT	0.06440	-0.12734	-0.12626	0.07313	-0.03159
	0.0043	0.0001	0.0001	0.0012	0.1623
	1967	1967	1967	1958	1958
MWAGE	0.32582	0.48568	0.37508	-0.12280	0.08360
	0.0001	0.0001	0.0001	0.0001	0.0002
	1967	1967	1967	1958	1958
MEC	-0.00944	-0.04785	-0.18926	0.17526	-0.07868
	0.6757	0.0338	0.0001	0.0001	0.0005
	1967	1967	1967	1958	1958
MEDI	-0.02687	0.12342	0.13157	-0.04865	0.04579
	0.2336	0.0001	0.0001	0.0313	0.0428
	1967	1967	1967	1958	1958
SYAFF	-0.01336	-0.03048	0.03163	-0.10431	-0.00720
	0.5538	0.1766	0.1609	0.0001	0.7502
	1967	1967	1967	1958	1958

The SAS System
Correlation Analysis
Pearson Correlation Coefficients / Prob > |R| under Ho: Rho=0
/ Number of Observations

	DRS	PDNSTY	NONWHITE	CONSTATE	CONLOW
CMI	0.07957	0.00130	0.07114	-0.12689	0.04111
	0.0004	0.9542	0.0016	0.0001	0.0690
	1967	1967	1967	1958	1958
INCOME	0.53513	0.42247	0.24447	0.17921	-0.04859
	0.0001	0.0001	0.0001	0.0001	0.0316
	1967	1967	1967	1958	1958
DRS	1.00000	0.30340	0.22971	0.15053	-0.06764
	0.0	0.0001	0.0001	0.0001	0.0028
	1967	1967	1967	1958	1958
PDNSTY	0.30340	1.00000	0.45937	0.08274	0.08038
	0.0001	0.0	0.0001	0.0002	0.0004
	1967	1967	1967	1958	1958
NONWHITE	0.22971	0.45937	1.00000	-0.23003	0.19691
	0.0001	0.0001	0.0	0.0001	0.0001
	1967	1967	1967	1958	1958
CONSTATE	0.15053	0.08274	-0.23003	1.00000	-0.21172
	0.0001	0.0002	0.0001	0.0	0.0001
	1958	1958	1958	1958	1958
CONLOW	-0.06764	0.08038	0.19691	-0.21172	1.00000
	0.0028	0.0004	0.0001	0.0001	0.0
	1958	1958	1958	1958	1958

APPENDIX B

DESCRIPTIVE INFORMATION ON THE NUMBER OF HOSPITALS, COST, AND QUALITY OF CARE (MORT) BY MARKET AREAS

The SAS System

OBS	MSANAME	NO_HOSP	HHI1 Mean	COST Mean	MORT Mean
1	ABILENE, TX, MSA	2	0.43502	4751.64	1.14775
2	AKRON, OH PMSA	5	0.74395	4645.91	0.97193
3	ALBANY-SCHENECTADY-TROY, NY, MSA	11	0.87212	4126.05	0.95940
4	ALBUQUERQUE, NM, MSA	4	0.73518	5163.24	1.02619
5	ALEXANDRIA, LA, MSA	2	0.46626	4331.66	1.05530
6	ALLENTOWN-BETHLEHEM-EASTON, PA, MSA	7	0.78661	4178.17	0.96051
7	ALTOONA, PA, MSA	4	0.61995	3162.65	1.04830
8	AMARILLO, TX, MSA	3	0.52425	4891.81	1.18317
9	ANCHORAGE, AK, MSA	2	0.43195	8023.31	0.95886
10	ANN ARBOR, MI PMSA	6	0.68780	5666.93	1.02762
11	ANNISTON, AL, MSA	1	0.00000	3785.53	0.87097
12	APPLETON-OSHKOSH-NEENAH, WI, MSA	7	0.79917	3555.48	1.00701
13	ASHEVILLE, NC, MSA	2	0.48958	4513.40	1.06533
14	ATHENS, GA, MSA	1	0.00000	4722.53	1.05195
15	ATLANTA, GA, MSA	20	0.93049	4617.75	0.98667
16	ATLANTIC-CAPE MAY, NJ, PMSA	4	0.66502	3777.00	0.99639
17	AUGUSTA-AIKEN, GA-SC, MSA	4	0.68048	4563.56	1.05836
18	AUSTIN-SAN MARCOS, TX, MSA	6	0.69219	3170.82	1.17040
19	BAKERSFIELD, CA, MSA	5	0.77222	4994.11	1.10585
20	BALTIMORE, MD, PMSA	21	0.94370	4576.70	0.96813
21	BANGOR, ME, MSA	3	0.43769	5030.99	1.07142
22	BARNSTABLE-YARMOUTH, MA, MSA	2	0.46365	3795.22	1.00581
23	BATON ROUGE, LA, MSA	3	0.52337	4535.81	0.98663
24	BEAUMONT-PORT ARTHUR, TX, MSA	7	0.79509	4423.15	0.99938
25	BELLINGHAM, WA, MSA	1	0.00000	3868.06	1.09742
26	BENTON HARBOR, MI, MSA	3	0.51250	3697.48	0.98824
27	BERGEN-PASSAIC, NJ, PMSA	10	0.88800	4075.07	0.98623
28	BILLINGS, MT, MSA	2	0.49258	5584.02	0.92636
29	BILOXI-GULFPORT-PASCAGOULA, MS, MSA	3	0.61063	4808.00	1.08860
30	BINGHAMTON, NY, MSA	2	0.47229	3601.90	0.96476
31	BIRMINGHAM, AL, MSA	8	0.84765	4258.36	0.99548
32	BISMARCK, ND, MSA	2	0.49616	5189.96	0.90915
33	BLOOMINGTON, IN, MSA	1	0.00000	3392.71	0.93407
34	BLOOMINGTON-NORMAL, IL, MSA	2	0.46192	4492.42	0.98256
35	BOISE CITY, ID, MSA	4	0.68705	3612.38	1.17461
36	BOSTON, MA-NH, PMSA	44	0.96823	5171.86	0.87165
37	BOULDER-LONGMONT, CO PMSA	1	0.00000	4098.01	0.96296
38	BRAZORIA, TX, PMSA	2	0.33062	3670.79	1.32474
39	BREMERTON, WA, PMSA	1	0.00000	3172.19	1.05723
40	BRIDGEPORT, CT, PMSA	7	0.82899	6285.35	0.94262
41	BRWNSVL-HARLINGEN-SAN BENITO,TX, MSA	3	0.56711	3386.73	1.22045
42	BRYAN-COLLEGE STATION, TX, MSA	2	0.44969	3136.80	1.10301
43	BUFFALO-NIAGARA FALLS, NY, MSA	13	0.88197	3976.19	1.01998
44	BURLINGTON, VT, MSA	3	0.42044	4592.17	1.01355
45	CANTON-MASSILLON, OH, MSA	5	0.74327	3783.68	1.14478
46	CASPER, WY, MSA	1	0.00000	5248.08	1.10794
47	CEDAR RAPIDS, IA, MSA	2	0.49258	3833.16	1.00234
48	CHAMPAIGN-URBANA, IL, MSA	1	0.00000	4564.21	0.92705

The SAS System

OBS	MSANAME	NO_HOSP	HHI1 Mean	COST Mean	MORT Mean
49	CHARLESTON, WV, MSA	4	0.53752	4706.55	1.04979
50	CHARLESTON-NORTH CHARLESTON, SC, MSA	5	0.73298	4362.03	1.00971
51	CHARLOTTESVILLE, VA, MSA	1	0.00000	2559.04	0.94048
52	CHARLTTE-GASTNIA-ROCKHILL,NC-SC, MSA	7	0.81947	4184.16	1.09629
53	CHATTANOOGA, TN-GA, MSA	7	0.77307	3878.28	0.99184
54	CHEYENNE, WY, MSA	1	0.00000	3907.64	1.00851
55	CHICAGO, IL, PMSA	69	0.98303	5140.16	0.97578
56	CHICO-PARADISE, CA, MSA	3	0.56791	5917.74	1.01845
57	CINCINNATI, OH-KY-IN, PMSA	12	0.89415	4450.77	0.96675
58	CLEVELAND-LORAIN-ELYRIA, OH, PMSA	29	0.94993	4317.70	0.93184
59	COLUMBIA, MO, MSA	2	0.47693	6111.14	0.80192
60	COLUMBIA, SC, MSA	2	0.41701	5723.14	1.12981
61	COLUMBUS, GA-AL, MSA	3	0.60347	4062.56	1.27650
62	COLUMBUS, OH, MSA	9	0.81847	4173.58	1.04333
63	CORPUS CHRISTI, TX, MSA	4	0.61383	3611.73	1.13890
64	CUMBERLAND, MD-WV, MSA	2	0.25094	3507.68	1.09614
65	DALLAS, TX, PMSA	31	0.93626	3967.71	1.08065
66	DANVILLE, VA, MSA	1	0.00000	3512.95	1.05067
67	DAVNPRT-MOLINE-ROCK ISLND,IA-IL, MSA	6	0.82538	4103.11	1.20503
68	DAYTON-SPRINGFIELD, OH, MSA	10	0.88082	4323.77	0.96244
69	DAYTONA BEACH, FL, MSA	4	0.70000	4705.79	1.03659
70	DECATUR, AL, MSA	1	0.00000	5036.20	0.99282
71	DECATUR, IL, MSA	2	0.48834	3591.58	1.06046
72	DENVER, CO, PMSA	9	0.85472	4710.98	1.06607
73	DES MOINES, IA, MSA	5	0.68852	5042.87	0.94911
74	DETROIT, MI, PMSA	41	0.96286	5421.79	1.03809
75	DOVER, DE, MSA	1	0.00000	4314.40	1.11207
76	DUBUQUE, IA, MSA	2	0.46288	3929.90	0.96071
77	DULUTH-SUPERIOR, MN-WI, MSA	5	0.67091	4484.57	1.17806
78	DUTCHESS COUNTY, NY, PMSA	3	0.58800	3832.21	1.04315
79	EAU CLAIRE, WI, MSA	5	0.69047	3436.97	0.90001
80	EL PASO, TX, MSA	4	0.71585	4151.78	1.03683
81	ELKHART-GOSHEN, IN, MSA	1	0.00000	3020.47	1.03116
82	ELMIRA, NY, MSA	2	0.46410	4910.11	1.05857
83	ENID, OK, MSA	3	0.60006	5213.86	1.07596
84	ERIE, PA, MSA	6	0.71284	3557.74	0.97061
85	EUGENE-SPRINGFIELD, OR, MSA	4	0.49657	3695.52	1.12761
86	EVANSVILLE-HENDERSON, IN-KY, MSA	5	0.75064	3838.67	1.04187
87	FARGO-MOORHEAD, ND-MN, MSA	3	0.57481	4758.00	0.88724
88	FAYETTEVILLE, NC, MSA	1	0.00000	5862.03	1.37209
89	FAYETTEVLL-SPRINGDALE-ROGERS,AR, MSA	5	0.73660	2775.58	1.06273
90	FLINT, MI, PMSA	5	0.70248	3890.74	0.79817
91	FLORENCE, AL, MSA	2	0.47995	3873.96	1.01598
92	FLORENCE, SC, MSA	3	0.57733	4047.17	1.07205
93	FORT COLLINS-LOVELAND, CO, MSA	1	0.00000	3717.61	0.82891
94	FORT LAUDERDALE, FL, PMSA	11	0.89006	5753.66	0.93101
95	FORT MYERS-CAPE CORAL, FL, MSA	2	0.35934	4490.34	0.90820
96	FORT PIERCE-PORT ST. LUCIE, FL, MSA	3	0.63310	3930.24	0.95649
97	FORT SMITH, AR-OK, MSA	3	0.59300	3047.17	0.94684
98	FORT WALTON BEACH, FL, MSA	3	0.52558	3577.10	0.87756
99	FORT WAYNE, IN, MSA	5	0.72760	4504.03	1.02314
100	FORT WORTH-ARLINGTON, TX, PMSA	15	0.90477	3939.02	1.16217
101	FRESNO, CA, MSA	5	0.68378	3675.42	1.10893

The SAS System

OBS	MSANAME	NO_HOSP	HHI1 Mean	COST Mean	MORT Mean
102	GADSDEN, AL, MSA	2	0.46057	3730.09	1.10553
103	GAINESVILLE, FL, MSA	3	0.63497	5772.00	0.98457
104	GALVESTON-TEXAS CITY, TX, PMSA	2	0.39966	5130.34	0.96659
105	GARY, IN, PMSA	4	0.76501	4784.94	1.03709
106	GLENS FALLS, NY, MSA	2	0.18904	3462.22	0.96690
107	GOLDSBORO, NC, MSA	1	0.00000	3380.89	1.20388
108	GRAND FORKS, ND-MN, MSA	3	0.25942	3450.43	1.16085
109	GRAND RAPIDS-MUSKEGON-HOLLND,MI, MSA	11	0.86408	4094.52	1.08619
110	GREAT FALLS, MT, MSA	2	0.48141	4456.45	0.95314
111	GREELEY, CO, PMSA	1	0.00000	4588.19	0.93333
112	GREEN BAY, WI, MSA	3	0.62946	4145.20	0.95285
113	GRNSBORO-WINSTON-SALEM-HI PT,NC, MSA	8	0.81481	4081.15	1.03117
114	GRNVILLE-SPARTANBRG-ANDERSON,SC, MSA	10	0.80441	4052.13	1.09926
115	HAGERSTOWN, MD, PMSA	1	0.00000	3541.29	1.10145
116	HAMILTON-MIDDLETOWN, OH, PMSA	3	0.66428	3613.22	1.14869
117	HARRISBURG-LEBANON-CARLISLE, PA, MSA	7	0.81987	5961.81	0.88084
118	HARTFORD, CT, MSA	10	0.85506	5629.75	0.97169
119	HATTIESBURG, MS, MSA	1	0.00000	3487.38	0.98374
120	HICKORY-MORGANTON-LENOIR, NC, MSA	5	0.75378	3612.15	0.97029
121	HONOLULU, HI, MSA	4	0.67811	7819.68	0.90372
122	HOUSTON, TX, PMSA	36	0.94499	5229.70	1.08883
123	HUNTINGTON-ASHLAND, WK-KY-OH, MSA	4	0.73597	3720.42	1.01796
124	HUNTSVILLE, AL, MSA	2	0.31069	4221.41	1.05900
125	INDIANAPOLIS, IN, MSA	6	0.68394	4638.43	0.98554
126	IOWA CITY, IA, MSA	1	0.00000	3677.45	0.97241
127	JACKSON, MI, MSA	1	0.00000	3390.83	1.13293
128	JACKSON, MS, MSA	4	0.70907	3762.29	0.98980
129	JACKSONVILLE, FL, MSA	8	0.84918	5319.95	1.03540
130	JAMESTOWN, NY, MSA	4	0.60760	2655.54	1.08377
131	JANESVILLE-BELOIT, WI, MSA	3	0.53849	3254.50	1.00720
132	JERSEY CITY, NJ, PMSA	9	0.86265	4204.78	0.97929
133	JOHNSN CTY-KNGSPRT-BRISTL,TN-VA, MSA	8	0.82407	3959.56	0.92317
134	JOHNSTOWN, PA, MSA	7	0.80007	3412.69	0.94797
135	JOPLIN, MO, MSA	4	0.67954	4028.37	1.15429
136	KALAMAZOO-BATTLE CREEK, MI, MSA	5	0.73815	4642.98	1.04828
137	KANKAKEE, IL, PMSA	2	0.48676	4260.12	1.14773
138	KANSAS CITY, MO-KS, MSA	21	0.93198	4233.05	1.00863
139	KENOSHA, WI, PMSA	1	0.49760	3315.54	1.10585
140	KILLEEN-TEMPLE, TX, MSA	3	0.52070	3824.32	1.10054
141	KNOXVILLE, TN, MSA	9	0.83833	4156.23	0.93350
142	KOKOMO, IN, MSA	1	0.00000	3455.73	1.03093
143	LA CROSSE, WI-MN, MSA	2	0.47113	4357.01	0.95631
144	LAFAYETTE, IN, MSA	2	0.49325	4147.33	1.17805
145	LAFAYETTE, LA, MSA	6	0.75705	3857.13	0.96102
146	LAKE CHARLES, LA, MSA	3	0.60547	3920.48	0.93711
147	LAKELAND-WINTER HAVEN, FL, MSA	6	0.62334	6620.22	0.92286
148	LANCASTER, PA, MSA	5	0.69808	3716.43	0.97235
149	LANSING-EAST LANSING, MI, MSA	6	0.68723	4331.36	0.97838
150	LAREDO, TX , MSA	2	0.40502	2771.96	0.88593
151	LAS VEGAS, NV-AZ, MSA	7	0.77754	4173.53	1.21169
152	LEWISTON-AUBURN, ME, MSA	2	0.48888	4492.64	1.07915
153	LEXINGTON, KY, MSA	10	0.84382	3619.97	0.87778
154	LIMA, OH, MSA	4	0.63513	3198.37	0.94781

The SAS System

OBS	MSANAME	NO_HOSP	HHI1 Mean	COST Mean	MORT Mean
155	LINCOLN, NE, MSA	2	0.49411	5387.07	1.15249
156	LITTLE ROCK-N. LITTLE ROCK,AR, MSA	6	0.77313	4306.44	0.99635
157	LONGVIEW-MARSHALL, TX, MSA	4	0.58911	3534.19	1.04355
158	LOS ANGELES-LONG BEACH, CA, PMSA	63	0.97534	6050.29	1.01838
159	LOUISVILLE, KY-IN, MSA	8	0.84449	4644.80	0.94361
160	LUBBOCK, TX, MSA	4	0.58264	5544.77	1.05663
161	LYNCHBURG, VA, MSA	3	0.58342	3338.83	1.07152
162	MACON, GA, MSA	3	0.60164	4278.64	1.04900
163	MADISON, WI, MSA	2	0.15516	3800.30	0.93568
164	MANSFIELD, OH, MSA	6	0.65064	3668.62	0.99242
165	MCALLEN-EDINBURG-MISSION, TX, MSA	4	0.71965	3064.74	1.11922
166	MEDFORD-ASHLAND, OR, MSA	2	0.46108	4712.38	1.14204
167	MELBOURNE-TITUSVLLE-PALM BAY,FL, MSA	3	0.58839	3879.18	0.98407
168	MEMPHIS, TN-AR-MS, MSA	8	0.77558	4337.36	1.23643
169	MERCED, CA, MSA	2	0.39385	3618.55	1.00387
170	MIAMI, FL, PMSA	19	0.93186	6185.76	0.92908
171	MIDDLESEX-SOMERSET-HUNTERDN,NJ, PMSA	7	0.83564	4489.89	1.00000
172	MILWAUKEE-WAUKESHA, WI, PMSA	16	0.92488	4021.05	0.98235
173	MINNEAPOLIS-ST. PAUL, MN-WI, MSA	19	0.90658	3696.55	1.00633
174	MOBILE, AL, MSA	3	0.62286	4449.89	0.93276
175	MODESTO, CA, MSA	2	0.48463	4184.20	1.07315
176	MONMOUTH-OCEAN, NJ, PMSA	8	0.86095	3837.45	0.99422
177	MONROE, LA, MSA	3	0.53159	3001.88	0.88844
178	MONTGOMERY, AL, MSA	5	0.71807	3599.38	1.10951
179	MUNCIE, IN, MSA	1	0.00000	4308.89	1.12941
180	MYRTLE BEACH, SC, MSA	2	0.49997	2714.37	1.02286
181	NAPLES, FL, MSA	1	0.00000	4591.12	1.00000
182	NASHUA, NH, PMSA	5	0.77018	4198.31	1.12846
183	NASHVILLE, TN, MSA	14	0.87633	4176.70	1.02246
184	NASSAU-SUFFOLK, NY, PMSA	23	0.93329	5183.10	0.96495
185	NEW HAVEN-MERIDEN, CT, PMSA	6	0.78229	6630.82	0.98030
186	NEW LONDON-NORWICH, CT-RI, MSA	2	0.49716	5049.22	1.03571
187	NEW ORLEANS, LA, MSA	13	0.90761	5475.66	1.03951
188	NEW YORK, NY, PMSA	56	0.97370	6241.80	0.90203
189	NEWARK, NJ, PMSA	24	0.94597	4356.62	0.96438
190	NEWBURGH, NY-PA, PMSA	6	0.80600	3525.88	0.90597
191	NORFLK-VA BCH-NEWPRT NEWS,VA-NC, MSA	13	0.89645	4100.51	1.07141
192	OAKLAND, CA, PMSA	7	0.78071	6287.05	1.03234
193	OCALA, FL, MSA	1	0.00000	4524.07	0.89744
194	ODESSA-MIDLAND, TX, MSA	1	0.00000	2610.46	0.90150
195	OKLAHOMA CITY, OK, MSA	10	0.86493	4666.98	1.10889
196	OLYMPIA, WA, PMSA	2	0.33592	4188.25	1.07814
197	OMAHA, NE-IA, MSA	8	0.84249	5049.19	1.01859
198	ORANGE COUNTY, CA, PMSA	20	0.93558	6042.04	1.05999
199	ORLANDO, FL, MSA	10	0.83426	4262.98	1.06167
200	OWENSBORO, KY, MSA	1	0.00000	3203.74	1.02059
201	PANAMA CITY, FL, MSA	1	0.00000	2970.79	1.06897
202	PARKERSBURG-MARIETTA, WV-OH, MSA	3	0.56532	3229.28	1.01836
203	PENSACOLA, FL, MSA	6	0.73724	3703.71	1.01895
204	PEORIA-PEKIN, IL, MSA	4	0.69749	5333.20	1.03799
205	PHEONIX-MESA, AZ, MSA	13	0.90378	4367.84	0.99403
206	PHILADELPHIA, PA-NJ, PMSA	59	0.97832	5305.00	0.93947
207	PINE BLUFF, AR, MSA	1	0.00000	4199.24	1.09009

The SAS System

OBS	MSANAME	NO_HOSP	HHI1 Mean	COST Mean	MORT Mean
208	PITTSBURGH, PA, MSA	33	0.96322	4737.49	0.91426
209	PITTSFIELD, MA, MSA	3	0.56603	4266.06	1.02161
210	PORTLAND, ME, MSA	6	0.64470	4015.12	1.09574
211	PORTLAND-VANCOUVER, OR-WA, PMSA	15	0.89591	4503.40	1.11901
212	PORTSMOUTH-ROCHESTER, NH-ME, PMSA	2	0.45496	4395.71	1.20016
213	PROVIDNC-FALL RIVR-WARWCK,RI-MA, MSA	15	0.91137	4168.69	0.93570
214	PROVO-OREM, UT, MSA	4	0.58781	2734.85	1.08664
215	PUEBLO, CO, MSA	2	0.48510	4237.57	1.16118
216	PUNTA GORDA, FL, MSA	2	0.49201	4533.26	1.00213
217	RACINE, WI, PMSA	2	0.45788	3618.83	1.24692
218	RALEIGH-DURHAM-CHAPEL HILL, NC, MSA	4	0.60283	4973.63	0.92436
219	READING, PA, MSA	3	0.56611	3388.23	1.06374
220	REDDING, CA, MSA	2	0.47340	6212.78	1.10941
221	RENO, NV, MSA	2	0.48660	6132.04	1.01590
222	RICHLAND-KENNEWICK-PASCO, WA, MSA	1	0.00000	3139.37	1.28613
223	RICHMOND-PETERSBURG, VA, MSA	8	0.83773	4782.81	0.88821
224	RIVERSIDE-SAN BERNARDINO, CA, PMSA	20	0.93137	4872.13	1.19386
225	ROANOKE, VA, MSA	3	0.63550	4972.67	0.98776
226	ROCHESTER, MN, MSA	2	0.45965	4657.37	0.59910
227	ROCHESTER, NY, MSA	13	0.86652	3835.79	0.92455
228	ROCKFORD, IL, MSA	4	0.68349	4619.24	1.02671
229	ROCKY MOUNT, NC, MSA	1	0.00000	2884.05	1.31350
230	SACRAMENTO, CA, PMSA	7	0.83157	5026.34	1.01129
231	SAGINAW-BAY CITY-MIDLAND, MI, MSA	5	0.79595	4569.58	1.01012
232	SALEM, OR, PMSA	3	0.26573	3455.42	1.05080
233	SALINAS, CA, MSA	1	0.00000	5122.01	1.18429
234	SALT LAKE CITY-OGDEN, UT, MSA	10	0.86831	3424.39	1.17445
235	SAN ANGELO, TX, MSA	2	0.48874	3503.95	0.95875
236	SAN ANTONIO, TX, MSA	9	0.83949	4827.46	0.94717
237	SAN DIEGO, CA, MSA	11	0.87999	5380.57	1.05027
238	SAN FRANCISCO, CA, PMSA	10	0.82383	8177.51	1.02324
239	SAN JOSE, CA, PMSA	5	0.76792	6985.24	0.99723
240	SANTA FE, NM, MSA	1	0.00000	3658.08	0.98750
241	SANTA ROSA, CA, PMSA	3	0.47799	5126.75	1.02206
242	SARASOTA-BRADENTON, FL, MSA	5	0.75698	4695.87	0.98545
243	SAVANNAH, GA, MSA	3	0.63975	5362.49	0.94783
244	SCRNTN--WLKES-BARRE--HAZLETN,PA, MSA	15	0.91188	3574.36	0.99938
245	SEATTLE-BELLEVUE-EVERETT, WA, PMSA	9	0.87545	4247.60	1.05299
246	SHARON, PA, MSA	4	0.72373	3103.95	0.90343
247	SHEBOYGAN, WI, MSA	3	0.59693	3325.72	1.09782
248	SHERMAN-DENISON, TX, MSA	3	0.63514	4111.25	1.05736
249	SHREVEPORT-BOSSIER CITY, LA, MSA	5	0.60080	5560.74	0.94366
250	SIOUX CITY, IA-NE, MSA	1	0.49999	3687.95	0.98311
251	SIOUX FALLS, SD, MSA	4	0.53533	3822.01	0.94874
252	SOUTH BEND, IN, MSA	4	0.66840	4851.23	1.00006
253	SPOKANE, WA, MSA	4	0.64804	4404.68	1.02869
254	SPRINGFIELD, IL, MSA	2	0.49793	5509.42	0.86922
255	SPRINGFIELD, MA, MSA	9	0.80434	3881.96	0.99478
256	SPRINGFIELD, MO, MSA	4	0.57455	4179.56	1.06059
257	ST LUIS OBS-ATSCDRO-PSO RBLS,CA, MSA	3	0.64930	4860.03	1.04390
258	ST. CLOUD, MN, MSA	1	0.00000	4422.68	0.98494
259	ST. JOSEPH, MO, MSA	1	0.00000	3824.06	1.13550
260	ST. LOUIS, MO-IL, MSA	32	0.95033	4844.01	0.98715

The SAS System

OBS	MSANAME	NO_HOSP	HHI1 Mean	COST Mean	MORT Mean
261	STA BARBARA-STA MARIA-LOMPOC,CA, MSA	5	0.67060	5229.82	0.98900
262	STATE COLLEGE, PA, MSA	1	0.00000	3269.99	1.02710
263	STEUBENVILLE-WEIRTON, OH-WV, MSA	3	0.65273	3505.75	1.11415
264	STOCKTON-LODI, CA, MSA	4	0.65022	4362.56	1.04823
265	SUMTER, SC, MSA	1	0.00000	3525.13	1.11628
266	SYRACUSE, NY, MSA	7	0.79019	3761.35	0.95654
267	TACOMA, WA, PMSA	4	0.70996	4498.23	1.14743
268	TALLAHASSEE, FL, MSA	3	0.40333	4070.89	1.19506
269	TAMPA-ST PETERSBRG-CLEARWTER,FL, MSA	27	0.94802	4618.17	1.01642
270	TERRE HAUTE, IN, MSA	2	0.44489	4270.00	0.96850
271	TEXARKANA, TX-TEXARKANA, AR, MSA	3	0.54702	5025.53	1.04004
272	TOLEDO, OH, MSA	8	0.83871	4205.41	0.99575
273	TOPEKA, KS, MSA	2	0.49949	5385.25	1.08400
274	TRENTON, NJ, PMSA	5	0.78834	3937.57	1.00835
275	TUCSON, AZ, MSA	6	0.79751	4588.41	1.02368
276	TULSA, OK, MSA	11	0.79522	3932.79	1.00648
277	TYLER, TX, MSA	3	0.53466	4029.42	1.13135
278	UTICA-ROME, NY, MSA	3	0.61517	3619.05	1.02687
279	VALLEJO-FAIRFIELD-NAPA, CA, PMSA	4	0.76105	5529.08	1.15551
280	VENTURA, CA, PMSA	6	0.82847	4739.70	1.02499
281	VICTORIA, TX, MSA	2	0.39534	3973.48	1.18395
282	VINELAND-MILLVLLE-BRIDGETON,NJ, PMSA	2	0.49863	3837.02	1.01563
283	VISALIA-TULARE-PORTERVILLE, CA, MSA	1	0.22646	10069.26	1.46744
284	WACO, TX, MSA	2	0.42045	3799.83	1.21754
285	WASHINGTON, DC-MD-VA-WV, PMSA	34	0.95879	4715.05	0.98930
286	WATERLOO-CEDAR FALLS, IA, MSA	2	0.47489	3582.22	1.03078
287	WAUSAU, WI, MSA	1	0.00000	4204.58	0.96622
288	WEST PALM BEACH-BOCA RATON, FL, MSA	13	0.90255	5184.50	1.01252
289	WHEELING, WV-OH, MSA	3	0.60053	3847.09	0.95790
290	WICHITA FALLS, TX, MSA	2	0.49580	3946.14	1.15043
291	WICHITA, KS, MSA	7	0.74663	4458.91	0.97491
292	WILLIAMSPORT, PA, MSA	4	0.64400	3145.71	0.85873
293	WILMINGTON, NC, MSA	3	0.44316	4231.94	1.08073
294	WILMINGTON-NEWARK, DE-MD, PMSA	4	0.55970	4723.28	0.98580
295	WORCESTER, MA-CT, PMSA	8	0.85085	3403.80	0.94634
296	YAKIMA, WA, MSA	4	0.63922	3433.79	1.07331
297	YOLO, CA, PMSA	2	0.38261	4028.08	1.18964
298	YORK, PA, MSA	3	0.53673	3866.54	0.97153
299	YOUNGSTOWN-WARREN, OH, MSA	8	0.83280	3842.54	0.98007
300	YUBA CITY, CA, MSA	2	0.49610	3664.24	1.15912
301	YUMA, AZ, MSA	1	0.00000	3254.95	1.08989

APPENDIX C

REGRESSION ANALYSIS OF HHI1, HHI2, HPEN, AND HHPEN

SYSLIN Procedure
First Stage Regression Statistics

Model:
Dependent variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	24	100.48321	4.18680	77.351	0.0001
Error	1933	104.62806	0.05413		
C Total	1957	205.11127			

Root MSE	0.23265	R-Square	0.4899
Dep Mean	8.38696	Adj R-SQ	0.4836
C.V.	2.77398		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.688736	0.078619	85.078	0.0001
HHI1	1	0.006278	0.033323	0.188	0.8506
HHI2	1	-0.023386	0.032499	-0.720	0.4719
HPEN	1	-0.187037	0.246112	-0.760	0.4474
HHPEN	1	0.355731	0.334877	1.062	0.2882
HITECH	1	-0.055848	0.047323	-1.180	0.2381
BED	1	0.000193	0.000044039	4.381	0.0001
OCC	1	-0.000961	0.000251	-3.823	0.0001
FPROFIT	1	0.004942	0.016136	0.306	0.7594
COTH	1	0.123603	0.022995	5.375	0.0001
STAFFIN	1	0.006501	0.002041	3.185	0.0015
SKMIX	1	0.000287	0.000183	1.565	0.1178
RESDNTS	1	0.007704	0.009010	0.855	0.3926
BCERT	1	-0.000399	0.000429	-0.930	0.3526
MWAGE	1	0.487630	0.046883	10.401	0.0001
MEC	1	0.002386	0.000481	4.961	0.0001
MEDI	1	0.002099	0.000651	3.224	0.0013
SYAFF	1	0.013284	0.010861	1.223	0.2214
CMI	1	0.618780	0.036727	16.848	0.0001
INCOME	1	0.000004210	0.000002251	1.870	0.0616
DRS	1	0.010754	0.006155	1.747	0.0808
PDNSTY	1	-0.000003179	0.000004764	-0.667	0.5047
NONWHITE	1	0.003239	0.000589	5.499	0.0001
CONSTATE	1	0.040775	0.014595	2.794	0.0053
CONLOW	1	-0.003150	0.018038	-0.175	0.8614

SYSLIN Procedure
First Stage Regression Statistics

Model:
Dependent variable: LMORT

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	24	4.67626	0.19484	9.722	0.0001
Error	1933	38.74220	0.02004		
C Total	1957	45.25393			

Root MSE	0.14157	R-Square	0.1077
Dep Mean	-0.00021	Adj R-SQ	0.0966
C.V.	-66014.05830		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.264244	0.047840	5.523	0.0001
HHI1	1	-0.041572	0.020277	-2.050	0.0405
HHI2	1	-0.001722	0.019776	-0.087	0.9306
HPEN	1	0.058763	0.149762	0.392	0.6948
HHPEN	1	-0.118183	0.203776	-0.580	0.5620
HITECH	1	0.013366	0.028796	0.464	0.6426
BED	1	-0.000090194	0.000026798	-3.366	0.0008
OCC	1	-0.000186	0.000153	-1.215	0.2244
FPROFIT	1	-0.023780	0.009819	-2.422	0.0155
COTH	1	-0.018525	0.013993	-1.324	0.1857
STAFFIN	1	-0.000760	0.001242	-0.612	0.5408
SKMIX	1	-0.000263	0.000112	-2.361	0.0183
RESDNTS	1	0.012656	0.005483	2.308	0.0211
BCERT	1	-0.000311	0.000261	-1.191	0.2337
MWAGE	1	-0.044709	0.028529	-1.567	0.1172
MEC	1	-0.000882	0.000293	-3.014	0.0026
MEDI	1	-0.000075934	0.000396	-0.192	0.8480
SYAFF	1	-0.002691	0.006609	-0.407	0.6839
CMI	1	-0.022618	0.022349	-1.012	0.3117
INCOME	1	0.000001536	0.000001370	1.121	0.2624
DRS	1	-0.026645	0.003746	-7.114	0.0001
PDNSTY	1	-0.000007364	0.000002899	-2.540	0.0112
NONWHITE	1	0.001143	0.000358	3.188	0.0015
CONSTATE	1	-0.040264	0.008881	-4.534	0.0001
CONLOW	1	0.021704	0.010976	1.977	0.0481

SYSLIN Procedure
Two-Stage Least Squares Estimation

Model: LCOST
Dependent variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	23	100.38436	4.36454	74.425	0.0001
Error	1934	113.41602	0.05864		
C Total	1957	205.11127			

Root MSE	0.24216	R-Square	0.4695
Dep Mean	8.38696	Adj R-SQ	0.4632
C.V.	2.88738		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.580879	0.210764	31.224	0.0001
LMORT	1	0.434895	0.728852	0.597	0.5508
HHI1	1	0.023999	0.045516	0.527	0.5981
HHI2	1	-0.021707	0.033836	-0.642	0.5212
HPEN	1	-0.210290	0.261361	-0.805	0.4212
HHPEN	1	0.405433	0.363254	1.116	0.2645
HITECH	1	-0.054159	0.052108	-1.039	0.2988
BED	1	0.000228	0.000082982	2.751	0.0060
OCC	1	-0.000883	0.000297	-2.968	0.0030
FPROFIT	1	0.015635	0.024136	0.648	0.5172
COTH	1	0.130660	0.026998	4.840	0.0001
STAFFIN	1	0.006817	0.002166	3.147	0.0017
SKMIX	1	0.000400	0.000270	1.480	0.1389
BCERT	1	-0.000295	0.000504	-0.585	0.5588
MWAGE	1	0.509110	0.058023	8.774	0.0001
MEC	1	0.002762	0.000819	3.372	0.0008
MEDI	1	0.002113	0.000679	3.113	0.0019
CMI	1	0.628554	0.043412	14.479	0.0001
INCOME	1	0.000003526	0.000002598	1.357	0.1748
DRS	1	0.022344	0.020611	1.084	0.2785
PDNSTY	1	-0.000000145	0.000007284	-0.020	0.9841
NONWHITE	1	0.002753	0.001035	2.658	0.0079
CONSTATE	1	0.057403	0.032764	1.752	0.0799
CONLOW	1	-0.012937	0.024773	-0.522	0.6016

SYSLIN Procedure
Two-Stage Least Squares Estimation

Model: LMORT
Dependent variable: LMORT

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	22	6.17512	0.28069	13.893	0.0001
Error	1935	39.09475	0.02020		
C Total	1957	45.25393			

Root MSE	0.14214	R-Square	0.1364
Dep Mean	-0.00021	Adj R-SQ	0.1266
C.V.	-66279.45974		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.506466	0.322781	1.569	0.1168
LCOST	1	-0.034358	0.046676	-0.736	0.4618
HHI1	1	-0.035782	0.020131	-1.777	0.0756
HHI2	1	0.003100	0.019829	0.156	0.8758
HPEN	1	0.018781	0.149298	0.126	0.8999
HHPEN	1	-0.070047	0.205483	-0.341	0.7332
HITECH	1	0.012568	0.028981	0.434	0.6646
BED	1	-0.000088629	0.000029419	-3.013	0.0026
OCC	1	-0.000267	0.000155	-1.722	0.0852
FPROFIT	1	-0.022134	0.009891	-2.238	0.0253
COTH	1	-0.014823	0.015448	-0.959	0.3374
STAFFIN	1	-0.000326	0.001273	-0.256	0.7980
SKMIX	1	-0.000267	0.000113	-2.372	0.0178
RESDNTS	1	0.012730	0.005528	2.303	0.0214
BCERT	1	-0.000340	0.000259	-1.314	0.1889
MEC	1	-0.000886	0.000306	-2.894	0.0039
MEDI	1	-0.000018742	0.000414	-0.045	0.9639
SYAFF	1	-0.001903	0.006676	-0.285	0.7756
CMI	1	-0.002326	0.038185	-0.061	0.9514
INCOME	1	0.000000535	0.000001430	0.374	0.7083
DRS	1	-0.025217	0.003780	-6.671	0.0001
CONSTATE	1	-0.044102	0.008693	-5.073	0.0001
CONLOW	1	0.024217	0.010938	2.214	0.0269

SYSLIN Procedure
First Stage Regression Statistics

Model:
Dependent variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	24	104.51127	4.35464	88.886	0.0001
Error	1918	93.96495	0.04899		
C Total	1942	198.47622			

Root MSE	0.22134	R-Square	0.5266
Dep Mean	8.38716	Adj R-SQ	0.5206
C.V.	2.63903		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.570542	0.076176	86.255	0.0001
HHI1	1	0.000124	0.031754	0.004	0.9969
HHI2	1	-0.024474	0.031038	-0.789	0.4305
HPEN	1	-0.190373	0.234479	-0.812	0.4170
HHPEN	1	0.375730	0.319091	1.178	0.2391
HITECH	1	-0.033988	0.045513	-0.747	0.4553
BED	1	0.000189	0.000042071	4.499	0.0001
OCC	1	-0.000809	0.000241	-3.364	0.0008
FPROFIT	1	0.008230	0.015473	0.532	0.5948
COTH	1	0.114290	0.021923	5.213	0.0001
STAFFIN	1	0.008601	0.001988	4.327	0.0001
SKMIX	1	0.000273	0.000174	1.564	0.1179
RESDNTS	1	-0.015565	0.010239	-1.520	0.1286
BCERT	1	-0.000495	0.000411	-1.205	0.2285
MWAGE	1	0.500387	0.044851	11.157	0.0001
MEC	1	0.003200	0.000472	6.786	0.0001
MEDI	1	0.002318	0.000625	3.707	0.0002
SYAFF	1	0.006042	0.010380	0.582	0.5606
CMI	1	0.645538	0.035547	18.160	0.0001
INCOME	1	0.000004525	0.000002151	2.103	0.0356
DRS	1	0.010041	0.005864	1.712	0.0870
PDNSTY	1	-0.000003204	0.000004540	-0.706	0.4804
NONWHITE	1	0.003351	0.000564	5.938	0.0001
CONSTATE	1	0.038207	0.013935	2.742	0.0062
CONLOW	1	-0.007882	0.017173	-0.459	0.6463

SYSLIN Procedure
First Stage Regression Statistics

Model:
Dependent variable: LMCVA

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	24	5.43417	0.22642	2.078	0.0016
Error	1918	209.01500	0.10898		
C Total	1942	215.40046			

Root MSE	0.33011	R-Square	0.0253
Dep Mean	-0.06994	Adj R-SQ	0.0131
C.V.	-471.96870		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.188100	0.113612	1.656	0.0980
HHI1	1	-0.098203	0.047359	-2.074	0.0383
HHI2	1	-0.029684	0.046291	-0.641	0.5214
HPEN	1	0.040270	0.349712	0.115	0.9083
HHPEN	1	0.020821	0.475905	0.044	0.9651
HITECH	1	0.028896	0.067880	0.426	0.6704
BED	1	-0.000081246	0.000062746	-1.295	0.1955
OCC	1	0.000388	0.000359	1.081	0.2797
FPROFIT	1	-0.046349	0.023077	-2.008	0.0447
COTH	1	-0.026771	0.032697	-0.819	0.4130
STAFFIN	1	0.001256	0.002964	0.424	0.6717
SKMIX	1	-0.000376	0.000260	-1.444	0.1489
RESDNTS	1	0.004918	0.015270	0.322	0.7475
BCERT	1	0.000853	0.000613	1.391	0.1644
MWAGE	1	-0.027418	0.066893	-0.410	0.6819
MEC	1	-0.001453	0.000703	-2.066	0.0390
MEDI	1	-0.000679	0.000932	-0.729	0.4663
SYAFF	1	0.002454	0.015481	0.159	0.8740
CMI	1	-0.083008	0.053016	-1.566	0.1176
INCOME	1	0.000003246	0.000003208	1.012	0.3118
DRS	1	-0.018293	0.008746	-2.092	0.0366
PDNSTY	1	-0.000000327	0.000006771	-0.048	0.9615
NONWHITE	1	-0.001008	0.000842	-1.197	0.2314
CONSTATE	1	-0.046558	0.020784	-2.240	0.0252
CONLOW	1	0.014444	0.025613	0.564	0.5729

SYSLIN Procedure
Two-Stage Least Squares Estimation

Model: LCOST
Dependent variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	23	104.43979	4.54086	8.813	0.0001
Error	1919	988.77830	0.51526		
C Total	1942	198.47622			

Root MSE	0.71781	R-Square	0.0955
Dep Mean	8.38716	Adj R-SQ	0.0847
C.V.	8.55849		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.970344	1.192225	5.847	0.0001
LMCVA	1	-2.108477	6.127246	-0.344	0.7308
HHI1	1	-0.207527	0.609896	-0.340	0.7337
HHI2	1	-0.086552	0.206107	-0.420	0.6746
HPEN	1	-0.109037	0.806806	-0.135	0.8925
HHPEN	1	0.428309	1.037362	0.413	0.6797
HITECH	1	0.024208	0.259662	0.093	0.9257
BED	1	0.000018072	0.000531	0.034	0.9729
OCC	1	0.000011460	0.002484	0.005	0.9963
FPROFIT	1	-0.089270	0.287551	-0.310	0.7563
COTH	1	0.056462	0.177683	0.318	0.7507
STAFFIN	1	0.011209	0.010106	1.109	0.2675
SKMIX	1	-0.000521	0.002370	-0.220	0.8260
BCERT	1	0.001289	0.005324	0.242	0.8088
MWAGE	1	0.443507	0.218983	2.025	0.0430
MEC	1	0.000140	0.009064	0.015	0.9876
MEDI	1	0.000865	0.004638	0.187	0.8520
CMI	1	0.472801	0.528710	0.894	0.3713
INCOME	1	0.000011349	0.000021089	0.538	0.5905
DRS	1	-0.028433	0.114031	-0.249	0.8031
PDNSTY	1	-0.000004042	0.000014869	-0.272	0.7858
NONWHITE	1	0.001238	0.006434	0.192	0.8474
CONSTATE	1	-0.060665	0.289677	-0.209	0.8341
CONLOW	1	0.022100	0.104740	0.211	0.8329

SYSLIN Procedure
Two-Stage Least Squares Estimation

Model: LMCVA
Dependent variable: LMCVA

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	22	6.30147	0.28643	2.638	0.0001
Error	1920	208.50020	0.10859		
C Total	1942	215.40046			

Root MSE	0.32954	R-Square	0.0293
Dep Mean	-0.06994	Adj R-SQ	0.0182
C.V.	-471.14154		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.989888	0.721059	1.373	0.1700
LCOST	1	-0.121568	0.105922	-1.148	0.2512
HHI1	1	-0.104243	0.046722	-2.231	0.0258
HHI2	1	-0.034259	0.046167	-0.742	0.4581
HPEN	1	0.055767	0.346629	0.161	0.8722
HHPEN	1	0.025306	0.477408	0.053	0.9577
HITECH	1	0.027263	0.067721	0.403	0.6873
BED	1	-0.000060314	0.000068017	-0.887	0.3753
OCC	1	0.000301	0.000359	0.840	0.4012
FPROFIT	1	-0.044748	0.023215	-1.928	0.0541
COTH	1	-0.011905	0.035380	-0.336	0.7365
STAFFIN	1	0.002457	0.003063	0.802	0.4226
SKMIX	1	-0.000337	0.000261	-1.291	0.1967
RESDNTS	1	0.003179	0.015303	0.208	0.8355
BCERT	1	0.000863	0.000606	1.426	0.1542
MEC	1	-0.001039	0.000758	-1.371	0.1707
MEDI	1	-0.000445	0.000976	-0.456	0.6482
SYAFF	1	0.003256	0.015477	0.210	0.8334
CMI	1	0.000261	0.090599	0.003	0.9977
INCOME	1	0.000004343	0.000003339	1.301	0.1935
DRS	1	-0.018191	0.008761	-2.076	0.0380
CONSTATE	1	-0.040046	0.020215	-1.981	0.0477
CONLOW	1	0.011231	0.025302	0.444	0.6572

SYSLIN Procedure
First Stage Regression Statistics

Model:
Dependent variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	24	96.51017	4.02126	90.915	0.0001
Error	1822	80.58862	0.04423		
C Total	1846	177.09879			

Root MSE	0.21031	R-Square	0.5450
Dep Mean	8.39522	Adj R-SQ	0.5390
C.V.	2.50513		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.422232	0.078017	82.319	0.0001
HHI1	1	0.013723	0.031037	0.442	0.6584
HHI2	1	-0.013799	0.030408	-0.454	0.6500
HPEN	1	-0.130144	0.228498	-0.570	0.5690
HHPEN	1	0.241091	0.312457	0.772	0.4405
HITECH	1	-0.029914	0.044490	-0.672	0.5014
BED	1	0.000217	0.000040483	5.356	0.0001
OCC	1	-0.000870	0.000232	-3.745	0.0002
FPROFIT	1	0.005278	0.015249	0.346	0.7293
COTH	1	0.099801	0.021158	4.717	0.0001
STAFFIN	1	0.009676	0.002026	4.777	0.0001
SKMIX	1	0.000278	0.000166	1.677	0.0936
RESDNTS	1	0.001514	0.013009	0.116	0.9074
BCERT	1	-0.000034901	0.000417	-0.084	0.9333
MWAGE	1	0.478950	0.044537	10.754	0.0001
MEC	1	0.004021	0.000475	8.464	0.0001
MEDI	1	0.003553	0.000642	5.538	0.0001
SYAFF	1	0.000745	0.010134	0.074	0.9414
CMI	1	0.663867	0.034869	19.039	0.0001
INCOME	1	0.000005963	0.000002073	2.876	0.0041
DRS	1	0.010098	0.005645	1.789	0.0738
PDNSTY	1	-0.000004687	0.000004388	-1.068	0.2857
NONWHITE	1	0.003464	0.000552	6.276	0.0001
CONSTATE	1	0.031567	0.013634	2.315	0.0207
CONLOW	1	-0.007649	0.016759	-0.456	0.6481

SYSLIN Procedure
First Stage Regression Statistics

Model:
Dependent variable: LMHFT

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	24	15.89900	0.66246	1.848	0.0075
Error	1822	653.31404	0.35857		
C Total	1846	673.96743			

Root MSE	0.59881	R-Square	0.0238
Dep Mean	-0.07503	Adj R-SQ	0.0109
C.V.	-798.04696		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	-0.005078	0.222132	-0.023	0.9818
HHI1	1	-0.113570	0.088369	-1.285	0.1989
HHI2	1	0.044623	0.086580	0.515	0.6063
HPEN	1	1.089856	0.650589	1.675	0.0941
HHPEN	1	-1.135768	0.889639	-1.277	0.2019
HITECH	1	0.109287	0.126673	0.863	0.3884
BED	1	-0.000242	0.000115	-2.102	0.0357
OCC	1	-0.000557	0.000661	-0.842	0.4001
FPROFIT	1	0.089809	0.043417	2.069	0.0387
COTH	1	0.043167	0.060242	0.717	0.4737
STAFFIN	1	0.002245	0.005768	0.389	0.6971
SKMIX	1	-0.000280	0.000473	-0.592	0.5538
RESDNTS	1	-0.018325	0.037039	-0.495	0.6208
BCERT	1	-0.001220	0.001187	-1.028	0.3039
MWAGE	1	-0.154127	0.126806	-1.215	0.2244
MEC	1	-0.001530	0.001353	-1.131	0.2581
MEDI	1	0.001603	0.001827	0.877	0.3804
SYAFF	1	0.034987	0.028854	1.213	0.2254
CMI	1	0.233185	0.099280	2.349	0.0189
INCOME	1	0.000001281	0.000005902	0.217	0.8283
DRS	1	-0.050610	0.016073	-3.149	0.0017
PDNSTY	1	0.000005750	0.000012495	0.460	0.6455
NONWHITE	1	-0.000118	0.001571	-0.075	0.9400
CONSTATE	1	0.007041	0.038820	0.181	0.8561
CONLOW	1	0.058561	0.047716	1.227	0.2199

SYSLIN Procedure
Two-Stage Least Squares Estimation

Model: LCOST
Dependent variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	23	96.50938	4.19606	94.916	0.0001
Error	1823	80.59142	0.04421		
C Total	1846	177.09879			

Root MSE	0.21026	R-Square	0.5449
Dep Mean	8.39522	Adj R-SQ	0.5392
C.V.	2.50449		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.422642	0.077894	82.453	0.0001
LMHFT	1	0.005598	0.264795	0.021	0.9831
HHI1	1	0.014319	0.043422	0.330	0.7416
HHI2	1	-0.013965	0.032759	-0.426	0.6699
HPEN	1	-0.135756	0.368695	-0.368	0.7128
HHPEN	1	0.246543	0.431972	0.571	0.5682
HITECH	1	-0.028865	0.050684	-0.570	0.5691
BED	1	0.000218	0.000075669	2.875	0.0041
OCC	1	-0.000867	0.000276	-3.145	0.0017
FPROFIT	1	0.004793	0.028357	0.169	0.8658
COTH	1	0.099616	0.023524	4.235	0.0001
STAFFIN	1	0.009664	0.002110	4.580	0.0001
SKMIX	1	0.000280	0.000182	1.536	0.1248
BCERT	1	-0.000032184	0.000533	-0.060	0.9518
MWAGE	1	0.479846	0.059643	8.045	0.0001
MEC	1	0.004031	0.000625	6.448	0.0001
MEDI	1	0.003542	0.000762	4.651	0.0001
CMI	1	0.662484	0.071649	9.246	0.0001
INCOME	1	0.000005963	0.000002091	2.851	0.0044
DRS	1	0.010357	0.014450	0.717	0.4736
PDNSTY	1	-0.000004718	0.000004595	-1.027	0.3047
NONWHITE	1	0.003464	0.000552	6.279	0.0001
CONSTATE	1	0.031461	0.013683	2.299	0.0216
CONLOW	1	-0.007984	0.022597	-0.353	0.7239

SYSLIN Procedure
Two-Stage Least Squares Estimation

Model: LMHFT
Dependent variable: LMHFT

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	22	20.47623	0.93074	2.581	0.0001
Error	1824	657.65247	0.36056		
C Total	1846	673.96743			

Root MSE	0.60046	R-Square	0.0302
Dep Mean	-0.07503	Adj R-SQ	0.0185
C.V.	-800.25325		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	1.313997	1.394279	0.942	0.3461
LCOST	1	-0.207684	0.208583	-0.996	0.3195
HHI1	1	-0.101408	0.087718	-1.156	0.2478
HHI2	1	0.042472	0.086676	0.490	0.6242
HPEN	1	1.003876	0.647983	1.549	0.1215
HHPEN	1	-1.024148	0.894107	-1.145	0.2522
HITECH	1	0.099115	0.127074	0.780	0.4355
BED	1	-0.000191	0.000129	-1.482	0.1386
OCC	1	-0.000734	0.000669	-1.096	0.2732
FPROFIT	1	0.088694	0.043687	2.030	0.0425
COTH	1	0.061782	0.065026	0.950	0.3422
STAFFIN	1	0.003820	0.006044	0.632	0.5274
SKMIX	1	-0.000226	0.000478	-0.472	0.6367
RESDNTS	1	-0.018016	0.037136	-0.485	0.6276
BCERT	1	-0.001362	0.001173	-1.161	0.2457
MEC	1	-0.000699	0.001542	-0.454	0.6502
MEDI	1	0.002446	0.002019	1.211	0.2260
SYAFF	1	0.034927	0.028926	1.207	0.2274
CMI	1	0.362927	0.177932	2.040	0.0415
INCOME	1	0.000001945	0.000006345	0.307	0.7592
DRS	1	-0.046878	0.016242	-2.886	0.0039
CONSTATE	1	0.012596	0.037871	0.333	0.7395
CONLOW	1	0.060330	0.047334	1.275	0.2026

SYSLIN Procedure
First Stage Regression Statistics

Model:
Dependent variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	24	25.99837	1.08327	30.872	0.0001
Error	568	19.93030	0.03509		
C Total	592	45.92867			

Root MSE	0.18732	R-Square	0.5661
Dep Mean	8.60555	Adj R-SQ	0.5477
C.V.	2.17673		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.676512	0.134247	49.733	0.0001
HHI1	1	0.118031	0.053825	2.193	0.0287
HHI2	1	-0.014722	0.045103	-0.326	0.7442
HPEN	1	0.157314	0.361145	0.436	0.6633
HHPEN	1	-0.329153	0.488576	-0.674	0.5008
HITECH	1	-0.078084	0.068982	-1.132	0.2581
BED	1	0.000060628	0.000051455	1.178	0.2392
OCC	1	-0.000963	0.000278	-3.462	0.0006
FPROFIT	1	-0.063850	0.027448	-2.326	0.0204
COTH	1	0.119402	0.024709	4.832	0.0001
STAFFIN	1	0.023030	0.003336	6.903	0.0001
SKMIX	1	0.000133	0.000164	0.810	0.4180
RESDNTS	1	0.041580	0.041470	1.003	0.3165
BCERT	1	0.001046	0.000735	1.422	0.1555
MWAGE	1	0.458555	0.076444	5.999	0.0001
MEC	1	0.003826	0.000852	4.490	0.0001
MEDI	1	0.005050	0.001120	4.508	0.0001
SYAFF	1	0.009502	0.016136	0.589	0.5562
CMI	1	0.314860	0.053147	5.924	0.0001
INCOME	1	0.000010674	0.000003596	2.968	0.0031
DRS	1	0.012908	0.007533	1.713	0.0872
PDNSTY	1	-0.000001941	0.000010677	-0.182	0.8558
NONWHITE	1	0.003372	0.000832	4.054	0.0001
CONSTATE	1	0.018100	0.019581	0.924	0.3557
CONLOW	1	-0.019426	0.027573	-0.705	0.4814

SYSLIN Procedure
First Stage Regression Statistics

Model:
Dependent variable: LMHRT

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	24	2.69903	0.11246	3.127	0.0001
Error	568	20.42612	0.03596		
C Total	592	24.53895			

Root MSE	0.18964	R-Square	0.1167
Dep Mean	-0.03908	Adj R-SQ	0.0794
C.V.	-485.26307		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.422049	0.135906	3.105	0.0020
HHI1	1	0.025007	0.054490	0.459	0.6465
HHI2	1	0.050729	0.045660	1.111	0.2670
HPEN	1	0.434043	0.365610	1.187	0.2357
HHPEN	1	-0.732734	0.494615	-1.481	0.1390
HITECH	1	0.027876	0.069835	0.399	0.6899
BED	1	-0.000166	0.000052091	-3.192	0.0015
OCC	1	-0.000214	0.000282	-0.760	0.4475
FPROFIT	1	-0.015447	0.027788	-0.556	0.5785
COTH	1	-0.021070	0.025015	-0.842	0.4000
STAFFIN	1	-0.003963	0.003378	-1.173	0.2411
SKMIX	1	-0.000232	0.000166	-1.397	0.1630
RESDNTS	1	-0.016797	0.041982	-0.400	0.6892
BCERT	1	-0.001019	0.000745	-1.369	0.1717
MWAGE	1	-0.284050	0.077389	-3.670	0.0003
MEC	1	-0.001401	0.000863	-1.624	0.1050
MEDI	1	0.001957	0.001134	1.726	0.0850
SYAFF	1	-0.014277	0.016335	-0.874	0.3825
CMI	1	0.051962	0.053804	0.966	0.3346
INCOME	1	-0.000001069	0.000003640	-0.294	0.7692
DRS	1	-0.005312	0.007626	-0.696	0.4864
PDNSTY	1	0.000006856	0.000010809	0.634	0.5262
NONWHITE	1	0.000982	0.000842	1.166	0.2441
CONSTATE	1	-0.064971	0.019823	-3.278	0.0011
CONLOW	1	0.032508	0.027914	1.165	0.2447

SYSLIN Procedure
Two-Stage Least Squares Estimation

Model: LCOST
Dependent variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	23	25.98183	1.12964	17.321	0.0001
Error	569	37.10931	0.06522		
C Total	592	45.92867			

Root MSE	0.25538	R-Square	0.4118
Dep Mean	8.60555	Adj R-SQ	0.3880
C.V.	2.96761		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	7.071874	0.618892	11.427	0.0001
LMHRT	1	-0.943112	1.438853	-0.655	0.5124
HHI1	1	0.140758	0.084658	1.663	0.0969
HHI2	1	0.033626	0.096775	0.347	0.7284
HPEN	1	0.559697	0.802390	0.698	0.4858
HHPEN	1	-1.020488	1.266347	-0.806	0.4207
HITECH	1	-0.039002	0.091739	-0.425	0.6709
BED	1	-0.000099722	0.000243	-0.410	0.6817
OCC	1	-0.001167	0.000482	-2.422	0.0157
FPROFIT	1	-0.078634	0.044904	-1.751	0.0805
COTH	1	0.100371	0.044774	2.242	0.0254
STAFFIN	1	0.019215	0.007286	2.637	0.0086
SKMIX	1	-0.000079976	0.000397	-0.202	0.8403
BCERT	1	0.000030573	0.001727	0.018	0.9859
MWAGE	1	0.194583	0.421440	0.462	0.6445
MEC	1	0.002509	0.002295	1.093	0.2748
MEDI	1	0.006870	0.003256	2.110	0.0353
CMI	1	0.365532	0.101651	3.596	0.0004
INCOME	1	0.000009649	0.000005121	1.884	0.0601
DRS	1	0.007805	0.012685	0.615	0.5386
PDNSTY	1	0.000004725	0.000017213	0.274	0.7838
NONWHITE	1	0.004254	0.001815	2.343	0.0194
CONSTATE	1	-0.043493	0.097200	-0.447	0.6547
CONLOW	1	0.012038	0.060545	0.199	0.8425

SYSLIN Procedure
Two-Stage Least Squares Estimation

Model: LMHRT
Dependent variable: LMHRT

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	22	3.78020	0.17183	4.432	0.0001
Error	570	22.10079	0.03877		
C Total	592	24.53895			

Root MSE	0.19691	R-Square	0.1461
Dep Mean	-0.03908	Adj R-SQ	0.1131
C.V.	-503.87750		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	2.334258	0.883781	2.641	0.0085
LCOST	1	-0.287622	0.128101	-2.245	0.0251
HHI1	1	0.080232	0.059721	1.343	0.1797
HHI2	1	0.052607	0.046876	1.122	0.2622
HPEN	1	0.353970	0.372306	0.951	0.3421
HHPEN	1	-0.698243	0.501766	-1.392	0.1646
HITECH	1	-0.000542	0.072491	-0.007	0.9940
BED	1	-0.000134	0.000053083	-2.532	0.0116
OCC	1	-0.000518	0.000313	-1.658	0.0980
FPROFIT	1	-0.035994	0.028339	-1.270	0.2046
COTH	1	0.009822	0.031159	0.315	0.7527
STAFFIN	1	0.001732	0.004535	0.382	0.7026
SKMIX	1	-0.000206	0.000172	-1.196	0.2321
RESDNTS	1	-0.015509	0.043870	-0.354	0.7238
BCERT	1	-0.000915	0.000776	-1.180	0.2385
MEC	1	-0.000145	0.001024	-0.141	0.8876
MEDI	1	0.003552	0.001397	2.542	0.0113
SYAFF	1	-0.009582	0.016990	-0.564	0.5730
CMI	1	0.104188	0.070273	1.483	0.1387
INCOME	1	-0.000000565	0.000004267	-0.132	0.8947
DRS	1	0.001080	0.008087	0.133	0.8938
CONSTATE	1	-0.063621	0.020330	-3.129	0.0018
CONLOW	1	0.029252	0.028635	1.022	0.3074

APPENDIX D

ORDINARY LEAST SQUARES REGRESSION RESULTS

Model: MODEL1
Dependent Variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	22	100.36749	4.56216	84.280	0.0001
Error	1935	104.74378	0.05413		
C Total	1957	205.11127			

Root MSE	0.23266	R-square	0.4893
Dep Mean	8.38696	Adj R-sq	0.4835
C.V.	2.77408		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.691120	0.07743337	86.411	0.0001
LMORT	1	-0.039656	0.03732148	-1.063	0.2881
HHI1	1	0.011533	0.03268041	0.353	0.7242
HHI2	1	-0.003321	0.02644572	-0.126	0.9001
HPEN	1	0.064064	0.06365213	1.006	0.3143
HITECH	1	-0.037262	0.04555845	-0.818	0.4135
BED	1	0.000183	0.00004396	4.167	0.0001
OCC	1	-0.000978	0.00025132	-3.891	0.0001
FPROFIT	1	0.005098	0.01614210	0.316	0.7522
COTH	1	0.121566	0.02295640	5.296	0.0001
STAFFIN	1	0.006609	0.00203674	3.245	0.0012
SKMIX	1	0.000285	0.00018339	1.553	0.1205
BCERT	1	-0.000444	0.00042896	-1.035	0.3010
MWAGE	1	0.488581	0.04687534	10.423	0.0001
MEC	1	0.002322	0.00048167	4.821	0.0001
MEDI	1	0.002057	0.00065025	3.163	0.0016
CMI	1	0.614257	0.03647399	16.841	0.0001
INCOME	1	0.000004213	0.00000225	1.871	0.0615
DRS	1	0.009356	0.00622974	1.502	0.1333
PDNSTY	1	-0.000003416	0.00000477	-0.717	0.4737
NONWHITE	1	0.003355	0.00058759	5.710	0.0001
CONSTATE	1	0.038370	0.01465274	2.619	0.0089
CONLOW	1	-0.004911	0.01788402	-0.275	0.7837

Variable	DF	Variance Inflation
INTERCEP	1	0.00000000
LMORT	1	1.16446568
HHI1	1	1.51170569
HHI2	1	1.15225580
HPEN	1	1.63039402
HITECH	1	1.19663807
BED	1	2.40707241
OCC	1	1.24024952
FPROFIT	1	1.33983151
COTH	1	1.66240632
STAFFIN	1	1.32376429
SKMIX	1	1.05775127
BCERT	1	1.15931914
MWAGE	1	2.39188437
MEC	1	1.32388784
MEDI	1	1.27996086
CMI	1	1.96147659
INCOME	1	2.32926578
DRS	1	1.53242893
PDNSTY	1	1.81050140
NONWHITE	1	1.64342210
CONSTATE	1	1.50351645
CONLOW	1	1.14924928

Model: MODEL1
Dependent Variable: LMCVA

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	21	7.00209	0.33343	3.074	0.0001
Error	1921	208.39837	0.10848		
C Total	1942	215.40046			

Root MSE	0.32937	R-square	0.0325
Dep Mean	-0.06994	Adj R-sq	0.0219
C.V.	-470.90385		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.778920	0.24213046	3.217	0.0013
LCOST	1	-0.090215	0.03231063	-2.792	0.0053
HHI1	1	-0.104623	0.04549417	-2.300	0.0216
HHI2	1	-0.033432	0.03720584	-0.899	0.3690
HPEN	1	0.063448	0.08629074	0.735	0.4623
HITECH	1	0.028385	0.06742680	0.421	0.6738
BED	1	-0.000068844	0.00006220	-1.107	0.2685
OCC	1	0.000316	0.00035523	0.889	0.3739
FPROFIT	1	-0.046867	0.02213169	-2.118	0.0343
COTH	1	-0.016000	0.03279303	-0.488	0.6257
STAFFIN	1	0.002198	0.00294480	0.747	0.4554
SKMIX	1	-0.000346	0.00025938	-1.334	0.1823
RESDNTS	1	0.003585	0.01522357	0.235	0.8139
BCERT	1	0.000879	0.00060319	1.458	0.1451
MEC	1	-0.001127	0.00070296	-1.603	0.1091
MEDI	1	-0.000538	0.00092847	-0.579	0.5627
SYAFF	1	0.002953	0.01543852	0.191	0.8483
CMI	1	-0.021687	0.05671091	-0.382	0.7022
INCOME	1	0.000003847	0.00000293	1.313	0.1895
DRS	1	-0.018668	0.00861896	-2.166	0.0304
CONSTATE	1	-0.040177	0.02019209	-1.990	0.0468
CONLOW	1	0.010132	0.02487299	0.407	0.6838

Variable	DF	Variance Inflation
INTERCEP	1	0.00000000
LCOST	1	1.90999605
HHI1	1	1.45640067
HHI2	1	1.12836705
HPEN	1	1.48743117
HITECH	1	1.28864745
BED	1	2.38253234
OCC	1	1.21333299
FPROFIT	1	1.23988806
COTH	1	1.69127650
STAFFIN	1	1.32599042
SKMIX	1	1.05544768
RESDNTS	1	1.10029811
BCERT	1	1.13089260
MEC	1	1.34586728
MEDI	1	1.28493481
SYAFF	1	1.03200216
CMI	1	2.27063969
INCOME	1	1.95365635
DRS	1	1.45738702
CONSTATE	1	1.41720354
CONLOW	1	1.10814774

Model: MODEL1
Dependent Variable: LMHFT

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	21	19.49668	0.92841	2.589	0.0001
Error	1825	654.47075	0.35861		
C Total	1846	673.96743			

Root MSE	0.59884	R-square	0.0289
Dep Mean	-0.07503	Adj R-sq	0.0178
C.V.	-798.09635		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.031730	0.46808662	0.068	0.9460
LCOST	1	-0.004808	0.06344882	-0.076	0.9396
HHI1	1	-0.133033	0.08500400	-1.565	0.1178
HHI2	1	-0.022200	0.06951818	-0.319	0.7495
HPEN	1	0.221698	0.16209866	1.368	0.1716
HITECH	1	0.095094	0.12620034	0.754	0.4512
BED	1	-0.000252	0.00011504	-2.195	0.0283
OCC	1	-0.000604	0.00065746	-0.919	0.3581
FPROFIT	1	0.073197	0.04171013	1.755	0.0794
COTH	1	0.041272	0.06045000	0.683	0.4949
STAFFIN	1	0.001688	0.00574425	0.294	0.7688
SKMIX	1	-0.000315	0.00047229	-0.666	0.5054
RESDNTS	1	-0.016900	0.03702483	-0.456	0.6481
BCERT	1	-0.001342	0.00116996	-1.147	0.2515
MEC	1	-0.001347	0.00136323	-0.988	0.3233
MEDI	1	0.001648	0.00183192	0.899	0.3686
SYAFF	1	0.034036	0.02883463	1.180	0.2380
CMI	1	0.221362	0.10787510	2.052	0.0403
INCOME	1	-0.000001381	0.00000541	-0.255	0.7984
DRS	1	-0.049533	0.01588032	-3.119	0.0018
CONSTATE	1	0.014840	0.03774493	0.393	0.6943
CONLOW	1	0.060950	0.04645001	1.312	0.1896

Variable	DF	Variance Inflation
INTERCEP	1	0.00000000
LCOST	1	1.98808650
HHI1	1	1.45658050
HHI2	1	1.12792296
HPEN	1	1.49223374
HITECH	1	1.28019848
BED	1	2.31265479
OCC	1	1.18987006
FPROFIT	1	1.25148163
COTH	1	1.71256907
STAFFIN	1	1.36730684
SKMIX	1	1.05627249
RESDNTS	1	1.09555509
BCERT	1	1.12944847
MEC	1	1.37937755
MEDI	1	1.31011364
SYAFF	1	1.03363319
CMI	1	2.22492729
INCOME	1	1.94653650
DRS	1	1.44897338
CONSTATE	1	1.42271303
CONLOW	1	1.10583828

Model: MODEL1
Dependent Variable: LMHRT

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	21	3.58334	0.17064	4.649	0.0001
Error	571	20.95561	0.03670		
C Total	592	24.53895			

Root MSE	0.19157	R-square	0.1460
Dep Mean	-0.03908	Adj R-sq	0.1146
C.V.	-490.21950		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	0.762895	0.30608800	2.492	0.0130
LCOST	1	-0.053671	0.04057031	-1.323	0.1864
HHI1	1	0.018264	0.05196050	0.352	0.7253
HHI2	1	0.018477	0.03750371	0.493	0.6224
HPEN	1	-0.198877	0.08913702	-2.231	0.0261
HITECH	1	0.017736	0.06999418	0.253	0.8001
BED	1	-0.000156	0.00005013	-3.117	0.0019
OCC	1	-0.000294	0.00028525	-1.030	0.3037
FPROFIT	1	-0.032318	0.02748082	-1.176	0.2401
COTH	1	-0.022093	0.02571306	-0.859	0.3906
STAFFIN	1	-0.003817	0.00349921	-1.091	0.2758
SKMIX	1	-0.000239	0.00016724	-1.430	0.1531
RESDNTS	1	-0.029238	0.04220168	-0.693	0.4887
BCERT	1	-0.001127	0.00074857	-1.506	0.1326
MEC	1	-0.001062	0.00088105	-1.205	0.2286
MEDI	1	0.002152	0.00114841	1.874	0.0614
SYAFF	1	-0.012811	0.01647427	-0.778	0.4371
CMI	1	0.030980	0.05412519	0.572	0.5673
INCOME	1	-0.000005182	0.00000332	-1.559	0.1196
DRS	1	-0.002863	0.00766171	-0.374	0.7088
CONSTATE	1	-0.059969	0.01968836	-3.046	0.0024
CONLOW	1	0.026556	0.02771145	0.958	0.3383

Variable	DF	Variance Inflation
INTERCEP	1	0.00000000
LCOST	1	2.05985345
HHI1	1	1.60578356
HHI2	1	1.15556518
HPEN	1	1.67025425
HITECH	1	1.26621354
BED	1	1.82099918
OCC	1	1.09666795
FPROFIT	1	1.25464471
COTH	1	2.01875431
STAFFIN	1	1.44063781
SKMIX	1	1.06720391
RESDNTS	1	1.16008527
B[illegible]ERT	1	1.11144996
MEC	1	1.47671631
MEDI	1	1.46414028
SYAFF	1	1.05068755
CMI	1	1.31163478
INCOME	1	2.03829523
DRS	1	1.32087655
CONSTATE	1	1.46161107
CONLOW	1	1.14509355

Model: MODEL1
Dependent Variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	23	100.86261	4.38533	81.356	0.0001
Error	1934	104.24866	0.05390		
C Total	1957	205.11127			

Root MSE	0.23217	R-square	0.4917
Dep Mean	8.38696	Adj R-sq	0.4857
C.V.	2.76823		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.823415	0.08863446	76.984	0.0001
HHI1	1	0.001797	0.03327809	0.054	0.9569
HHI2	1	-0.023207	0.03242511	-0.716	0.4743
HPEN	1	-0.176053	0.24541141	-0.717	0.4732
HHPEN	1	0.336159	0.33376186	1.007	0.3140
HITECH	1	-0.037450	0.04556221	-0.822	0.4112
BED	1	0.000177	0.00004384	4.040	0.0001
OCC	1	-0.000976	0.00025072	-3.893	0.0001
MORT	1	-0.102118	0.03355851	-3.043	0.0024
FPROFIT	1	0.002224	0.01613164	0.138	0.8903
COTH	1	0.121895	0.02292144	5.318	0.0001
STAFFIN	1	0.006529	0.00203381	3.210	0.0013
SKMIX	1	0.000262	0.00018314	1.431	0.1527
BCERT	1	-0.000489	0.00042827	-1.141	0.2539
MWAGE	1	0.486217	0.04676864	10.396	0.0001
MEC	1	0.002363	0.00047986	4.924	0.0001
MEDI	1	0.002091	0.00064944	3.220	0.0013
CMI	1	0.613220	0.03639711	16.848	0.0001
INCOME	1	0.000004366	0.00000225	1.943	0.0522
DRS	1	0.008160	0.00619485	1.317	0.1879
PDNSTY	1	-0.000004174	0.00000476	-0.877	0.3808
NONWHITE	1	0.003398	0.00058978	5.762	0.0001
CONSTATE	1	0.034907	0.01464593	2.383	0.0173
CONLOW	1	-0.001605	0.01800406	-0.089	0.9290

Model: MODEL2
Dependent Variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	24	102.02578	4.25107	79.714	0.0001
Error	1933	103.08550	0.05333		
C Total	1957	205.11127			

Root MSE	0.23093	R-square	0.4974
Dep Mean	8.38696	Adj R-sq	0.4912
C.V.	2.75346		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	7.055140	0.10116485	69.739	0.0001
HHI1	1	-0.002837	0.03311534	-0.086	0.9317
HHI2	1	-0.021479	0.03225417	-0.666	0.5055
HPEN	1	-0.156347	0.24413805	-0.640	0.5220
HHPEN	1	0.333074	0.33198114	1.003	0.3158
HITECH	1	-0.022141	0.04543742	-0.487	0.6261
BED	1	0.000185	0.00004364	4.246	0.0001
OCC	1	-0.000862	0.00025059	-3.439	0.0006
MORT	1	-0.663970	0.12484986	-5.318	0.0001
MORT2	1	0.273567	0.05857677	4.670	0.0001
FPROFIT	1	0.003179	0.01604685	0.198	0.8430
COTH	1	0.115759	0.02283694	5.069	0.0001
STAFFIN	1	0.005634	0.00203200	2.773	0.0056
SKMIX	1	0.000254	0.00018217	1.395	0.1632
BCERT	1	-0.000544	0.00042615	-1.277	0.2017
MWAGE	1	0.482023	0.04652769	10.360	0.0001
MEC	1	0.002684	0.00048223	5.566	0.0001
MEDI	1	0.002124	0.00064602	3.288	0.0010
CMI	1	0.636321	0.03653918	17.415	0.0001
INCOME	1	0.000005126	0.00000224	2.287	0.0223
DRS	1	0.006343	0.00617406	1.027	0.3044
PDNSTY	1	-0.000004455	0.00000474	-0.941	0.3470
NONWHITE	1	0.003332	0.00058680	5.678	0.0001
CONSTATE	1	0.033215	0.01457227	2.279	0.0228
CONLOW	1	-0.001304	0.01790808	-0.073	0.9420

Model: MODEL1
Dependent Variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	23	104.84748	4.55859	93.432	0.0001
Error	1919	93.62874	0.04879		
C Total	1942	198.47622			

Root MSE	0.22089	R-square	0.5283
Dep Mean	8.38716	Adj R-sq	0.5226
C.V.	2.63361		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.637697	0.07902972	83.990	0.0001
HHI1	1	-0.005746	0.03172691	-0.181	0.8563
HHI2	1	-0.025137	0.03096551	-0.812	0.4170
HPEN	1	-0.192940	0.23388148	-0.825	0.4095
HHPEN	1	0.386415	0.31812880	1.215	0.2246
HITECH	1	-0.048197	0.04362487	-1.105	0.2694
BED	1	0.000187	0.00004179	4.463	0.0001
OCC	1	-0.000797	0.00023998	-3.321	0.0009
MCVA	1	-0.050768	0.01637960	-3.099	0.0020
FPROFIT	1	0.006661	0.01544544	0.431	0.6663
COTH	1	0.112568	0.02184579	5.153	0.0001
STAFFIN	1	0.008515	0.00198299	4.294	0.0001
SKMIX	1	0.000257	0.00017418	1.477	0.1398
BCERT	1	-0.000469	0.00040960	-1.145	0.2523
MWAGE	1	0.498259	0.04473655	11.138	0.0001
MEC	1	0.003121	0.00047149	6.620	0.0001
MEDI	1	0.002287	0.00062366	3.666	0.0003
CMI	1	0.644905	0.03539332	18.221	0.0001
INCOME	1	0.000004675	0.00000215	2.177	0.0296
DRS	1	0.009272	0.00585917	1.582	0.1137
PDNSTY	1	-0.000003264	0.00000453	-0.721	0.4711
NONWHITE	1	0.003333	0.00056320	5.918	0.0001
CONSTATE	1	0.035940	0.01390499	2.585	0.0098
CONLOW	1	-0.007816	0.01713480	-0.456	0.6483

Model: MODEL2
Dependent Variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	24	105.32847	4.38869	90.367	0.0001
Error	1918	93.14775	0.04857		
C Total	1942	198.47622			

Root MSE	0.22037	R-square	0.5307
Dep Mean	8.38716	Adj R-sq	0.5248
C.V.	2.62753		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.679223	0.07994353	83.549	0.0001
HHI1	1	-0.010615	0.03169135	-0.335	0.7377
HHI2	1	-0.026553	0.03089720	-0.859	0.3902
HPEN	1	-0.206951	0.23338324	-0.887	0.3753
HHPEN	1	0.412505	0.31750157	1.299	0.1940
HITECH	1	-0.052765	0.04354820	-1.212	0.2258
BED	1	0.000191	0.00004172	4.584	0.0001
OCC	1	-0.000759	0.00023974	-3.164	0.0016
MCVA	1	-0.144865	0.03407446	-4.251	0.0001
MCVA2	1	0.037043	0.01177066	3.147	0.0017
FPROFIT	1	0.006091	0.01541080	0.395	0.6927
COTH	1	0.110450	0.02180567	5.065	0.0001
STAFFIN	1	0.008482	0.00197844	4.287	0.0001
SKMIX	1	0.000249	0.00017380	1.431	0.1525
BCERT	1	-0.000429	0.00040885	-1.049	0.2943
MWAGE	1	0.501749	0.04464690	11.238	0.0001
MEC	1	0.003200	0.00047106	6.793	0.0001
MEDI	1	0.002268	0.00062225	3.644	0.0003
CMI	1	0.650114	0.03535028	18.391	0.0001
INCOME	1	0.000004637	0.00000214	2.164	0.0306
DRS	1	0.009048	0.00584605	1.548	0.1219
PDNSTY	1	-0.000003446	0.00000452	-0.763	0.4458
NONWHITE	1	0.003267	0.00056229	5.810	0.0001
CONSTATE	1	0.034824	0.01387737	2.509	0.0122
CONLOW	1	-0.007307	0.01709595	-0.427	0.6691

Model: MODEL1
Dependent Variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	23	96.58033	4.19914	95.072	0.0001
Error	1823	80.51847	0.04417		
C Total	1846	177.09879			

Root MSE	0.21016	R-square	0.5453
Dep Mean	8.39522	Adj R-sq	0.5396
C.V.	2.50336		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.412747	0.07822052	81.983	0.0001
HHI1	1	0.014800	0.03102457	0.477	0.6334
HHI2	1	-0.013906	0.03037794	-0.458	0.6472
HPEN	1	-0.143167	0.22855485	-0.626	0.5311
HHPEN	1	0.254277	0.31235004	0.814	0.4157
HITECH	1	-0.029943	0.04268522	-0.701	0.4831
BED	1	0.000219	0.00004023	5.454	0.0001
OCC	1	-0.000864	0.00023218	-3.721	0.0002
MHFT	1	0.009330	0.00736019	1.268	0.2051
FPROFIT	1	0.004128	0.01526494	0.270	0.7869
COTH	1	0.099519	0.02111314	4.714	0.0001
STAFFIN	1	0.009705	0.00202440	4.794	0.0001
SKMIX	1	0.000281	0.00016590	1.693	0.0907
BCERT	1	-0.000017592	0.00041558	-0.042	0.9662
MWAGE	1	0.480263	0.04450141	10.792	0.0001
MEC	1	0.004059	0.00047560	8.535	0.0001
MEDI	1	0.003562	0.00064087	5.558	0.0001
CMI	1	0.660045	0.03495492	18.883	0.0001
INCOME	1	0.000005953	0.00000207	2.876	0.0041
DRS	1	0.010240	0.00563897	1.816	0.0696
PDNSTY	1	-0.000004642	0.00000438	-1.059	0.2897
NONWHITE	1	0.003471	0.00055125	6.297	0.0001
CONSTATE	1	0.031158	0.01360948	2.289	0.0222
CONLOW	1	-0.008540	0.01675748	-0.510	0.6104

Model: MODEL2
Dependent Variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	24	96.97299	4.04054	91.879	0.0001
Error	1822	80.12580	0.04398		
C Total	1846	177.09879			

Root MSE	0.20971	R-square	0.5476
Dep Mean	8.39522	Adj R-sq	0.5416
C.V.	2.49793		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.423344	0.07813149	82.212	0.0001
HHI1	1	0.011043	0.03098285	0.356	0.7216
HHI2	1	-0.013334	0.03031270	-0.440	0.6601
HPEN	1	-0.143171	0.22805943	-0.628	0.5302
HHPEN	1	0.267207	0.31170302	0.857	0.3914
HITECH	1	-0.030743	0.04259353	-0.722	0.4705
BED	1	0.000224	0.00004017	5.576	0.0001
OCC	1	-0.000838	0.00023185	-3.613	0.0003
MHFT	1	-0.018473	0.01185365	-1.558	0.1193
MHFT2	1	0.006745	0.00225735	2.988	0.0028
FPROFIT	1	0.003375	0.01523394	0.222	0.8247
COTH	1	0.099094	0.02106785	4.704	0.0001
STAFFIN	1	0.009852	0.00202061	4.876	0.0001
SKMIX	1	0.000276	0.00016555	1.668	0.0954
BCERT	1	-0.000032345	0.00041471	-0.078	0.9378
MWAGE	1	0.483382	0.04441722	10.883	0.0001
MEC	1	0.004179	0.00047625	8.774	0.0001
MEDI	1	0.003554	0.00063949	5.558	0.0001
CMI	1	0.661155	0.03488113	18.955	0.0001
INCOME	1	0.000005693	0.00000207	2.754	0.0060
DRS	1	0.009953	0.00562756	1.769	0.0771
PDNSTY	1	-0.000004748	0.00000437	-1.086	0.2778
NONWHITE	1	0.003438	0.00055016	6.250	0.0001
CONSTATE	1	0.032761	0.01359057	2.411	0.0160
CONLOW	1	-0.007316	0.01672618	-0.437	0.6619

Model: MODEL1
Dependent Variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	23	25.95404	1.12844	32.145	0.0001
Error	569	19.97463	0.03510		
C Total	592	45.92867			

Root MSE	0.18736	R-square	0.5651
Dep Mean	8.60555	Adj R-sq	0.5475
C.V.	2.17723		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.689111	0.14658790	45.632	0.0001
HHI1	1	0.112827	0.05361064	2.105	0.0358
HHI2	1	-0.015107	0.04520673	-0.334	0.7384
HPEN	1	0.145962	0.36161291	0.404	0.6866
HHPEN	1	-0.317364	0.48975502	-0.648	0.5172
HITECH	1	-0.053869	0.06520504	-0.826	0.4091
BED	1	0.000052313	0.00005154	1.015	0.3105
OCC	1	-0.000973	0.00027838	-3.496	0.0005
MHRT	1	-0.003180	0.03892915	-0.082	0.9349
FPROFIT	1	-0.062221	0.02738334	-2.272	0.0234
COTH	1	0.119694	0.02468465	4.849	0.0001
STAFFIN	1	0.022940	0.00333643	6.876	0.0001
SKMIX	1	0.000134	0.00016383	0.820	0.4126
BCERT	1	0.000952	0.00073180	1.300	0.1940
MWAGE	1	0.461253	0.07729696	5.967	0.0001
MEC	1	0.003799	0.00085684	4.434	0.0001
MEDI	1	0.004990	0.00112119	4.450	0.0001
CMI	1	0.318759	0.05305275	6.008	0.0001
INCOME	1	0.000010617	0.00000360	2.952	0.0033
DRS	1	0.012681	0.00753279	1.683	0.0928
PDNSTY	1	-0.000001279	0.00001068	-0.120	0.9047
NONWHITE	1	0.003326	0.00083056	4.005	0.0001
CONSTATE	1	0.017549	0.01976531	0.888	0.3750
CONLOW	1	-0.018980	0.02758400	-0.688	0.4917

Model: MODEL2
Dependent Variable: LCOST

Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Value	Prob>F
Model	24	26.14049	1.08919	31.264	0.0001
Error	568	19.78819	0.03484		
C Total	592	45.92867			

Root MSE	0.18665	R-square	0.5692
Dep Mean	8.60555	Adj R-sq	0.5509
C.V.	2.16895		

Parameter Estimates

Variable	DF	Parameter Estimate	Standard Error	T for H0: Parameter=0	Prob > |T|
INTERCEP	1	6.820218	0.15664248	43.540	0.0001
HHI1	1	0.112829	0.05340681	2.113	0.0351
HHI2	1	-0.022485	0.04514766	-0.498	0.6186
HPEN	1	0.125701	0.36034446	0.349	0.7273
HHPEN	1	-0.278334	0.48818452	-0.570	0.5688
HITECH	1	-0.055805	0.06496251	-0.859	0.3907
BED	1	0.000053754	0.00005135	1.047	0.2956
OCC	1	-0.000938	0.00027773	-3.379	0.0008
MHRT	1	-0.239029	0.10907749	-2.191	0.0288
MHRT2	1	0.091769	0.03966896	2.313	0.0211
FPROFIT	1	-0.072228	0.02762008	-2.615	0.0092
COTH	1	0.116512	0.02462926	4.731	0.0001
STAFFIN	1	0.022244	0.00333734	6.665	0.0001
SKMIX	1	0.000120	0.00016332	0.734	0.4630
BCERT	1	0.000974	0.00072908	1.335	0.1823
MWAGE	1	0.465803	0.07702818	6.047	0.0001
MEC	1	0.003929	0.00085543	4.593	0.0001
MEDI	1	0.005052	0.00111725	4.522	0.0001
CMI	1	0.329297	0.05304698	6.208	0.0001
INCOME	1	0.000010326	0.00000359	2.880	0.0041
DRS	1	0.011611	0.00751839	1.544	0.1231
PDNSTY	1	-0.000002778	0.00001065	-0.261	0.7944
NONWHITE	1	0.003361	0.00082754	4.061	0.0001
CONSTATE	1	0.016429	0.01969611	0.834	0.4046
CONLOW	1	-0.018408	0.02748023	-0.670	0.5032

APPENDIX E

REGRESSION RESULTS--DEPENDENT VARIABLE 1991 COST PER ADJUSTED ADMISSION: 29 LARGEST MSAS

Regression Results--Dependent Variable 1991 Cost Per Adjusted Admission: 29 Largest MSAs

Regressors	Group A Coefficient (SE)	Group B Coefficient (SE)
HHI1	1.547*** (0.436)	1.520*** (0.428)
DRS	0.036* (0.019)	0.036* (0.019)
INCOME	-0.000006 (0.000004)	-0.000006 (0.000004)
PDNSTY	0.000002 (0.000007)	0.000002 (0.000007)
FPROFIT	-0.016 (0.025)	-0.018 (0.025)
COTH	0.174*** (0.031)	0.160*** (0.030)
MWAGE	0.459*** (0.071)	0.438*** (0.069)
MEDI	0.003*** (0.0009)	0.004*** (0.0009)
MEC	0.002** (0.0007)	0.002*** (0.007)
OCC	-0.001*** (0.0003)	-0.0009*** (0.0003)
MORT	-0.0116* (0.062)	-0.162* (0.062)
CMI	0.754*** (0.055)	0.798*** (0.056)
Constant	5.545*** (0.423)	5.549*** (0.418)
N	840	834
Adjusted R-squared	0.464	0.481
Model F-value	61.652	65.274

* Significant at the 0.10 level
** Significant at the 0.05 level
*** Significant at the 0.01 level

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