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ORGANIZATIONAL SLACK, EFFICIENCY, AND QUALITY OF CARE IN ACUTE CARE HOSPITALS

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ORGANIZATIONAL SLACK, EFFICIENCY, AND QUALITY OF CARE IN ACUTE CARE HOSPITALS

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy at Virginia Commonwealth University

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ABSTRACT

ORGANIZATIONAL SLACK, EFFICIENCY, AND QUALITY OF CARE IN ACUTE CARE HOSPITALS

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The relationship between technical efficiency and quality of care in hospitals is studied in the context of resource availability in hospital organizations. The resource availability of hospitals is conceptualized by organizational slack.

An integrated model is developed encompassing the source of organizational slack, its impact on technical efficiency and on quality of care, and its impact on the relationship between efficiency and quality. Organizational threat as an environmental factor affecting the level of slack is measured by the level of competition and regulation. Organizational slack is measured using financial and operational indicators of the hospitals. Technical efficiency is estimated by efficiency scores generated using the Data Envelopment Analysis. Mortality rates of Medicare patients are used as the proxy for quality of care in individual hospitals.

The sample is composed of 832 urban, not-for-profit hospitals in the United States. The data are compiled from the Health Care Finance Administration data set and the American

Hospitals Association annual survey data set. Hypotheses are tested using ordinary least squares regression and logistic regression.

The analysis reveals that the level of and change in organizational slack have a negative relationship with efficiency and a positive relationship with quality of care. The results also indicate that environmental threat has a negative effect on level of slack, and efficiency has a negative effect on quality of care.

The findings are discussed in terms of the theoretical implications for the concept of organizational slack and the implications for health policy and hospital management.

CHAPTER 1

INTRODUCTION

A hospital's ultimate goal is the provision of high quality care with high efficiency. Achievement of this task requires maintenance of an appropriate level of resources in the hospital as an organization. Organizations are open systems, interacting with their environments to secure the resources they need. The availability of resources from the environment, combined with, the availability of internally reserved resources, influences hospital organizations' strategic and operational decisions, which in turn affect their efficiency and effectiveness (Cyert & March, 1963; Thompson, 1967).

Until the 1970s the environment of the hospital industry in the United States was relatively generous, with the expansion of access to care, abundant public and philanthropic support, and little interference from government. The underlying philosophy of government health policy was that Americans needed more medical care and that medical professionals and private voluntary institutions were best equipped to decide how to organize those services (Starr, 1982). However, societal confidence in the health care industry has dissipated as society has been confronted with limited resources and exponentially increasing heath care spending. This change of environment has led to stringent governmental controls over hospital expenditures and increased competition among providers.

The current hospital environment can be characterized as resource scarce, from the combined effect of the increasing governmental regulations and the increasing competition among the health care providers. The restructured economic incentives of the Prospective Payment System (PPS) influenced the practice patterns of hospital care (Rogers, et al., 1990). The significant declines in hospital admissions and length of stays for both Medicare and non-Medicare populations have been attributed to the PPS (Scheffler, et al., 1994). At the same time, competition for inpatient markets has intensified since the appearance of alternative care delivery systems such as Health Maintenance Organizations (HMOs), Preferred Providers Organizations (PPOs), and other managed care organizations. These plans demand discounted rates and strict utilization review for their patients. In addition, the emergence of freestanding ambulatory surgery centers supported by rapidly advancing technology has eroded the traditional market for hospital inpatient care (Jonas & Rosenberg, 1986). Observing these environmental changes, Shortell et al. (1994) predict that hospital care in the future will be concentrated in intensive care.

This study conceptualizes the environmental resource availability for a hospital in terms of the level of environmental threat which the hospital confronts. Staw, Sandelahds, and Dutton (1981) define environmental threat as the environmental events such as resource scarcity, competition, or reduction in the size of the market that have impending negative or harmful consequences for the entity. Under conditions of threat, they argue, organizations are preoccupied with conserving their resources by emphasizing efficiency in their operations.

In response to the current environmental threat, hospitals have become more conscious about efficiency in their operations. Hospitals' emphasis on efficiency, in turn, has caused concerns about the implication for the quality of care. There is growing concern that, as hospitals are increasingly buffeted by external pressures to reduce costs, they may be forced to allocate resources in ways that could adversely affect patient care outcomes. The probable adverse effects of the efficiency emphasis on quality of care in this environment are speculated on in numerous studies (Broyles, 1990; Gay, et al., 1989; Harkey & Vraciu, 1992; Hartz, et al., 1989). This argument ultimately leads to the debate on how efficiency and quality of care are related.

Theoretical Perspectives on the Relationship of Efficiency and Quality

Garvin (1988) explained the relationship of efficiency and quality in terms of three mainstream perspectives: the production-based approach, the operational management approach, and the quality costs approach. Quality and efficiency are negatively related in the production-based approach. In this perspective, the quality differences are conceived as the variations in performance, features, durability, or other product and service attributes that require more expensive components or materials, additional labor hours in construction, or other commitments of tangible resources.

A positive relationship between efficiency and quality is argued in operations management literature. In this perspective, quality is defined as the conformity to specifications. Efficiency and quality are positively related, because the costs of improving quality are thought to be less than the resulting savings in rework, scrap, warranty expenses, and other costs involved in quality control activities. Furthermore, the efforts to improve quality normally lead to better understanding of work processes, and the learning translates into higher efficiency.

Another distinct perspective on the relationship is the "quality costs" approach. Quality costs are defined as any expenditures on manufacturing or service in excess of those that would have been incurred if the production had been built or the service had been performed exactly right the first time (Campanella & Corcoran, 1983). Typically, the quality costs are classified into four components: prevention costs, appraisal costs, internal failure costs, and external failure costs. Prevention costs are the costs incurred to keep mistakes from happening in the first place, such as on-the-job training and product redesigning; appraisal costs include expenditures on inspection, testing, and other activities designed to ferret out mistakes once they have occurred; internal failure costs include expenditures on rework, scrap, and other errors found within the factory; and external failure costs include expenditures on warranty claims, product liability suits, and other problems that arise after products have reached the customers. The argument of the quality costs approach is that the closer one gets to a final product, the higher the failure costs, and therefore, the greater the possible saving when defects are prevented in earlier stages of production.

The Relationship Between Quality of Care and Efficiency in Hospitals

The perspectives on the efficiency and quality relationship can be employed to understand that relationship in hospitals. The assumption often made about the relationship is that a higher quality of care requires more resources. This relationship is illustrated by Donabedian, Wheeler and Wyszewianski (1982) at the individual patient level. The relationship between patient care outcome and the amount of resources used is positive under the care of an "ideal" physician. Any additional resources utilized by an ideal physician, who treats patients with optimal clinical strategy, will improve the health status of the patients. This argument lends credence to the concern that cost containment measures would adversely affect quality of care by under-utilization of care at the patient level. At the hospital level, the discontinuation of unprofitable services, insufficient and less qualified staff, and less investment in the improvement of manpower, facilities, and equipment may adversely affect the quality of care.

On the other hand, there are studies maintaining that efficiency and quality of care can be positively related. Efficiency and quality of care can be improved simultaneously by the elimination of such inefficiencies as poor turnaround time for laboratory tests, inaccurate reports, duplication of tests, and poor coordination of patient care among key hospital departments (Shortell, Becker, & Neuhauser, 1976). Higher quality implies lower production costs, since higher quality means fewer reworks and less waste. A simplified production process with fewer steps is typically associated with higher quality, as there are fewer opportunities for errors. The simplified production results in more efficient and less labor or less capital-intensive production processes. In hospitals, adverse outcomes almost invariably cost more than desirable outcomes. Adverse outcomes require more intensive and extensive care to try to save or heal the patient, than do desirable outcomes (Binns, 1991). In the same vein, the quality costs perspective points out that malpractice claims, readmissions, or nosocomial infections can be very costly to hospitals, but these costs can be reduced with relatively small investment in preventive measures at earlier stages of care. In this sense, current total quality management (Deming, 1982; Jencks & Wilensky, 1990) and quality assurance initiatives in hospitals could improve efficiency as well as the quality of care, resulting in the positive relationship between efficiency and quality of care.

This study approaches the relationship between efficiency and quality of care by analyzing the impact of efficiency on the quality of care. The study argues that whether the impact is positive or negative depends on a hospital's current levels of efficiency, quality of care, and resources availability. If the hospital's resource utilization is at maximal efficiency, any additional resources would improve the quality of care, as argued by Donabedian, Wheeler, and Wyszewianski (1982). However, in reality, no hospital operates at such an optimal level of efficiency, and there are wide variations in the efficiency of individual hospitals. Therefore, this study argues, it may not be appropriate to draw conclusions about the direction of the efficiency and quality of care relationship by simply looking at the associations between costs and quality of care indicators in cross-sectional studies. The relationship has to be studied in a longitudinal perspective taking into account the organizational characteristics that may interact simultaneously with the efficiency and quality of care. This study argues that the resources availability is a critical organizational characteristic that affects both the hospital's efficiency and the quality of its care.

Perspectives on Organizational Slack

This study investigates the effect of internal resource availability on efficiency and on the quality of care in hospitals. The level of internal resource availability will be represented by using the organizational slack concept. Organizational slack is defined in many ways. Simply put, it is the difference between the resources of an organization and the combination of demands made on the resources (Cohen, March, & Olsen, 1972; Cyert & March, 1963).

There are two distinctive perspectives on organizational slack: the economics perspective and organizational theory perspective. According to the economics, slack exists because of market failure (Feldstein, 1988; Leibenstein, 1976; Selten, 1982). In other words, slack at market equilibrium is always zero. The presence of slack is an evidence of a market inequilibrium that guarantees the entry of firms into the market. However, in reality, the market does not function effectively enough to eliminate slack completely, so organizations maintain many forms of slack. Managerial economics explains the existence of slack in terms of information asymmetry and goal difference between owners and managers, resulting in allocational inefficiency in a firm (Antle & Eppen, 1985; Scharfstein, 1988). Because of the separation between ownership and control in firms, managers have the opportunity to pursue goals of their own, such as growth maximization or effort minimization, which are in conflict with profit or market value maximization, the goals of owners.

In contrast, organizational theorists argue that the perpetual existence of slack in organizations is useful as well as inevitable. They argue that slack functions in an organization as a buffer that protects the organization from environmental fluctuations (Bourgeois, 1981; Clark, Varadarajan, & Pride, 1994; Meyer, 1982; Thompson, 1967). Also, slack is the source of flexibility in satisfying the multiple demands (Child, 1972; Cyert & March, 1963; Galbraith, 1973) in an organization.

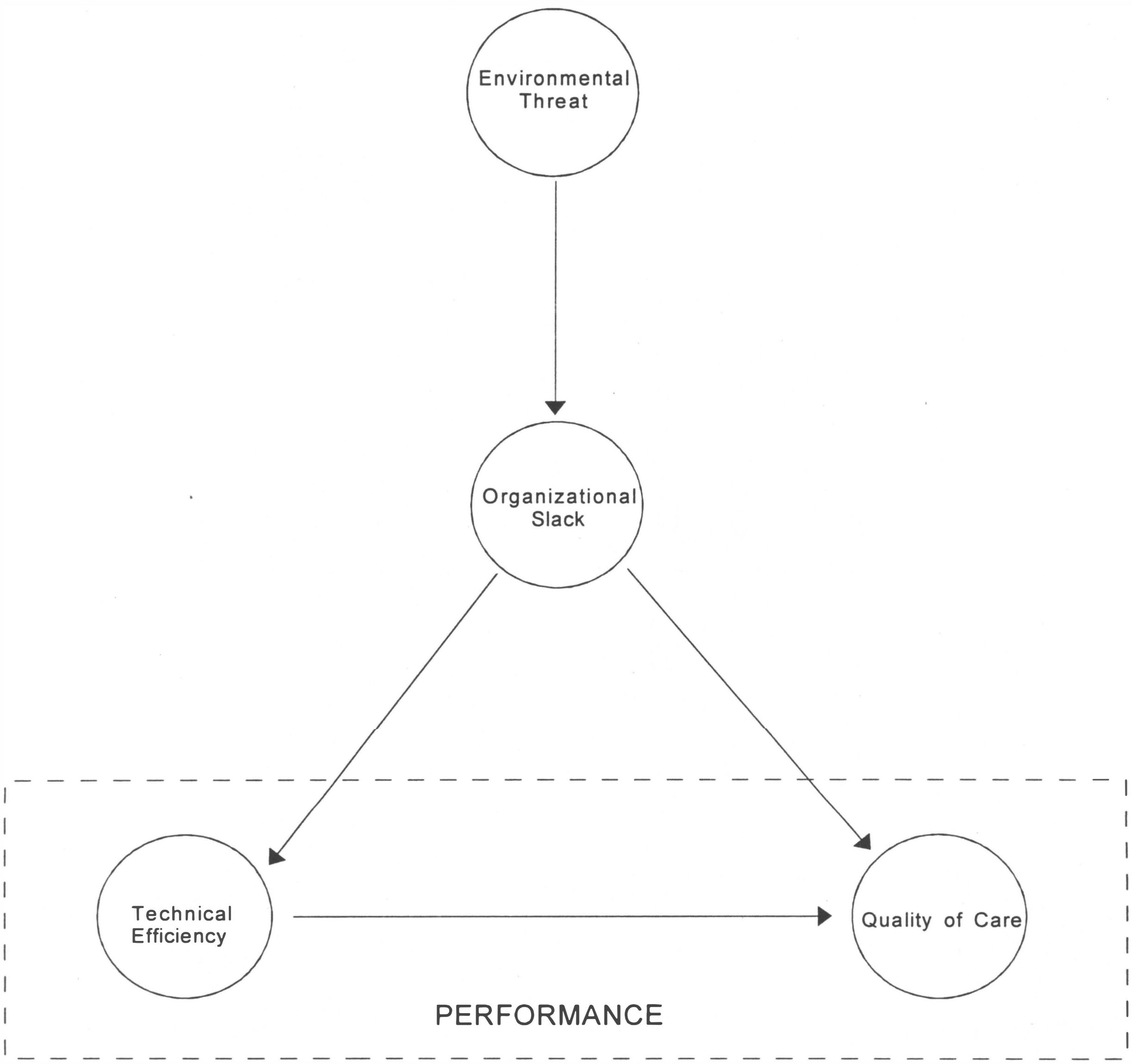
Recognizing organizational slack's functional roles in an organization, this study investigates the impact of level of slack and change in the level of slack on a hospital's efficiency and quality of care, by considering the slack as a moderator between a hospital's environment and its performance. The effect of environmental pressure on organizational decision making is filtrated by slack in an organization. In the organization, slack can be a source of inefficiency, or on the other hand can facilitate initiatives that enhance performance as an organization adjusts to its task environment. This study argues that the way slack affects organizational performance depends on the level of slack (high or low) at a point in time and the subsequent direction of change (increase or decrease) in its level.

Sharfman (1985) suggests that an organization needs different kinds of slack, depending on the characteristics of the organization's environment. Bourgeois and Singh (1983) classify slack into three interrelated but conceptually distinct dimensions based on the "easiness of recovery": available, recoverable, and potential slack. Available slack corresponds to excess, uncommitted liquid resources in organizations; recoverable slack corresponds to excess costs, staff, and salary. Potential slack is an organization's potential to raise funds from the financial market. For example, cash and marketable securities represent readily available resources (available slack); accounts receivable and overhead items may take more effort and time to recover (recoverable slack); and resources can be raised from the external capital market (potential slack). These three types of slack may have different roles in an organization, resulting in different composition of the types of slack in the organization, dependent on the requirements of its environment.

Research Questions

The present research is motivated by the concern about the possible detrimental effects of resource scarcity on the quality of care of hospitals. The study considers resource availability as one of the most critical factors in determining a hospital's performance. Environmental resource availability affects the level of internal resource availability and the internal resource availability, in turn, affects a hospital's performance.

Figure 1. A Conceptual Framework Relating Environmental Threat, Organizational Slack, Technical Efficiency, and Quality of Care



In this study, environmental resource availability is represented by the level of environmental threat which a hospital confronts; internal resource availability is represented by organizational slack. Performance of a hospital is represented by the quality of care and efficiency of the hospital. Thus, this study explores the relationship between environmental threat, organizational slack, efficiency, and quality of care in hospitals.

The study attempts to answer several research questions:
1) How does environmental threat affect the level of slack and the composition of different types of slack?
2) How are level of slack and organizational performance related?
3) How does change (increase or decrease) in slack in hospitals with different levels of slack (high or low) affect the quality of care and efficiency?
4) How does change in efficiency (increase or decrease) affect quality of care in hospitals with different levels of slack?

Figure 1 describes the conceptual model posited in this study. It is postulated that environmental threat affects the slack level of individual hospitals. Then the slack level affects technical efficiency and quality of care simultaneously. Finally, technical efficiency influences quality of care.

Significance of Study

Although researchers agree that efficiency and quality of care affect each other (Scott & Flood, 1987; Wan, 1992), previous studies of the impact of the environment on the two concepts examine either efficiency or quality of care as the dependent variable. Little is known about the simultaneous impacts of independent variables on both efficiency and quality of care (Scott & Flood, 1984). Furthermore, most studies that have examined quality of care and efficiency simultaneously are atheoretical in nature. Their descriptive conclusions about the relationship may not be very useful to such information users as health policy makers and health care organization managers.

With the implementation of the PPS and increased competition, hospitals have been encountering critical environmental changes characterized by increasing environmental threat. The environmental threat affects the level of organizational slack in hospitals. This study focuses on the effect of level of and change in organizational slack on the performance of a hospital. By doing so, this study investigates hospital efficiency and quality of care simultaneously in a theoretical framework.

Organizational slack has been an interest of organization researchers since its first recognition by Cyert and March (1963) as an important factor in analyzing organizational decision making. The slack concept has been employed in investigating various aspects of organizational strategic and operational decision making and their effects on organizational performance. However, most of the studies about the impact of slack on organizational performance have focused on the financial performance of private corporations. This research investigates the impact of slack on performance in terms of operational characteristics of hospitals, such as quality of care and efficiency. Considering the functional roles of slack in an organization, assessing performance in terms of efficiency and the quality of products is more specific approach. Also, the application of the slack concept to the study of efficiency and quality of care in hospitals is significant, considering hospitals' public service nature. The application of the concept seems particularly important considering the current resource scarcity in the health care industry and its implications for quality of care.

The slack concept provides a unique perspective, different from the concepts traditionally employed in research on the performance of health care service organizations. Slack is distinctive from financial soundness. Although there may be some association between financial soundness and the level of slack, slack is presumed to be the result of managerial preference decisions (Antle & Eppen, 1985). While financial soundness is the result of financial performance, slack is the result of managerial decisions. Financial soundness is one of the factors that influence managerial decisions on level and composition of slack in an organization. In this sense, the slack concept is useful in analyzing operational characteristics, such as efficiency and quality of care in a hospital. Efficiency and quality of care would be directly affected by the level and changes in the level of slack. Slack is also distinct from organizational size. Both small and large firms can have relatively large or small slack resources. Clark, Varadarajan, and Pride (1994) argue that there is no logical reason to suppose that slack and size would be correlated. Therefore, analyzing hospital performance in terms of slack differs from studies investigating how other financial and structural characteristics of organizations affect performance.

Methodologically, most of the empirical studies on the relationship between efficiency and quality of care have employed either cost per case or cost per patient day as the proxy of efficiency of care. The underlying assumption in using these measures is that costs can approximate the amount of resources used in the patient care. However, higher cost per patient day or case could result from other factors than the amount of resources used in patient care. It could be due to the intensity of training activities, excessive prices paid for resources used, or other activities that are not relevant to patient care. When we investigate the relationship between efficiency and quality of care, the assessment of efficiency should focus on the actual resources used in the patient care.

This study measures hospital efficiency using Data Envelopment Analysis (DEA). DEA allows a measurement of technical efficiency more directly than other traditional measures of efficiency do by using the number of actual units of the inputs and outputs used. Furthermore, the capability of the DEA algorithm to incorporate multiple inputs and outputs allows more valid measurement of the technical efficiency because hospitals produce multi-outputs using multi-inputs.

Summary

Resource availability is the most critical factor for an organization's survival and function as a purposive entity. Environmental resources are the resources to be taken in, and slack resources are those reserved within the boundary of an organization. Both types of resources affect an organization's performance. External resources affect the level of internal resources, and the internal resources affect the functioning of an organization as a purposive entity.

In this study, a hospital's purpose for existing is viewed as the provision of high quality care with high efficiency. The efficiency and the quality of care are influenced by the management's strategic and operational decisions, which are affected by the level of slack. Therefore, this study argues that the *environmental impact on hospitals' efficiency and* quality of care should be studied in conjunction with the slack level of each hospitals.

On the other hand, efficiency and quality of care are not independent of each other. Considering the inconclusive results of previous research on the relationship between efficiency and quality of care, it is difficult to predict how change in efficiency caused by a changing environment will affect the quality of care. This study proposes that the relationship should be studied in the context of a theoretical framework, considering organizational characteristics that affect efficiency and quality of care simultaneously. In an attempt to study the relationship in a theoretical framework, this study investigates the impact of changes in efficiency on the quality of care by considering the level of slack and changes in the level of slack in individual hospitals.

CHAPTER 2

REVIEW OF LITERATURE

The relationship between hospital efficiency and quality of care is equivocal and complex. The primary objective of this research is to shed some light on the connection between efficiency and quality of care by exploring the impact of resource availability on the relationship. This chapter reviews the studies that have attempted to investigate quality of care and efficiency concepts simultaneously. After the literature on the relationship between efficiency and quality of care, the literature on organizational slack is reviewed. The theoretical property of slack is discussed by presenting various authors' conceptualizations of slack. The discussion of the roles of slack focuses on the strategic and operational roles of slack in an organization. The final section reviews the studies about the impact of slack on organizational performance.

Hospital Efficiency and Quality of Care

Earlier researchers have attempted to identify the inherent relationship between efficiency and quality of care. Neuhauser (1971) studied the relationship between the cost of seven non-medical departments (measured by direct costs and man-hours) and quality of care (measured by expert opinion, Joint Commission on

Accreditation of Hospitals' evaluation, overall in-hospital death rate, and staff qualifications). The data showed some significant associations between cost measures and structural indicators of quality, suggesting that the more efficient hospitals also exhibited higher care quality. The use of multiple measures for both quality and efficiency reflects a methodological advance in this area of research. However, in addition to the doubtful direct effects of non-medical departments on quality of care, the quality of care and costs measures were not adjusted for case mix. In-hospital death rate was adjusted for length of stay (LOS), which has many properties other than severity of cases, such as efficiency of operation and effectiveness of discharge planning.

Longest (1978) studied ten hospitals in the metropolitan Atlanta area. The ten hospitals were rank ordered on the bases of direct costs of services provided and the quality of their services. Per unit cost and work hours of seven key departments (dietary, housekeeping, laundry, medical records, pharmacy, laboratory, and radiology) were measured and ranked to develop the cost index and work hour index. For quality of care, three dimensions of quality were measured: the percentage of board certified specialists on medical staff (structural quality), perception by medical staff and outside experts of the quality of the process of service provided (process quality), and death rate adjusted for case severity (outcome quality). Spearman rank-order correlations were made using the cost measures and the quality measures. The results were statistically significant in six of the eight correlations. The author concluded that hospitals with higher quality services tend to provide services at lower direct costs and with fewer work-hours.

In contrast to the conclusions of the two studies discussed, Berry (1974) reported a negative relationship between efficiency and quality of care. After analyzing average costs of approximately 6,000 short-term hospitals for a three-year (1965 - 1967) period, Berry (1974), admitting the crudeness of the dichotomized quality measure (the accreditation status and availability of "quality enhancing" services), cautiously concluded that quality of care and average costs have a positive relationship. Accredited hospitals had higher average costs and had more quality-enhancing services such as a blood bank, pathology laboratory, pharmacy with pharmacist, and post-operative recovery room. Considering the use of structural indicators of quality of care, the conclusion seems to be natural: better facilities cost more.

Recognizing the limitations of the structural indicators of quality of care, many researchers have used outcome indicators such as adjusted mortality rates, readmission rate, and other adverse outcomes as proxy for the quality of hospital services provided. Flood et al. (1982) recommended that, in the absence of an established causal relationship among the structural, process, and outcome quality indicators (Donabedian, 1980; 1988), the outcome measures that reflect the ultimate goal of hospital service should be used as the quality indicator.

Flood et al. (1979) studied medical records of 670,000 patients treated in 17 stratified sample hospitals from 1,377 hospitals across the United States. The quality of care measure was an adjusted mortality rate. The researchers adjusted the case mix differences in the mortality rate among sample hospitals by standardizing on admission status, existence of surgical procedures or medical treatment, complications, and discharge status. They found that hospitals that rendered more specific services (in terms of type, amounts, and relative costliness) had lower than expected in-hospital death rates. They also found a positive association between length of stay (representing routine nursing care and hotel service only) and adjusted mortality rate. However, when regional effect was controlled, the relationship was not statistically significant, indicating a significant regional variation in LOS.

More recently, Bradbury, Golec, and Steen (1994) analyzed the relationship, using the data of the ten most frequently occurring diagnosis related groups (DRGs) for adult medical service admissions to 43 hospitals in Pennsylvania. They used mortality and morbidity as quality of care indicators. Total charge, ancillary charges, and length of stay were measured as resource use indicators. Those measures were adjusted for admission severity group classification, based on the Key Clinical Findings at admission. The results of ordinary least squares (OLS) regression of each of six outcome and expenditure pairs showed positive associations. They concluded that hospitals with relatively poor outcomes were also inefficient resource users.

The search for the inherent cost and quality of care relationship seems to conclude with Fleming's (1991) complex relationship argument. He studied the relationship between cost and quality using the data from 656 hospitals' discharges. Quality measures were the adjusted mortality rate and the adjusted unscheduled readmission rate. Costs were measured by adjusted variable costs of individual hospitals. A cost function was developed including quality indicators and output variables, to control for the output level. In order to model a nonlinear relationship, higher order terms of quality indicators were included in the cost function. The three (first, second, and third order) coefficients of the readmission measure were statistically significant, indicating a cubic relationship between cost and readmission rate. Also, surgical mortality was a significant determinant of cost with significant coefficients in higher terms. From the results, Fleming (1991) concluded that the relationship between cost and quality of care is far from pure and simple. Marginal cost curves derived from the regressions were convex, with positive association between cost and quality at the low and the high ranges of quality of care. At the medium quality range, higher quality was associated with lower costs.

The search for a generalizable conclusion on the relationship has been futile, as shown by the contradictory results. Under the necessity for a theoretical framework to guide the specifications in modeling the relationship, researchers incorporated organizational structure constructs in research on the relationship.

Scott, Flood, and Ewy (1979) studied the effects of hospital structural characteristics on the average intensity (the number of diagnostic and therapeutic services provided), the duration of service (LOS), the average amount of expenditure for patient care, and the average quality outcomes. Measures of the structural characteristics of hospitals were grouped into two categories: capacity and control. Capacity refers to those aspects that represent a hospital's potential to supply services. They were measured by total number of personnel employed, number of different types of diagnostic facilities, staff-to-daily census ratio, residents-to-regular staff ratio, ratio of RN to other type of nurse, and occupancy rate. Control refers to the distribution of power or influence over decisions, and mechanisms for the control and coordination of work activities. Influence over decisions was measured by asking questions about the influence of physicians and administrators on decisions in hypothetical situations. To measure the control level and frequency of interaction among the clinical staff, ratio of supervisory to direct care personnel, average number of ward clerks and secretaries, and explicitness of general nursing policies were measured. The results showed somewhat ambiguous associations among the four constructs: quality, quantity, cost, and organizational structure. There was only a slight positive association between standardized mortality rate and capacity to deliver services. Intensity was negatively associated with mortality rate, and not significantly associated with cost. Duration was positively associated with costs and mortality rate. Administrators' within-domain influence was positively related to service duration, higher costs, and quality of care.

Flood et al. (1982) studied the determinants of quality of care in hospitals. Three sets of independent variables were measured: the characteristics of the larger organizational context; the characteristics of the corporate structure by which the professionals organized themselves; and the characteristics of the individual practitioners. They assessed the quality of surgical outcomes by measuring morbidity occurring seven days after surgery, or death within 40 days, adjusting for the patients' physical status, stage of disease, age, and sex. Of the hospital context variables, the expense per patient day was significantly associated with better quality of care. On the surgical staff organization level, the number of contracted physicians and the number of surgical specialties were found to be significantly associated with better quality of care. On the individual level, commitment (the percentage of each surgeon's practice at the study hospitals) and qualification (the number of residencies completed) were significantly associated with better quality of care. Comparing the impacts of the three levels of independent variables, Flood et al. conclude that characteristics of the hospital organization and the component structure of the professional group were more strongly associated with the differences in quality of care than were the differences among individual surgeon's characteristics.

Both of these studies are disadvantaged by the small sample sizes; 17 hospitals in Scott et al. (1979), and 15 hospitals in Flood et al. (1982). The small number of hospitals limits the confidence to be placed in any generalization relating hospitals characteristics to the dependent variables.

Based on the entrepreneurial theory of organizations, Shortell, Becker, and Neuhauser (1976) hypothesized that visibility of organizational consequences is positively associated with efficiency and quality of care. Hence, they surmised efficiency and quality of care should be positively related. The entrepreneurial theory posits that greater visibility of consequences, less specification in complex work departments, and non-programmed mechanisms to coordinate the work of interdependent departments are associated with more effective utilization of resources.

The sample consisted of 58 short-term, voluntary, non-teaching hospitals with 100 beds or more in Massachusetts. Efficiency was measured by direct costs per patient day in three non-medical support departments, direct costs per patient day in four medical support departments, and overall cost per case. Quality of care was measured by the medical surgical death rate and by the postoperative complication rate following clean surgery. Visibility of consequences was measured by the number of reports prepared for management, the level of management's awareness of the information on operation. The data showed a negative association between visibility of consequence and both medical and non-medical support department costs. However, the quality of care was not significantly associated with any measures of visibility of consequences. The relationship between efficiency and quality of care was examined by dividing the hospitals into two groups based on their scores on each of the efficiency and quality measures. The results show that 63% of those hospitals with low medical surgical death rates also had low combined non-medical and medical support department costs per patient day, while 70 % of those with high medical surgical death rates had high combined non-medical and medical support department cost per patient day. The authors conclude that the managerial and organization design variables over which administrators and medical staff members have some degree of control were strongly associated with hospital performance.

Using the identical data and theoretical framework, Becker, Shortell, and Neuhauser (1980) examined the impact of the visibility of consequences and procedure specifications on hospital length of stay. The dependent variables were pre-op length of stay of Medicare, Medicare length of stay, and overall length of stay. The dependent variables were controlled by case mix severity based on the judgement of physicians as to the probability of death or complication in each of the 38 diagnostic categories. The quality of care indicators (the medical-surgical death rates and post-surgical complication rates) were included as the control variables. The results indicated an association between a higher medical-surgical death rate and a longer preoperative length of stay. The authors suggest, based on the results, that external attempts to regulate rising hospital costs and stimulate internal efficiency are not necessarily incompatible with maintaining or improving the quality of hospital care.

Schulz, Greenley, and Peterson (1983) posited that the efficiency and quality of the care relationship is dependent on managerial efforts. They studied the relationship between cost and quality of care in 13 acute-care, inpatient psychiatric units and concluded that the relationship was dependent on the managerial approach rather than on any generalizable relationship of cost and quality. They found that each unit showed different directions of relationship. The negative relationship between cost and quality of care (better quality with lower costs) was found in the units with proactive management that focused on organizational outcomes, that made consequences of operation visible, and that promoted mutual coordination. In the units that showed a negative relationship, they concluded, various managerial mechanisms designed to control costs seemed also to be associated with more careful attention to the quality of patient care.

Wan and Shukla (1987) studied the effects of contextual and organizational variables on the quality of care at 60 community hospitals, using the process quality indicators as the proxy of quality of care. They used incident rates generated from hospital reports, such as the volume of errors in medication, errors in intravenous line administration, patient falls, patient injuries, and inappropriate diagnostic and therapeutic interventions as the quality indicators. No significant relationship was found between nursing resource use and the quality of care indicators.

Since Peer Review Organizations (PROs) have been reviewing medical records of Medicare patients using a number of explicit criteria, many researchers have used the review results as the quality of care indicator. In the PROs review, medical records that have failed to conform to any of the criteria are referred to physician advisors to determine if there are justifiable reasons (Feldman & Rundall, 1993; Haywared, et al., 1993; Wan, 1992). Although the correlation between HCFA (Health Care Financing Administration) mortality rates and the PRO problem rate was relatively low (r = .19), the studies using the PRO problem rate showed similar results to the results obtained using the HCFA mortality rate in investigating the association between hospital characteristics and quality of care (Kuhn, et al., 1991).

Using the PRO confirmed problem rate as the quality of care indicator, Kuhn et al. (1991) studied the associations of hospital characteristics with quality of care. Medical review data were obtained from 42 PROs between July 1987 through June 1988. The data showed that higher occupancy rate, greater payroll expense per bed, higher proportion of physicians who were board certified specialists, greater technological specification, higher number of beds, higher proportion of nurses who were registered, and membership in the Council of Teaching Hospitals were significantly associated with lower rates of confirmed problems. The authors conclude that hospital resources, including financial status (measured by payroll expense and occupancy rate), training of medical personnel, and the availability of sophisticated equipment, were positively related to the quality of care.

Considering the conceptual and methodological difficulties in dealing with the efficiency and quality of care of hospitals, the contradictory reports on the relationship of the two concepts are not surprising. As the literature indicates, the search for the unconditional and universal relationship between the two concepts has been futile in producing sensible results. The relationship depends on the types of patients from whom these measures are developed, the organizational characteristics of the hospitals chosen for the analysis (Fleming, 1991), and the temporal and spatial environment in which the hospitals are situated. In order to overcome the complexity involved in the study of the relationship, the research has to be guided by a theoretical framework that can alleviate the problems with the concepts. Churning out conclusions based on atheoretical empirical analysis is not appropriate. The relationship between efficiency and quality of care is an essential issue to be answered for the users of such information to effectively perform their tasks. Especially under the current pressure for cost containment, the issue should be studied in a practical way so that the results can be informative to the users.

Methodologically, most of the studies on the relationship have been performed using a cross sectional perspective. This study argues that the direction of the effect of efficiency on quality of care is dependent on the hospital's current level of efficiency, quality of care, and organizational slack. If the relationship is indeed dependent upon the current level of the variables, conclusions based on cross sectional analysis may not be valid. Thus, research on the relationship has to analyze data using a longitudinal perspective and considering the direction of the changes in the variables.

Organizational theories provide a framework that can guide studies of the relationship. Building upon the previous studies on the impact of organizational characteristics on efficiency and quality of care, this study incorporates the organizational slack concept by analyzing the effects of level of slack and change in the level of slack on the relationship between efficiency and quality of care.

Organizational Slack

Definition of Slack

Cyert and March (1963) defined slack as "the disparity between the resources available to the organization and the payments required in maintaining the coalition" (Cyert & March, 1963, p.36). They conceptualized an organization as a coalition of individuals, some of whom are further organized into sub-coalitions. Individual participants in an organization may have substantially different preference ordering for the organization's goals, and the differences may lead to goal conflicts. The goal conflicts are resolved in the short term through bargaining processes among the organizational participants, resulting in a dominant coalition. The payment to the dominant coalition is critical to hold it together within general terms synthesized in the bargain processes. Organizational slack is "payments to members of the coalition in excess of what is required to maintain the organization" (p.36). The side payment can take many forms: money, personal treatment, authority, or organizational policy.

Galbraith (1973) defined slack as the additional resources needed when an organization reduces the required level of performance in its work process. The slack can be more staff, more lenient deadlines, or other factors that provide flexibility between the work related groups. Galbraith (1973) argues that although slack is usually regarded as a source of inefficiency, it can be a less costly alternative than others in allowing rational action in the face of complexity.

Bourgeois (1981) attempted to provide a general definition of the concept, synthesizing from the literature. He defined slack as follows:

> Organizational slack is that cushion of actual or potential resources which allows an organization to adapt successfully to internal pressures for adjustment or to external pressures for change in policy, as well as to initiate changes in strategy with respect to the external environment (p.30).

This definition illustrates the roles of slack in an organization. Slack works as a buffer for the environmental fluctuation and, at the same time, works as the source of resources for dealing actively with environment. Internally, slack provides a resource pool for meeting multiple demands.

The definition of slack is further refined by Sharfman (1985) and Sharfman, Wolf, and Tansik (1988). They argue that in order for resources to be considered as the slack, they must be visible to the manager and employable in the future. The "visibility" suggests that the slack should be in tangible forms; i.e., money, people, inventory, machine capacity, etc. Thus, slack is different from other intangible systems and procedures intended to buffer an organization and its subsystems. The "employable" suggests that with no substantial changes of systems or recycling process, the resources should be available to managers for the redeployment. With these qualifications, inefficiency and slack can be differentiated. As argued in

Sharfman, Wolf, and Tansik (1988), substantial changes in the current system are required to convert inefficiency to organizational slack. For the resources to be functional in management's decisions about resource allocation, they should be readily available without significantly affecting the current system.

Role of Slack

In this section, literature on slack's roles is summarized in terms of intra-organizational roles and strategic behavior facilitator roles. The intra-organizational roles include the role as the resource pool that satisfies the multiple internal demands (Cyert & March, 1963; Dess & Origer, 1987), and the role as the device for the reduction of information processing needs and sub-unit interdependencies (Galbraith, 1973).

Slack provides the flexibility to the organizational strategic decision making. Slack supplies resources for active engagement with the environment. It funds innovations, risk taking, and other experimentation of an organization (Cyert & March, 1963; Damanpour, 1991; Haveman, 1994). On the other hand, slack serves as the buffer between organizations and external contingencies (Thompson, 1967) by paying the price for not conforming to the environmental demands (Child, 1972; Litschert & Bonham, 1978).

Intra-organizational Roles of Slack. Cyert and March's definition of slack addresses slack's role in retaining the organizational participants within the organizational boundary.

They define slack as overpayment for the contribution of the participants. If the payment is perceived to be less than a participant's contribution, the participant will search for another organization that can maximize his/her slack. This argument can be related to slack's role as a minimizer of goal conflict.

As discussed previously, the goal conflicts are resolved in bargaining processes. The bargaining processes to accommodate the conflicting demands of organizational subgroups are performed partly by sequential attentioning in organizational decision making and partly by decentralizing the decision-making power (Scott, 1987). Sequential attentioning is giving attention to one set of demands at one point and to other sets when they become more pressing (Pfeffer & Salancik, 1978). Decentralization delegates the resource deployment decision to a lower level of hierarchy, and by allowing "local rationality," optimizes the subsystem's goal. Consequently, sub-optimality of performance in the organization as a whole is allowed. Slack makes such strategies feasible because it provides the resource pool that substitutes for value homogeneity by absorbing discords (Chakravarthy, 1982) and by satisfying more diverse demands of subgroups.

Singh (1986), in his study of 64 medium-to-large United States and Canadian corporations, hypothesized that organizational slack has a positive relationship with decentralization of decision making. However, contrary to that prediction, the results showed a negative relationship between slack and decentralization. He suspected the measurement of decentralization in his study -- the CEO's delegation of decision authority to top executives. Singh argued that although high slack is related to centralization in top management, the relationship may be reversed at the lower levels of organizational hierarchy.

In connection with slack's role as a minimizer of goal conflict, researchers studied the effect of slack on political behavior. Cyert and March (1963) posited a negative relationship between political behavior and level of slack. They argued that the high slack satisfies the demands of all the participants so that there is no need for political behavior in allocation of resources. In contrast, Astley (1978) argued that slack, as the available resources to be allocated, would be the target of political behavior.

Bourgeois and Singh (1983) studied the relationship between slack and political behavior among members of top management. Strategic discord and goal disagreement were dependent variables and measured by surveying the top management members. The results established no significant relationship between the overall level of slack and each dependent variable. The disaggregation of slack into components, however, showed a stronger set of relationships. Political behavior showed a strong negative association with recoverable slack and a positive association with potential slack. But after controlling for the size of the management team, recoverable slack no longer had a significant negative effect on political behavior while potential slack still affected political behavior positively.

Wayne and Rubinstein (1992) performed an experimental study to explore the effects of slack and scarcity (the absence of slack) on political behavior. They tested the Goodin's game theoretic mathematical model (Goodin, 1988). The model predicts that superabundance (slack) makes mean (noncooperative) games kinder (more cooperative), and kind (cooperative) games meaner (less cooperative). In contrast, scarcity makes mean games meaner and kind games kinder. Subjects were asked to determine to what degree they would fund competing plans devised by a kind (cooperative and rule-abiding) planner and a mean (selfish, non-cooperative) planner. The researcher predicted that under scarcity, decision makers would select the option advocated by the buccaneering contestant, and that under abundance, they would select the option advocated by the cooperative and rule-abiding planner. The results showed that both groups of decision makers supported the kind planner. However, under scarcity, support for the plan advocated by the buccaneering planner rose to its highest level, and support for the plan advocated by the rule-abiding planner was in its lowest level.

Slack works as the buffer between subunits linked in a work flow in an organization. Galbraith (1973) explains the required coordination level between subunits of an organization in terms of the amount of information exchanged in performing tasks. High performance standards increase the need for coordination, which can strain the information flow between subunits. In order to reduce the information flow requirements, Galbraith suggests, either the subunit's standard of performance can be lowered, or redundancy can be introduced in the form of slack. He argues that allowing slack in the form of a larger margin of error and redundant processes (i.e., an allowance for mistake, waste, spoilage, and similar unavoidable accompaniments of work) may be more efficient than attempting to optimize an overall system. Galbraith (1973) suggests that since creating slack resources is a relatively easy and painless solution available to organizations, whether or not it is employed is likely to be determined by the amount of competition confronting the organization in its task environment.

In his qualitative study of complex structures that supply repair services of electronic equipment in the U. S. Navy, Kmetz (1984) illustrates the use of informational buffers that provide the independent task performance capacity among subunits. Information buffers are the collections of information formed through organizational problemistic search and leaning (Cyert & March, 1963), to support decision making or monitoring of work-flow variables. When a dysfunction occurs and the existing system cannot provide the solution, the subunit makes the decision using the information buffers.

Strategic Roles of Slack. Organizational slack represents the cushion that plays an adaptive role in the changing environment (Cyert & March, 1963; Horton, 1987). According to Cyert and March (1963), slack tends to stabilize an organization in two ways: 1) by absorbing excess resources, it retards the upward adjustment of aspirations during relatively good times, and 2) by providing the pool of emergency resources, it permits organizational aspiration to be maintained during relatively bad times. In this way slack prevents the organization from responding to short-term random changes in environmental stability. Marino and Lange (1982), in their study of firms in the apparel and motor vehicle parts industry, hypothesized that high slack firms would exhibit less variation in reported earnings than would low slack firms in the same industry. The variation in reported earnings was used as the proxy of organizational stability. The results showed that over the eight-year study period, the high slack firms exhibited less variation in earnings.

Slack is the source of resources for the implementation of strategies to buffer organization from the external environment. Buffering strategies serve two purposes: preserving organizational autonomy (Pfeffer & Salancik, 1978) and maintaining optimal effectiveness of the technical core (Thompson, 1967). An organization, as an open system, has to struggle for autonomy and discretion when confronted with constraints and controls from its environment. When an organization submits to external demands, it generates additional demands for various actions, and restricts its ability to adapt to future demands by other external groups (Pfeffer & Salancik, 1978). In maintaining autonomy, slack is crucial, since the organization may have to pay the penalty for not meeting the environmental mandates.

An organization will attempt to buffer its technical core from environmental fluctuations by elaborating subsystems for securing inputs and disposing outputs. Slack is the source of resources for the buffering strategies that require additional resources to align an organization's subsystems with the environment. Measuring the slack by the profit level of 20 companies in Canada, Dimick and Murray (1978) studied the effect of the level of slack resources on the characteristics of human resource management. They report a significant positive association between the sophistication of the personnel selection process and the level of slack. They argue that slack created the conditions that made the costly personnel selection policies affordable.

Slack allows an organization to interact with its environment more boldly (Bourgeois, 1981; Singh, 1986) by providing a buffer against downside risks. Slack reduces the criteria by which organizational actions are judged acceptable (Thompson, 1967). Cyert and March (1963) argue that organizations with high slack have the opportunity to experiment with new products or markets. Slack reduces the problem of scarce resources and supplies the funds for innovations that would not be possible under resource scarcity.

These arguments on the roles of slack are applied in empirical research in the area of innovation and risk taking. The relationship between the trial of new drugs (innovation) and level of organizational slack in hospitals was studied by Rosner (1966). The sample hospitals consisted of 24 non-teaching, short-term hospitals in the Chicago area. Results showed that innovation, as measured by the frequency and promptness in using the new drug, varied directly with the organizational slack as measured by the hospital occupancy rates.

Moses (1992) examined the relationship of slack and risk-taking behavior. The dependent variable was pricing strategy (skimming or penetration). Penetration pricing sacrifices short-run profits in an attempt to establish a market and generate profits over the long run; skimming pricing tries to recover investment in the early stage of the product life cycle with initial high pricing. Thus, penetration pricing is riskier than skimming pricing. The data for the study were collected for the aerospace industry in the U.S. defense market. Following Bourgeois and Singh (1983), slack was measured by using publicly available financial accounting data to capture the three dimensions of slack. The results show a significant positive association between slack level and penetration pricing strategy.

Bromiley (1991) investigated the effects of slack on performance and risk taking within the framework of the process theory of organizational decision making (Cyert & March, 1963). He proposed that high or low slack organizations would take more risk than would organizations with moderate levels of slack. He argued, from process theory that managers of high-slack organizations have a buffer against failure in risk taking, and managers of low-slack organizations strongly aspire to increase the level of slack. Thus, managers in either high or low slack organizations are more likely to take risks. The moderate slack organizations, on the other hand, will take fewer risks, because they perceive their current performance as satisfactory. The data, however, did not support a curvilinear relationship between slack and risk-taking. Instead, the levels of slack and of risk-taking showed a negative relationship.

The moderating effect of slack on the relationship between performance and risk-taking behavior was studied by Singh (1986). In his model, performance has a negative relationship with risk-taking, but a positive relationship with organizational slack. Slack, on the other hand, has a positive relationship with risk-taking. High performance will make an organization conservative in its decision making, but the high slack in the such an organization will allow it to take risks. The data showed that high performance increases both the available slack and the recoverable slack. The recoverable slack increases risk-taking behaviors, but available slack does not have a significant relationship with risk taking. Singh suggests that the results show the different properties of the two types of slack in organizational decision making.

Cheng and Kesner (1988) maintained that organizational slack does not directly affect an organization's strategy formation. Instead, it plays an indirect role in strategic decision making. Slack affects an organization's response to environmental change through its interactive effect on the organization's strategic orientation. The authors argued the slack of an organization is the necessary condition for it to pursue and realize its chosen strategic orientation. Using the Miles and Snow (1978) framework, they hypothesized that in a changing environment, the prospector or defender orientation of an organization would be reinforced by high levels of slack. The data were collected from the 19 airlines before and after deregulation (from 1975 to 1978). Data showed that airlines that were more prospector-oriented three years before deregulation responded more forcefully to deregulation in 1978 than did those that were less prospector-oriented. This relationship was stronger for airlines that had a high level of slack before deregulation.

Slack and Organizational Performance

The intra-organizational and strategic roles of slack arise from the flexibility that slack provides in an organization's operational and strategic decision making. The flexibility of an organization influences the organization's performance. However, there have been few studies that investigated the impact of slack on organizational performance. This section reviews the studies on how the slack affects organizational performance, and the studies on how financial performance affects hospitals' quality of care.

Galbraith (1973) emphasized the functional aspects of slack in coordinating the subunits of a complex organization. Slack reduces the information overflow among the connected work processes and makes complex tasks more manageable. Marino and Lange (1982) estimated the level of slack deployed to decouple the subsystems, by measuring the turnover rate of work-in-process inventory. They argued that, in a manufacturing firm, a production-smoothing objective might be realized through deployment of slack as work-in-process inventory. They hypothesized that larger inventory investments in the high-slack firms would result in less increase in the rate of inventory *turnover* than the low-slack firms have, as sales increases. The data show that during the study period the increase in inventory turnover in the high-slack firms was significantly lower than that in the low-slack firms.

Marino and Lang (1982) also tested whether the high-slack organizations have higher administration and selling costs. The argument was that the firms with slack resources would sacrifice efficiency, to some extent, to enhance effectiveness. Such emphasis on effectiveness requires increased staff personnel and higher selling and administrative costs per sale. The data show no significant difference between the high-slack and low-slack firms in the rate of expenses per sale over the study period.

Bromiley (1991) posited a curvilinear relationship between organizational performance and level of slack. That is, the higher-slack and lower-slack organizations would have higher future performance than would the organizations moderate slack levels. Bromiley (1991) argued that slack may be useful to organizations because it provides an essential buffer for their activities. For example, without slack, any reductions in cash flow would result in immediate shortages of funds, causing dysfunctional organizational changes such as layoffs and cancellation of capital investments that would lead to lost business opportunities. On the other hand, he argued, the low-slack firms would manage very carefully, finding ways to reduce costs and improve performance. The results show slack, particularly available and potential slack, to be associated with high performance. However, the results do not provide strong support for a nonlinear relationship of slack with future performance. The positive association between future performance and slack is supported by Hambrick and D'Aveni (1988). They compared 57 large bankruptcies and 57 matched survivors. Depletion of slack was one of the major indicators of bankruptcy, and the chronic depletion of slack was detected as early as 10 years before the bankruptcy.

Although there are no studies that investigate the impact of slack on hospital performance, some researchers studied the impact of financial performance on hospital quality of care. Harkey and Vraciu (1992) studied the relation between operating margin and quality of care, using survey and financial data from 82 small and medium-sized hospitals. The data show a positive association between the perception of quality and operating margin. Duffy and Friedman (1993) reported, in their study on hospitals with chronic financial losses, that most of the hospitals with low financial resources still survived even without observable improvement in efficiency. They had reduced rates of investment in new technology, however, which could have long-term adverse effects on the quality of care.

A positive association between resource availability and quality of care is reported by many studies. Kuhn et al. (1991) found that hospitals with greater technological sophistication had higher quality of care. Cleverley and Harvey (1992) found that hospitals with higher mortality rates for four consecutive years had lower investment in capital assets. Levitt (1994) investigated the relationship between the rate of confirmed failure of PRO generic quality screening and the amount of investment in property, plant, and equipment of 87 hospitals in Massachusetts; the study reported positive associations.

Although the theoretical arguments about the properties of slack convey an obvious relationship between slack and organizational performance, few studies have investigated the relationship empirically. Furthermore, most studies that investigated the impact of slack on performance (Bromiley, 1991; Hambrick & D'Aveni, 1988; Marino & Lange, 1983) used financial performance as the indicator of organizational performance. However, the present study argues that in considering the functional roles of slack in an organization, assessing performance in terms of efficiency and the quality of products is more specific approach to investigating the relationship between slack and performance. Although financial performance can summarize overall organizational performance, the efficiency and quality of care may more directly describe the effect of strategic and operational decisions influenced by the level of slack. This approach is also more appropriate in view of the not-for-profit characteristic of the majority of hospitals in the United States.

Summary

Many studies have sought to identify the generic relationship between cost, or technical efficiency, of hospital services and the quality of care. Obviously the two concepts affect each other, as stated in Scott and Flood (1987): "cost and quality of care are more analogous to Siamese twins: a change in one has the potential to alter significantly the other" (p.98). However, the conceptual and methodological complexity of the two concepts hinders a generalizable conclusion about the relationship. In order to generate more useful information about the relationship, later researchers incorporated organizational theory that would guide theoretical specifications of their studies.

The present research employs the concept of organizational slack to investigate the relationship between efficiency and hospital quality of care. The fundamental property of organizational slack is the flexibility it provides for the organization's strategic, tactical, and operational decision making. Literature on slack can be summarized in terms of its intra-organizational roles and its roles as a facilitator of strategic behavior. The intra-organizational roles include minimizing organizational goal conflicts, coalition maintenance, and buffering work flow. In strategic management, slack facilitates such behaviors as technical core buffering, innovation, and risk taking.

The concept of organizational slack plays a vital role in this study's investigation of efficiency and quality of care in hospitals. The argument is that the level of slack, which is determined by environmental threat and management's discretion, affects the organization's flexibility in making strategic, tactical, and operational decisions. Hence, organizational performance should be affected by the level of slack.

CHAPTER 3

THEORETICAL MODEL

This study proposes a model of environment-organization interface and associated performance outcome. The main purpose of this study is to investigate the impact of level of slack (high and low) and the changes in the level of slack (increase and decrease) on organizational performance. The investigation is based on three theoretical assumptions: 1) the level of slack is a function of the level of environmental resource availability; 2) organizational slack has a curvilinear relationship with efficiency and with effectiveness; and 3) management strives to maintain slack at an optimal level in a given environment, in order to maximize the efficiency and effectiveness of its organization.

The resource availability in an environment influences the survival and growth of the organization within that environment (Dess & Beard, 1984; Randolph & Dess, 1984). When resources are abundant, it is relatively easy for organizations to survive, and thus they can pursue goals other than survival (Castrogiovanni, 1991). However, when environmental resources are scarce, survival becomes the main concern of an organization. Staw, Sandelahds, and Dutton (1981) suggest that when the environmental resources of organizations are poor, they are preoccupied with conserving their limited internal resources. The strategic choices open to them tend to be limited by the scanty material resources available. They are more likely to pursue defensive strategies emphasizing the efficiency of internal operations (Staw & Szwajkowski, 1975). In such an environment, slack will be searched out and reduced. Therefore, the level of organizational slack is a function of the environmental resource availability for an organization. This study predicts a positive association between the level of slack and the environmental resource availability.

Changes in slack level affect the performance (or efficiency and effectiveness) of an organization (Kmetz, 1980). In this study, organizational slack is assumed to be curvilinearly related to efficiency and to effectiveness. Since slack is, by definition, the extra resources over the minimum necessary to accomplish tasks, the extra resources provide flexibility in strategic and operational decisions, thus improving organizational performance up to a point. However, excessive slack will be detrimental to organizational performance, because lenient management will reduce organizational control. Thus, there exists an optimal level of slack for achieving maximal efficiency and for achieving maximal effectiveness in an organization. Until slack reaches the optimum, efficiency and effectiveness improve as slack increases. When slack exceeds the optimum, however, it adversely influences efficiency and effectiveness. Therefore, this study posits that slack has a curvilinear relationship with efficiency and with quality of care in a hospital.

The study assumes that the management of an organization strives to maximize its performance. To do so, management must maintain the level of slack in its optimal range. Although environmental forces strongly affect the level of slack in an organization, management manipulates the slack level within the limits imposed by the environment. The study posits that reducing slack in the high-slack hospitals will improve efficiency and quality of care, but in the low-slack hospitals adversely affect efficiency and quality of care. Increasing slack will have the opposite effect on hospital efficiency and on quality of care in different levels of slack.

Ashby (1971) argued that the survival of an organization requires its effectiveness and efficiency to be kept within desired limits. The desired limits for effectiveness and efficiency can be represented by the optimal range in level of slack at which the organization achieves optimal performance. A management whose level of slack is not in its optimal range (through either excessive or lack) will attempt to tune the slack level to the optimal range, thereby affecting the efficiency of production and the quality of products.

In investigating the relationship between efficiency and quality of care, this study considers how changes in efficiency affect the quality of care. The slack level influences efficiency, and the change in efficiency influences the quality of care. The impact of change in efficiency on quality of care is dependent on a hospital's current level of slack. The study posits that in the high-slack hospitals change in efficiency has a positive relationship with quality of care, that is, increased efficiency will improve quality of care, and decreased efficiency will worsen the quality of care. In the low-slack hospitals, the relationship is assumed to be negative: increased efficiency worsen the quality of care, and the decreased efficiency improves the quality of care. The high-slack hospitals can pursue multiple goals (improvement of efficiency and quality of care), but the low-slack hospitals cannot afford to do so. The argument is that the hospitals that improve efficiency by voluntary efforts rather than under threats to their survival are more likely to improve efficiency and quality of care simultaneously. On the other hand, those hospitals that improve efficiency because they have no other alternative are more likely to make trade-off of quality of care and efficiency.

Definition of Constructs

Environmental resource availability is conceptualized in terms of the level of environmental threat. Following Staw, Sandelahds, and Dutton's (1981) definition of environmental threat, this study looks at the level of regulatory pressure and competition among individual hospitals to determine the level of threat. The study views the implementation of the PPS and increasing competition in hospitals' current environment as the critical elements in determining the level of environmental threat for individual hospitals.

Organizational slack is defined as the extra resources that are available to the management without significantly changing the current production system. Thus, for example, resources generated by reducing the current production level are not classified as slack resources. In this study, slack is classified as available slack, recoverable slack, and potential slack, according to ease of availability (Bourgeois & Singh, 1983; Singh, 1986). Available slack refers to the slack that is most easily available to the management in an organization. Recoverable slack refers to the slack that has been put into a system as a type of costs and is available only with some effort. Potential slack refers to the organizational capacity to generate resources from external financial markets. The total slack is the weighted sum of different types of slack in an organization.

In this study technical efficiency refers to the degree to which an organization converts its inputs to outputs, as compared to the performances of its peers (Ozcan, Luke, & Haksever, 1992; Saxton, et al., 1989). Thus, a hospital is defined as inefficient if it could have produced the same amount of patient care and other outputs with fewer resources than it actually consumed, or if it could have produced more output with the amount of resources it used (Ozcan, 1992; Sherman, 1984). Change in technical efficiency is any alteration in input-output relationships, including those resulting from changes in the production process, changes in methods of using existing processes, changes in input proportions or output mix, and changes in the rate or scale at which existing processes are utilized.

The quality of care, in this study, is the quality of inpatient care provided in medical/surgical hospitals. The Institute of Medicine (1991) defined quality of care as "the degree to which health services for individuals and populations increase the likelihood of desired health outcomes and are consistent with current professional knowledge" (p. 8). Using this definition of quality of care, this study assumes that since good hospital care is more effective than poor hospital care and thus leads to better outcomes, rates of adverse outcomes can be used as the basis for judging the hospital care provided (Thomas, Holloway, & Guire, 1993). With these assumptions, the study measures quality of hospital care by the mortality rates of individual hospitals.

Environmental Threat and Slack

The current environment of the hospital industry is seen as threatening because of the combined impacts of various cost containing regulations and the competition from alternative health care delivery systems. The PPS, especially, has profoundly affected the hospital environment. The PPS restructured the economic incentives faced by hospitals. Under the cost-based payment system, maximizing income to meet rising expenses can also be expressed as maximizing costs to increase income. There were few restrictions on raising prices to meet increasing costs. To correct this deficiency, the PPS pays hospitals a fixed price per case type, or DRG, providing financial incentives to reduce costs in hospital services (Shortell, Morrisey, & Conrad, 1985; Sloan, Morrisey, & Valvona, 1988).

Another factor that influences the hospitals' environment is the increasing competition among health care providers. During the 1980s there was an increasing reliance on market forces to contain health cost. Also, both individual and institutional awareness of exponentially increasing health care costs has made the consumers more prudent in buying health care services. Equipped with knowledge and market power, consumers evoked increasing price competition among providers. In response, third party payers provided plans with various levels of cost sharing and deductibles to reach for cost-sensitive consumers (Wrightson, 1990).

Under increasing environmental threat, organizations tend to represent less varied interests and become more concerned about survival. The thesis of "threat-rigidity effects" (Staw, Sandelands, & Dutton, 1981:501) predicts that in response to a threatening environment, conservative, status-maintaining decisions rather than radical, high risk decisions are made. Bozeman and Slusher (1979) argue that under resource scarcity, public organizations will reduce their domain and scope of services.

Under adverse conditions, resource allocation decisions tighten control over resource use. Ordinarily, managements are seldom consciously aware of slack. Slack is so pervasive that most managements are not aware of it unless something happens to force management to look for it. Once identified, however, slack can be increased or decreased (Galbraith, 1973). Management's recognition of environmental threat will result in a decrease of the total level of slack (Sharfman, Wolf, & Tansik, 1988). In other words, hospital management's initial response to the pressure of environmental threat will be to search for slack and reduce it, rather than to engage in serious efforts to improve efficiency of operation.

> **H1**: Environmental threat and level of slack in a hospital are negatively associated.

Slack can be stored in different forms - financial slack, human resources, or technology, for example - and these forms provide different buffers against the environment (Meyer, 1982). This study differentiates available slack from recoverable slack or potential slack. Available slack is, as discussed previously, the most easily available internal resource in an organization. Management can easily deploy this resource in a wide variety of situations. Recoverable slack, on the other hand, represents less discretionary resources that can be used as protection in only a few specific situations, such as extraordinary increase in demand, or capacity failure (Sharfman, 1985), while potential slack becomes available only through substantial efforts.

Although a priori theory about the differential effects of the slack components is lacking (Singh, 1986), Sharfman (1985) argued that different types of environmental pressure may require different types of slack. In an environment where supply and demand are unstable, an organization may increase the input and output stocks in order to smooth the production process. Inventory stocks and overcapacity are categorized as recoverable slack. In an environment where the price and technology are unstable, on the other hand, organizations may want to have a more flexible form of slack so that they can be more adaptable to environmental change.

Hospitals are in continuous price negotiations with private insurance and other managed care institutions in order to secure a constant flow of patients (Melnick & Zwanziger, 1988; Robinson & Luft, 1988). Moreover, under the PPS the hospitals have to accept a fixed price rather than set their own price based on the costs incurred. Change in input price may thus cause financial instability under the fixed price schedule of the PPS. At the same time, hospitals have to keep up with rapidly advancing technology to satisfy the demands of physicians, who control a significant portion of hospital revenue (Mullner, 1990). In this environment, hospital management needs flexibility in funding these demands. Therefore, in the current hospital environment, hospital management will attempt to increase the portion of available slack in total slack.

H2: The ratio of available slack to total slack is positively associated with the environmental threat.

Relationship Between Slack Level and Hospital Performance

In order to discuss the relationship between slack and organizational performance, it is necessary to clarify the conceptual difference between slack and inefficiency. Selten (1982) explained that slack involves some inefficiency, but part of slack is appreciated as "consumption at the working place." Slack has its benefits for the members of the organization, but the welfare gains are worth less than they cost. Thus, according to Selten's (1982) definition, slack includes both inefficiency and certain resources that exist in an organization but are not essential in the production. In this study slack and inefficiency are differentiated. The slack, in this study, includes only the "consumption at the working place" portion of Selten's (1982) definition. The inefficiency is waste of resources that can be recovered only by improving technical efficiency, while slack is a strategic variable over which managements have discretion.

While in traditional economics theory slack is viewed as evidence of allocational inefficiency in an organization (Horn, Lang, & Lundgren, 1994), organizational theorists argue that organizational slack is useful as well as inevitable. Slack resources give the firm leeway in managing changes in the environment (Sharfman, Wolf, & Tansik, 1988). Lack of slack may expedite the downfall of an organization in a rapidly changing environment. Hambrick and D'Aveni (1988) suggests that, in the face of an environment that inevitably calls for some degree of adaptation, the lack of slack resources may prevent active engagement with the environment.

The effects of slack on an organization's interaction with its environment are described in the seemingly conflicting arguments of Cyert and March (1963). They argue that slack is positively related to innovations and other forms of active engagements with environment, because slack provides the resources needed for those activities. On the other hand, they argue that an organization with a high level of slack can be complacent about its current performance and undertake few initiatives to respond to environmental changes. These conflicting arguments can be reconciled by recognizing the flexibility that slack provides in strategic decision making. The high-slack organizations are able to engage in either active or passive interaction with their environments. The choice can depend on the level of environmental pressure and the level of utility of autonomy in the organization.

Slack provides flexibility in an organization's internal operations by allowing structural elaboration and decoupling between subunits. Thompson (1967) argues that an organization's structural elaboration and subunit decoupling depend on the availability of slack resources. Slack allows the elaboration of organizational structure in order to buffer the technical core from the fluctuation of the task environment. In hospitals, such systems as personnel screening processes, quality assurance programs, and utilization review programs will enhance the performance of the hospital technical core.

The decoupling between the subunits protects them from fluctuations of their immediate environments, optimizing their performance without affecting the entire system. For example, when there is an extraordinary surge of inpatients, a nursing department in a hospital that lacks slack nursing resources may have to increase its use of part-time, on-call nurses. The performance of full-time nurses and the performance of part-time, on-call nurses may be significantly different in terms of quality and efficiency. With slack in the form of extra nursing personnel, the nursing department can work with its in-house staff, independent of the personnel department.

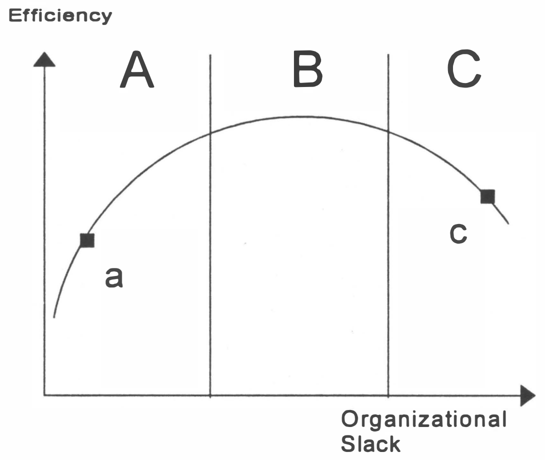
However, excessive slack may adversely affect organizational performance. Slack may be perceived as evidence of poor management, inefficiency, and other dysfunctional consequences (Kmetz, 1980). Thompson (1967) argues that the technical core has to be "fully buffered" from environmental fluctuations to achieve its maximal effectiveness and efficiency. Sharfman (1985) explains that Thompson (1967) implies the existence of an optimal level of buffering in an organization by using the term "fully buffered." Thus, excessive slack may buffer an organization over the optimal range, eventually leading to declining performance.

Bourgeois (1981) maintains the existence of a curvilinear relationship between slack and "success" in an organization. He argues that slack and success are positively related up to a point, but negatively related after that because of the excessive inefficiency. The inefficiency can be related to the lack of managerial control or the lack of management's aspiration to improve performance (Cyert & March, 1963). The adverse effect of excessive slack can be especially evident in public service organizations such as community hospitals. Thus, excessive slack in hospitals can be a source of organizational dysfunction, and thus it can worsen the efficiency and the quality of care because of the lack of accountability for organizational consequences.

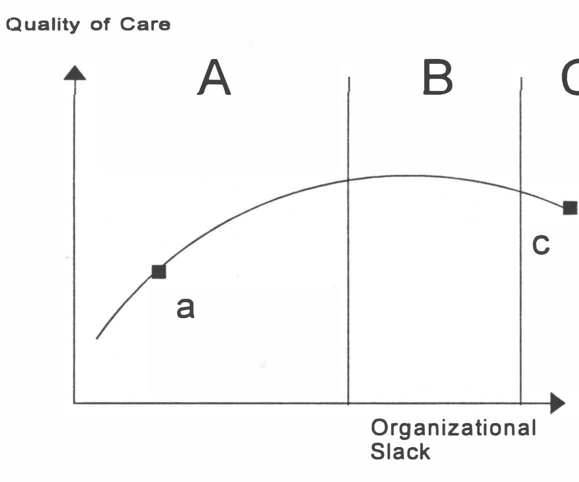
The positive effects of strong managerial control on hospital performance has been reported in many studies. Becker, Shortell, and Neuhauser (1980) suggest that high visibility of consequences to the chief of the medical staff and the hospital administrator are associated with better quality of care, higher efficiency, and shorter length of stay. Scott, Flood, and Ewy (1979) found that greater controls exercised by administrators and physicians were associated with efficient use of resources. Better quality of medical care is positively related to the hospital administration's influence over decisions within its own domain and to the ability of the physician staff to regulate its members (Scott & Flood, 1987; Shortell, Becker, & Neuhauser

Figure 2. Postulated Curvilinear Relationship of Slack with Organizational Performance

A) Slack and Efficiency



B) Slack and Quality of Care



(1976).

Figure 2 presents the posited relationship of slack with efficiency and with quality of care. Slack has a curvilinear relationship with efficiency and with quality of care. Region A has a positive relationship with performance; the relationship is not significant in region B; and region C has a negative relationship, resulting in downward opened parabola. While both efficiency and quality of care have curvilinear relationships with slack, the relationship between slack and efficiency has a steeper slope than the slope of slack and quality of care does. Although it is not within the scope of this study, the difference of slope represents the difference in the sensitivity of the effects of slack level on the performance variables. Efficiency is directly affected by level of slack, and quality of care is indirectly affected through efficiency in the study. Thus, efficiency is more sensitive to slack level than quality of care is.

> **H3**: Total slack and efficiency are curvilinearly related, and the shape is a downward opened parabola.

> **H4**: Total slack and quality of care are curvilinearly related, and the shape is a downward opened parabola.

Effect on Performance of Change in Level of Slack in High-Slack Hospitals and in Low-Slack Hospitals

This section discusses the impacts of change in slack on efficiency and on quality of care in different levels of slack.

As shown in Figure 2, region A represents the low-slack hospitals and region C represents the high-slack hospitals, and region B represents the hospitals with slack levels around optimal (or moderate level). The high-slack hospitals have poor quality of care and low efficiency because of the adverse effects of excessive slack on organizational performance. The low-slack hospitals also have low efficiency and poor quality of care, but their inferior performance is due to the lack of slack. The moderate slack hospitals are achieving around optimal performance.

As discussed previously, environmental threat forces hospitals to reduce the slack level. However, wide variations in financial performance under the PPS have been reported in many studies (Bray, et al., 1994; Cleverley, 1994). There are hospitals that managed to increase internal resources under the PPS (Fisher, 1992; Hsia & Ahern, 1992). Also, some hospitals may have competitive advantages in their market areas. Furthermore, most U.S. hospitals have sources of funds other than from operation, such as income from grants, loan forgiveness, and other public subsidies. These types of funds give management more discretion in maintaining the appropriate level of slack.

Management would attempt to maintain the optimal slack level in order to maximize the hospital's performance. Assuming the postulation that efficiency and quality of care have curvilinear relationships with slack, the high-slack hospitals will improve performance by reducing their slack level. In Figure 2, as the

Table 1
Predicted Effects on Hospital Performance of Change in Slack Level for Different Levels of Slack

Slack at Time One	Changes in Slack	Changes in Efficiency	Changes in Quality
High-Slack Hospitals	Increased	-	-
	Decreased	+	+
Low-Slack Hospitals	Increased	+	+
	Decreased	-	-

Notes: "+" indicates the increase of the performance variable.
"-" indicates the decrease of the performance variable.

point **c** (a high-slack hospital) shifts to the left (decrease in slack), the efficiency and quality of care are improving. In contrast, if the low-slack hospitals reduce the level of slack, their performance will be adversely affected. The point **a** (a low-slack hospital) will move further to the left, resulting in decrease of performance. On the other hand, the increase of slack in the high-slack hospitals will affect their performance adversely, but it will affect the low-slack hospitals' performance positively. Therefore, hospital performance would be affected by the management's ability to maintain the slack as closely as possible to the optimal range. Table 1 summarizes the posited relationships.

> **H5a**: In the hospitals with high, decreased slack, the change in level of slack has a positive relationship with performance.
>
> **H5b**: In the hospitals with low, increased slack, the change in level of slack has a positive relationship with performance.
>
> **H6a**: In the hospitals with high, increased slack, the change in level of slack has a negative relationship with performance.
>
> **H6b**: In the hospitals with low, decreased slack, the change in level of slack has a negative relationship with performance.

Level of Slack and the Relationship Between Efficiency and Quality of Care

Extrapolating Donabedian, Wheeler, and Wyszewianski's (1982) "ideal" physician concept to the hospital level, Fleming (1989) presents a complex quality and efficiency relationship model. He argues that the "ideal" hospital's relationship between quality of care and costs is positive: Increase in resource use will improve the quality of care. The ideal hospitals operate in maximal efficiency without any waste of resources, so any additional resource will result in improvement of quality of care. However, in reality, no hospitals work at this level. Most hospitals operate with sub-optimal utilization of resources, resulting in sub-optimal quality of care and efficiency. In these hospitals, efficiency and quality of care can have a negative or positive relationship or none, depending on the nature of the care (necessary, unnecessary, or harmful) that is added or dropped.

Assuming that most hospitals operate with sub-optimal efficiency, this study predicts that efficiency has a positive relationship with quality of care in the high-slack hospitals and that it has a negative relationship in the low-slack hospitals. The argument assumes that level of slack affects a hospital's priorities in its operation and its ability to attend to multiple goals. Marino and Lange (1982) argue that firms possessing slack resources will sacrifice efficiency, to some extent, in the interest of enhancing effectiveness. In contrast, low-slack organizations are preoccupied with conserving their limited resources by emphasizing efficiency. Therefore, this study argues, the high-slack hospitals will put their priority on quality of care, in pursuit of their long-term goals. These hospitals tend to approach improvement of efficiency as one of the ways to improve quality of care. On the other hand, the low-slack hospitals set their priority on efficiency, addressing their immediate goal, which is survival (Fleming & Boles, 1994). These hospitals tend to approach improvement of efficiency with an emphasis on cost cutting.

In the high-slack hospitals, increased efficiency is likely to be the result of conscious efforts by management to improve efficiency and quality of care simultaneously through tighter organizational control, which would positively affect the quality of care. Decrease in efficiency occurs through management's lack of aspiration to improve performance, caused by an excessive level of slack. Thus quality of care will be lowered in these hospitals. In low-slack hospitals, increased efficiency can be the result of a trade-off between quality and efficiency in an attempt to raise the slack level. Decreased efficiency can be due to the absence of the trade offs, or investment in quality of care in order to maintain minimum requirements of quality.

H7: Efficiency is positively related with quality of care in hospitals with high slack.

H8: Efficiency is negatively related with quality of care in hospitals with low slack.

Summary

This chapter presents an integrated model incorporating environment, organizational slack, and organizational performance. The theme is the impact of resource availability on the efficiency and quality of care in hospitals. Availability of environmental resources is conceptualized as environmental threat, and organizational resources are represented by organizational slack. Environmental threat affects organizational slack, and organizational slack in turn affects organizational performance. Under increasing environmental threat, the slack will be reduced and the proportion of available slack in total slack will be increased.

This study argues that the presence of slack gives hospitals flexibility in making strategic and operational decisions. The flexibility provided by an appropriate level of slack will be the source of improvement in organizational performance. However, excessively high or low slack will be detrimental to organizational performance. The effects of excessively high slack will appear as lack of managerial control in an organization; excessively low slack results in loss of opportunities to improve performance. Guided by these arguments, the study posits that the level of slack has a downwardly opened parabolic relationship with efficiency and with quality of care of hospitals.

The change in slack level affects efficiency and quality of care in a hospital differently depending on the hospital's level of slack. The level of slack can be manipulated by management within the limits imposed by the environment. This study posits that change in the level of slack has a negative relationship with performance in the high-slack hospitals, but a positive relationship in the low-slack hospitals.

The study investigates the impact of changes in efficiency on the quality of care in hospitals with different levels of slack (high or low). From the arguments about the effect of slack on managerial decisions, this study posits that a change in efficiency (decrease or increase) has a positive relationship with quality of care in the high-slack hospitals, and a negative relationship in the low-slack hospitals.

CHAPTER 4

METHODOLOGY

This study investigates the impact of environment on slack, the impact of slack on performance, and the impact of technical efficiency on quality of care at different levels of slack. In this chapter, research design, selection of sample, measurement of study variables, and analytical plan to test the hypotheses are presented.

Research Design

This is a panel study (Cook & Campbell, 1979) to analyze the effect of independent variables at time 1 on the dependent variables at time 2. In addition, panel analysis is performed to determine the relationship between the changes in slack indicators and the changes in performance variables over the two time periods. The unit of analysis is the individual hospital.

The design is implemented by employing data collected for two time periods: PPS V (from Oct. 1, 1987 to Sep. 31, 1988) and PPS VII (from Oct. 1, 1989 to Sep. 31, 1990) for slack variables, and 1988 and 1990 for performance and environment variables. Thus, for the slack and environment relationship, environmental threat measures at 1988 are independent variables, and the level of slack at 1990 is a dependent variable. In the analysis of the slack and performance relationship, the level of slack at 1988 is an independent variable and performance measure at 1990 is a dependent variable. Finally, for the analysis of the relationship between efficiency and quality of care, efficiency measure at 1988 is an independent variable and quality of care at 1990 is a dependent variable.

The two-year time frame is used to maximize the difference in slack level between the two periods, given the limits of the data available for this study. The literature indicates that the initial price discounts negotiated by managed care plans with little leverage of market share, and the initial three years of DRG process through 1986 were not as difficult as they could have been (Eastaugh, 1992). However, the lag in update of the Diagnosis Related Groups (DRGs) reimbursement rates in the later period of the PPS (McCarthy, 1988) and the spill-over effects of the PPS to private sectors have resulted in "barebones reimbursement" for some facilities. Cleverley (1994) suggests that the real turbulent environment began in 1986, and 1990 was the year with the worst financial ratios for hospitals.

Considering the environmental trends of the hospital industry, the measure of changes in slack level may be maximized by collecting the data before 1986 for time 1 and after 1990 for time 2. However, the data available for slack measures are limited to 1988 (PPS V) through 1991 (PPS VIII), while the latest mortality data available are 1990 for this study. Thus, within the limit of data availability, the time frame of 1988 for time 1 and 1990 for time 2 is justified.

Data Base and Sources

Organizational slack is estimated from data compiled from the Health Care Financing Administration (HCFA) capital data set, HCFA minimum cost data set, and American Hospital Association (AHA) annual survey data set. The HCFA capital data set provides the data on balance sheet items, and the HCFA minimum cost data set provides income statement items for hospitals in this study. The AHA survey data set provides the data on the individual hospitals' operational characteristics adopted to adjust the slack indicators in this study.

The data on organizational efficiency are drawn from the AHA annual survey data set. The data set provides hospital-specific information on expenses, service mix, personnel, and facility utilization levels. This data set also contains variables describing hospitals' operational, structural, and environmental characteristics that are employed as control variables in this study.

Mortality data are compiled from the HCFA mortality data set. The data set contains the hospital-specific information on overall Medicare patient mortality and each of sixteen diagnostic categories. The data consist of the number of Medicare patients, the actual mortality rate, and a range of predicted mortality given the mix of patients. The study uses the mortality rate estimates based on death within 30 days of admission to the hospital as the proxy measure of quality of care.

Sample

In order to make the study sample more homogeneous, this study employed several decision rules to select the hospitals. The sample is drawn from the population of urban, not-for-profit hospitals in the United States. The rural hospitals are excluded in consideration of their significant differences in case mix from the urban hospitals. The for-profit hospitals are excluded because there may be significant differences in mission between the not-for-profit and for-profit hospitals.

Hospitals that are not in the general medical/surgical category, such as psychiatric and rehabilitation hospitals, are excluded because of the differences in products. Federal hospitals, including those hospitals operated by the military, Public Health Service, or Veterans Administration, are excluded, since there are few Medicare patients in these hospitals (Hartz, et al., 1989). Further, these hospitals' availability of direct government subsidies and their potential mission differences (Vogel, et al., 1993) are likely to alter the posited relationships in this study. Also, those hospitals that are not designated as Medicare service facilities are excluded and hospitals that have data missing for the variables employed in this study are excluded. Using these decision rules, a total of

832 hospitals are identified as the sample for this study.

Measurement of Variables

This section discusses the measurement of study variables. Table 2 presents the list of variables and their definitions.

Measurement of Environmental Threat

This study measures the environmental threat to the individual hospitals in terms of the level of regulatory pressure and the level of competition a hospital confronted in its local market. The level of regulatory pressure is measured by the proportion of a hospital's annual discharges reimbursed by the national Medicare program. Higher proportions of these services indicate the vulnerability of the hospital to government regulations (Robinson & Luft, 1988).

The level of market competition is measured by the status of individual hospitals' formal contracts with managed care organizations, and by the converted Herfindahl Index. Shortell and Hughes (1988) use the percentage of a state's population enrolled in HMO as the indicator of intensity of competition. The assumption underlying the measure is that hospitals located in a state where HMOs have enrolled a high proportion of the population face more pressure to compete each other for patients on the basis of price. In this study, the average number of formal contracts with managed care organizations (HMO or PPO) of

Table 2
List of Measures and Their Definitions

Code	Definition
Environmental Threat	
REGU	(Medicare discharges + Medicaid discharges)/adjusted discharges
MAND	Average contract status with HMO and PPO in the SMSA
HERF	(1 - Herfindahl Index)
Organizational Slack	
Available slack	
AS1	Net income/adjusted discharges
AS2	Total fund balances/adjusted discharges
AS3	Current asset (not including inventory)/adjusted discharges
Recoverable slack	
RS1	Fixed asset/adjusted discharges
RS2	Number of non-clinical employees (number of part-time employees adjusted)
RS3	Inventory/adjusted discharges
Potential slack	
PS1	(net income + interest charge)/interest charge
PS2	Total fund balances/long-term liability

Table 2 (Cont.)
List of Measures and Their Definitions

Code	Definition
Technical Efficiency	
Inputs	
IN1	Number of beds staffed
IN2	Number of services provided
IN3	Number of paid hours for non-clinical employees (number of part-time employees adjusted)
IN4	Amount of operational expenses (not including payroll and capital depreciation)
Output	
OT1	Case-mix adjusted discharges
OT2	Number of outpatient visits
Quality of Care	
MORT	Medicare patient mortality rate within thirty days of admission to a hospital
Control Variables	
Environmental	
SMSA	Metropolitan Statistical Area classification
WEST	Western Region (1=Yes, 0=No)
EAST	Eastern Region (1=Yes, 0=No)
SOUT	Southern Region (1=Yes, 0=No)
CENT	Central Region (1=Yes, 0=No)
Institutional	
BEDS	Number of beds staffed
TICH	*Membership of Council of Teaching Hospitals* (1=Yes, 0=No)
SMIX	Service mix (number of services provided)
Operational	
CMIX	HCFA case mix index
SEVR	Number of intensive care days/total patient days
ALOS	Average length of stay
AGEE	Proportion of Medicare patients

the hospitals in an area is used as the proxy measure of the intensity of market competition among hospitals. If a hospital has a formal contract with a managed care organization, 1 is assigned and if not, 0 is assigned. Thus, the total value of managed contract status is 2 for the hospitals with both contracts (with HMO and with PPO), 1 for the hospitals with either one, and 0 for the hospitals with no contracts. The contract status values of hospitals are summed for each of the 340 SMSAs and divided by the number of hospitals in the area, resulting in the average number of managed contracts for a hospital in the area. The average number of managed contracts is divided by 2 to construct an index, ranging 0 to 1.

The degree of industry concentration was measured by the Herfindahl Index, a frequently used measure of market concentration, constructed based on the number of admissions to hospitals (Lynch & Ozcan, 1994). The index is constructed by calculating the sum of squared market shares of all hospitals in a SMSA. Market share is defined to be each facility's percentage share of total admissions in the area. The index is converted by subtracting the calculated index score from 1 so that a higher value indicates a greater market competition. Thus, a converted Herfindahl Index with a value of 0 would indicate a market area with sole provider.

Index Construction of Slack level

While it is not difficult to conceptualize organizational slack as the resource that provides cushion or flexibility in organizational activities, its direct measurement is problematic (Marino & Lange, 1983). The fundamental difficulty in measuring slack is in drawing the line between excess resources and normal resources. In economics terms, the normal use of resources can be optimal efficiency with "zero-slack." Since the "zero-slack" level is somewhat difficult to know empirically, it is difficult to directly measure the absolute level of slack.

As an alternative approach, most studies on slack use financial ratios as surrogate measures of slack level. Dimick and Murray (1978) and Marino and Lange (1982), for example, employed a profitability criterion to measure the level of slack. These authors focused on the conditions under which excess resources are likely to be available to an organization. The logic is that, in order to attract additional resources from the environment, firms must demonstrate technical competence in their current operations by being profitable (Marino & Lange, 1983).

The measurement of slack has become more sophisticated by classifying slack into the three dimensions: available, recoverable, and potential (Bourgeois & Singh, 1983). Researchers (Bourgeois & Singh, 1983; Bromiley, 1991; Moses, 1992; Singh, 1986) employed these dimensions in measuring slack. However, the theoretical distinction of the roles of these three dimensions is not clear. Moreover, Moses (1992) doubts their empirical distinctiveness. He reports, from correlation and factor analysis of ten variables that represented the three dimensions of slack, that they were not empirically distinctive.

He warns that it would be inappropriate to use a single measure to represent each of the dimensions.

This study employs the three dimensions of slack. Available slack is measured by net income, total fund balances, and current asset (excluding inventory). Bourgeois (1981) suggests that resources generated by profits, and change in retained earnings scaled by sales are appropriate measures of slack. These measures represent sources of slack that are deemed to be flexible in satisfying a variety of managerial demands.

Recoverable slack is measured by fixed assets, number of non-clinical employees, and inventory. Fixed assets, selling and administrative costs, and inventory are frequently used as the proxy measures of recoverable slack in literature (Moses, 1992). In this study, the number of non-clinical employees in a hospital is regarded as the equivalent of the selling and administrative costs in other industries. These measures indicate the resources a hospital has tied up in the current operation. Following Bourgeois' (1981) suggestion for adjusting sales in estimating slack levels in other industries, in this study the measures of available slack and recoverable slack are adjusted by the number of discharges and the number of outpatient visits.

As discussed previously, potential slack is a hospital's capability to raise resources from outside the organizational boundary. Potential slack has two measures in this study: times-interest-earned ratio and total-equity-to-asset ratio. The former represents short term solvency and the latter represents the leverage ratio of a hospital. A corporation with a larger income relative to interest charges is better able to take on additional debt than is a corporation with low income relative to interest charges, and thus has high potential slack (Bromiley, 1991). A corporation with a high debt-to-equity ratio has a relatively low ability to obtain additional funds through incurring debt, and thus has little potential slack.

The total slack level is estimated by adding up the eight slack indicators. The weight of the contribution of each slack indicator to total slack level is considered in aggregating the individual indicators. To estimate the weights of individual slack indicators, a confirmatory factor analysis (Bollen, 1989) was performed on the combined data for slack indicators in both periods (1988 and 1990). The measurement model for total slack level includes one latent variable, which is organizational slack, and eight slack indicators. The measurement model (Figure 3) can be described by the equation:

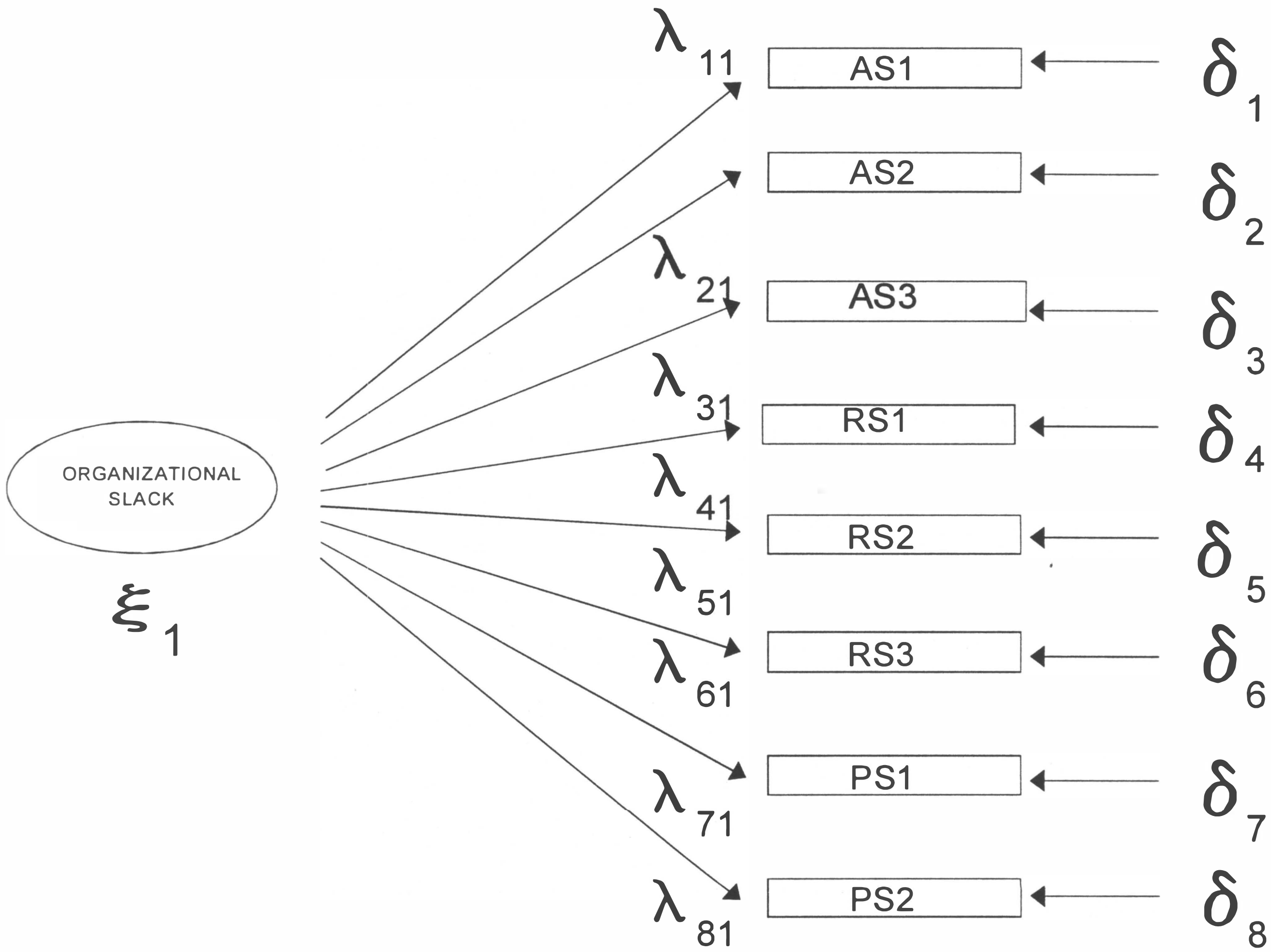
$$X = \Lambda_x \xi + \delta$$

where

X is a (q x 1) vector of slack indicators
ξ is a (s x 1) vector of common factors
Λ_x is a (q x s) matrix of factor loadings
δ is a (q x 1) vector of unique factors.

The Λ_x is used as the weight of each slack indicator.

Figure 3. A Measurement Model of Organizational Slack Construct



Therefore,

$$\text{Total slack level} = \sum \Lambda_x X_x .$$

The individual slack indicators are standardized by the mean of each indicator from pooled data, and the standardized values are multiplied by the weights, establishing the total slack level index. Table 3A presents the results of CFA. The weight of slack indicator RS1 (fixed assets adjusted by discharges) is set at one because it is considered to be the best indicator of total slack in the study. The magnitude of lambda indicates the influence of the unobserved concept on the observed indicators. Available slack and recoverable slack indicators were loaded strongly to total slack. However, PS1 (times-interest-earned ratio) was statistically insignificant and PS2 (total-equity-to-asset-ratio) was loaded in a negative direction, indicating that as PS2 increases, total slack decreases. Considering the statistical insignificance of PS1 and the negative loading of PS2 and its weak loading compare to other indicators, this study excludes potential slack from estimating the total slack level.

In order to estimate the levels of the three dimensions of slack, the weights are estimated with the CFA model with three latent variables (available slack, recoverable slack, and potential slack). Available slack and recoverable slack have three indicators, and potential slack has two indicators. Table 3B presents the CFA results with the three dimensions of organizational slack. AS2 (total fund balances adjusted by

Table 3A
Results of Confirmatory Factor Analysis with One Latent Variable

Path	Factor Loading	Indicator	Constructs	t-value
1 1	0.318	AS1	Total Slack	10.3
2 1	0.885	AS2	Total Slack	31.0
3 1	0.835	AS3	Total Slack	29.5
4 1	-	RS1	Total Slack	-
5 1	0.777	RS2	Total Slack	27.1
6 1	0.629	RS3	Total Slack	21.3
7 1	0.025	PS1	Total Slack	0.8
8 1	-0.183	PS2	Total Slack	-5.7

Notes: Chi-Square with 18 df = 275.73 (p = 0.000).
Adjusted Goodness of Fit Index = 0.923.

- : not estimated

Table 3B

Results of Confirmatory Factor Analysis with Three Latent Variables

Path	Factor Loading	Indicator	Constructs	t-value
1 1	0.234	AS1	Available Slack	7.5
2 1	-	AS2	Available Slack	-
3 1	0.792	AS3	Available Slack	26.8
4 2	-	RS1	Recoverable Slack	-
5 2	0.751	RS2	Recoverable Slack	27.0
6 2	0.608	RS3	Recoverable Slack	21.3
7 3	0.401	PS1	Potential Slack	5.0
8 3	-	PS2	Potential Slack	-

Notes: Chi-Square with 15 df = 250.90 (p = 0.000).
Adjusted Goodness of Fit Index = 0.967.

- : not estimated

discharge), RS1 (non-clinical employees adjusted by discharges) and PS2 (ratio of total fund balances to assets) were set to one. The indicators are standardized with the means from pooled data, and the standardized values are multiplied by the lambdas (the estimated weights) to come up with the index for the three dimensions of slack.

Measurement of Technical Efficiency

Technical efficiency of an organization can be measured using the Data Envelopment Analysis (DEA) method. The DEA method was introduced in the late 1970s by Charnes, Cooper, and Rhodes (1978). The DEA method addresses the limitations associated with ratio analysis and regression analysis which are traditionally used in estimating the efficiency of an organization. Ratio analysis, by its nature, cannot easily accommodate situations where multiple outputs are produced using multiple inputs. On the other hand, regression techniques are based on estimating average input-output relationships on data that include both efficient and inefficient organizations (Sherman, 1984).

The DEA is a linear programming technique that compares a set of an organization's actual inputs and outputs during a common time period to estimate the organization's technical efficiency. The DEA simultaneously considers the multiple outputs and inputs without the need to know the relative weights of inputs and outputs in the production system, as are needed for ratio analysis and most types of regression analysis. The weights of individual inputs and outputs are estimated by locating the values that satisfy the objective function and constraints within the observation set. By doing so, the DEA explicitly identifies the efficient organizations in the observation set by assigning an efficiency score of 1 (E = 1). These decision-making units (DMUs) with efficiency scores of 1 form the reference group against which other DMUs are evaluated. The inefficient DMUs, which were not able to produce as many outputs as the reference group had produced (or used more inputs in producing the same or less amount of outputs than the reference group) are assigned an efficiency score less than 1 (E < 1). Furthermore, the DEA relates to the sources and amounts of inefficiency in inputs and outputs by identifying slack input and slack output (Grosskopf & Valdmanis, 1987; Sherman, 1984).

The DEA program algorithm is briefly presented by the following equation (adapted from Charnes & Cooper, 1980):

Maximize:

$$E_o = \frac{\sum_{j=1}^{s} u_r * y_{rj}}{\sum_{i=1}^{m} v_i * x_{ij}}$$

Subject to:

$$\frac{\sum_{r=1}^{s} u_r * y_{rj}}{\sum_{i=1}^{m} v_i * x_{ij}} \leq 1$$

$$u_r,\ v_i > 0 \text{ for all } r \text{ and } i$$

where

E_o is efficiency score of the target hospital "o" being evaluated
u_r is unknown weight of output r
v_i is unknown weight of input i
x_{ij} is i th input of hospital j
y_{rj} is r th output of hospital j
n is the number of peer hospitals
m is the number of inputs
s is the number of outputs.

Since the introduction of the DEA method, researchers have applied the method to measure the efficiency of health care organizations (Ozcan, 1992; Ozcan & Luke, 1993; Ozcan, Luke, & Haksever 1992; Sherman, 1984; Valdmanis, 1990; Wan, 1992; Wan, 1995). In applying the DEA to measure the efficiency of hospitals that have multiple inputs and outputs, the identification of relevant inputs and outputs is essential for a valid specification of the model. The DEA is most useful when more direct and complete measures indicating resource utilizations are employed (Sherman, 1984).

Ozcan and Luke (1993) identify three primary outputs of a hospital: treated cases, outpatient visits, and teaching FTEs (full-time equivalents). Treated cases were measured by overall discharges adjusted using the Medicare case-mix index to reflect the differences in intensity of care among hospitals. Outpatient visits represent one of the hospital outputs distinct from inpatient care. Teaching FTEs reflects the educational functions of hospitals. For input, the authors identify three types of resources: capital, labor, and supply. Plant size (number of operational hospital beds) and plant complexity (number of diagnostic and special services provided) were used as the proxies of capital. Labor was measured by number of non-physician FTEs and weighted (using a weight of .5) number of part-time personnel. Supply was measured by the amount of operational expenses, not including payroll, capital, or depreciation expenses.

Following Ozcan and Luke (1993), this study uses adjusted discharges and outpatient visits as the output variables. Number of teaching FTEs is excluded because of the lack of sensitivity of the variable in measuring efficiency. The teaching status, instead, is a control variable in the analysis. Inputs include number of beds staffed, number of diagnostic and special services provided, number of labor hours paid, and non-payroll operational expenses. Number of labor hours paid is used instead of number of employees, used in the Ozcan and Luke (1993) model. The measure is used in the assumption that it can measure the use of actual labor input more directly than number of employees can. The AHA annual survey data set provides the total facility labor hours paid. Thus, in the case where a hospital provided other services than acute care, such as long term care, the paid hours item includes those work hours as well as acute care service hours. If the institution had provided other services in addition to acute care service, the facility work hours paid was adjusted by the ratio of number of hospital employees to number of total facility employees.

Measurement of Quality of Care

Mortality rate is used as the proxy for quality of care in this study. The appropriateness of using patient care outcome in measuring quality of care has gained wide acceptance (DesHarnais, et al., 1988; McNeil, Pederson, & Gatsonis, 1992; Thomas, Holloway, & Guire, 1993). Several reasons are: 1) patient outcome is one of the important products in hospitals which have many products; 2) the process measures that are used to measure the effectiveness of most professional work do not directly assess the effectiveness of the activities performed; and 3) outcome measures have the benefit of summarizing actions by all health care professionals involved in treatments. Thus, considering that the research questions of this study are investigating the quality care by a hospital as a whole, the use of an outcome indicator as the measure of quality of care is appropriate.

The HCFA has released data annually in recent years on mortality of Medicare patients. Although HCFA explicitly notes that the mortality rate is not a direct measure of quality (Berwick & Ward, 1990), hospital mortality rate has been used extensively to measure the quality of care by a hospital because it is readily available, unambiguous, and usually recorded consistently (DesHarnais, et al., 1988). This study employs 30-days' actual mortality rates of overall Medicare patients treated as the proxy of quality of care of the hospitals. The mortality rate represents the percentage of each hospital's Medicare patients who died within 30 days of the admission that resulted in the last-occurring discharge of the patient in the specific year.

Control Variables

Al-Haider and Wan (1991) suggest that the factors contributing to the variation in mortality rate across hospitals can be conceptualized into three major categories: patient characteristics, hospital organizational characteristics, and community/contextual factors. A similar categorization has been applied in the studies of financial performance of hospitals. McCue (1991), in his study on financial distress of hospitals, used operational, institutional, and market measures to control possible differences in financial status other than the study variables. Since this study employs financial ratios as the proxy measure for organizational slack, and mortality rate as the proxy measure for quality of care, the study identifies three levels of control variables: environmental, institutional, and operational control variables.

The AHA regional classification and Standard Metropolitan Statistical Areas (SMSA) classification are used to control the environmental differences of individual hospitals. AHA regional classification classifies hospitals in the states into 10 categories according to the geographical locations of the hospitals. In this study, the categories are aggregated into four U.S. areas: Western, Eastern, Southern, and Central regions. Four dummy variables are created for each of the regions. The dummy variable that represents Western region is regarded as the reference. In addition to the regional classification, the SMSA classification is used as an environmental control variable. The SMSA classifies metropolitan areas into six classes based on the population in the area. Institutional control variables control for the structural variation in the hospitals; they include size measured by number of available beds, teaching status measured by membership status in the Council of Teaching Hospitals, and service mix index measured by number of services offered in the hospitals. Operational control variables are intended to control for differences in the characteristics of patients a hospital served; they include HCFA case mix index, average length of stay, case severity measured by the proportion of intensive care patient days in total patient days, and patient age measured by the proportion of Medicare patients discharged in total discharges.

Analysis

The analysis is conducted in three stages. The first stage investigates the effect of environmental threat on the level of slack and on the composition of slack (ratio of available slack to total slack). Multiple regression analysis is performed on the total slack, on each of the three types of slack, and on the ratio of available slack to total slack, using environmental threat indicators as the regressors. Thus, following equations test the Hypothesis 1 and Hypothesis 2.

Slack level = f (environmental threat indicators, control variables)

Slack ratio = f (environmental threat indicators, control variables)

In the second stage, the impact of slack on efficiency and on quality of care is investigated, using multiple regression and logistic regression analysis. The postulated curvilinear relationship between slack and performance is tested using the second-order polynomial regression model with slack variables and their second order terms (square of the slack level). The regression models with the second order terms are analyzed with the mean adjusted slack variables and their second order terms using SAS GLM (General Linear Model) procedure to minimize multicollinearity. Thus, the Hypothesis 3 and 4 will be tested with following equations.

Efficiency = f (total slack, control variables)

Efficiency = f (available slack, recoverable slack, potential slack, control variables)

Quality of Care = f (total slack, control variables)

Quality of Care = f (available slack, recoverable slack, potential slack, control variables)

In addition, the sample hospitals are classified into high-slack hospitals and low-slack hospitals to compare the effect of slack in the organizations that have an extremely high or low level of slack. Thus, if the relationship between slack level and organizational performance is indeed a downward opened parabola shape as posited in the hypotheses, this study expects a significant, negative coefficient of the second order term in the polynomial regression model, and change in the direction of the coefficients of the slack variable in the two groups of hospitals (positive in the low-slack hospitals and negative in the high-slack hospitals). There is no consensus in the literature on the appropriate level of slack in an organization. Thus, whether a particular hospital is deemed to exhibit high or low slack is defined, for the purposes of the present study, in relation to the slack levels of other hospitals in the sample. In accordance with this approach, the study defines the high-slack hospitals to be those hospitals in the upper 10% and the low-slack hospitals to be those hospitals in the bottom 10% of total slack level in the sample hospitals.

The interaction effects of the level of total slack (high or low) and change in the level of total slack (increase or decrease) on performance are tested, using logistic regression. The study hospitals are divided into four subgroups based on the level and direction of change in total slack over the study period. First, the study hospitals are divided into two groups: those with total slack level in 1988 above the mean, and those with total slack level in 1988 below the mean. The mean (instead of the upper and bottom 10% classification used in multiple regressions) is used as the base of classification in order to maintain an appropriate sample size in each group for logistic regression. The two groups of hospitals are further divided into the decreased-slack hospitals and the increased-slack hospitals, resulting in four subgroups of hospitals: above mean increased, above mean decreased, below mean increased, and below mean decreased. The hospitals that did not change in slack level or in performance indicators during the period are excluded from the analysis.

Logistic regression is used to analyze the data on the four groups of hospitals. Logistic regression is useful in performing a multiple regression analysis of binary dependent variable. It produces measures of the relative odds of the outcome associated with particular characteristics. In this study, the parameters of interest are the estimated coefficient of the changes in the slack variable in determining the odds of the change in each of the performance variables. Thus, the independent variable is the absolute value of the change in total slack over the study period. The dependent variable is the change in efficiency score (increase or decrease) in the slack and efficiency model, and the change in mortality rate (increase or decrease) in the slack and quality of care model. If the performance measures increased during the study period, value 1 was assigned, and if they decreased, the value 0 was assigned. The conversion of a continuous variable to a binary one may cause the loss of information. However, since the research questions focus on the direction of effect, rather than magnitude of effect, the conversion can make the analysis more comparable. The Hypothesis 5a, 5b, 6a, and 6b will be tested by following model.

E(1,0) = f (change in slack, control variables)
Q(1,0) = f (change in slack, control variables)

where "E" is DEA scores, increased (1) or decreased (0);
"Q" is mortality rates, increased (1) or decreased (0).

Finally, the third stage investigates the effect of efficiency on quality of care (Hypothesis 7 and Hypothesis 8) in different levels of slack. Multiple regression is performed for the all hospitals, the high-slack hospitals (top 10% in total slack level), and the low-slack hospitals (bottom 10% in total slack level). The dependent variable is the mortality rate in 1990, and the independent variable is the efficiency score in 1988.

Quality of Care = f (Efficiency, control variables)

Summary

This study investigates the relationships among environmental threat, level of slack, and performance in hospitals in a panel analysis framework. The data were collected in two time periods, 1988 and 1990. The sample consists of 832, non-profit, urban hospitals in the United States.

In order to measure organizational slack, the study uses financial data from the HCFA capital data set. Mortality rate data are compiled from the HCFA mortality data file. Efficiency data are compiled from the AHA annual survey.

Using the data compiled, a slack level index is developed using the Confirmatory Factor Analysis (CFA). The CFA provides the weight of individual slack indicators in calculating total slack level. Technical efficiency of the study hospitals is estimated using the Data Envelopment Analysis (DEA). The DEA provides methodological advantages in measuring hospital efficiency: the direct measurement of input, output units, and consideration of the multiple production factors in a hospital.

The data analysis is performed in three stages. The first stage tests whether there are significant associations between the level of environmental threat and the level of slack, and between the level of environmental threat and composition of the three types of slack, using a multiple regression. The second stage investigates the relationship between slack and organizational performance, using a multiple regression. In addition, the interaction effects between the level of slack and change in the level of slack on efficiency and on quality of care are investigated in this stage, using logistic regression. The final stage analyzes the impact of change in efficiency on the quality of care in hospitals with different levels of slack, using multiple regression.

CHAPTER 5

RESULTS

To investigate the relationships among the study variables, this study analyzed the influence of independent variables at time 1 on dependent variables at time 2. In addition, panel analysis was performed to determine the effects of the changes in independent variables on the changes in dependent variables over the study period. This chapter presents descriptive statistics of the study variables and describes the results from multiple regression analysis and logistic regression analysis. Results are reported mainly on estimated coefficients of the independent variables and their test statistics, t-values. Statistical significance is based on a p-value of 0.05 or lower in analysis with all hospitals. In analysis that involves the high-slack and low-slack hospitals, however, statistical significance is based on a p-value of 0.1 or lower because of the smaller sample size.

Descriptive Statistics

Eight hundred and thirty-two not-for-profit hospitals located in urban areas constitute the sample for this study. The following sections present the descriptive statistics for the study variables, and the results of Analysis of Variance (ANOVA) in which the significance of the changes in the variables over the study period was tested.

Environmental Threat Variables

The Herfindahl Index was constructed by calculating the sum of squares of market share of individual hospitals in an area. A hospital's market share is defined as the percent share of admissions of the hospital in a SMSA. The Herfindahl Index values are converted by subtracting the values from 1 so that a value close to 1 suggests a high competition. The 7,037 hospitals reported to the 1988 AHA annual survey were located in 340 SMSAs and the 6,871 hospitals reported in 1990 were located in 341 SMSAs. The average converted Herfindahl Index of the SMSAs is 0.660 in 1988 and 0.671 in 1990. The average converted Herfindahl Index of the study hospitals is 0.820 in 1988 and 0.824 in 1990. Thus, a greater portion of the study hospitals are located in higher competition areas. Five hospitals in 1988 and four hospitals in 1990 were the sole providers in their SMSAs, with the index value 0.

The contract status with HMO and PPO was measured as a proxy for market competition along with the Herfindahl Index. The average number of contracts in the study hospitals were divided by 2 in order to have the same unit value with other environmental threat variables. The average managed care contract status (MAND) in the SMSAs is 0.49 in 1988 and 0.48 in 1990. In the study hospitals, the MAND has the average 0.57 in 1988 and 0.56 in 1990, ranging from 0 to 1 in both years. A value of MAND variable 0 indicates that none of the hospitals in

Table 4A
Descriptive Statistics of Environmental Threat Variables (n=832)

Variables	Description	Year	Mean	sd
HERF	(1 - Herfindahl Index)	1988	0.820	0.176
HERF	(1 - Herfindahl Index)	1990	0.824	0.173
MAND	Managed Care Contract Status	1988	0.571	0.237
MAND	Managed Care Contract Status	1990	0.560	0.217
REGU	Medicare and Medicaid Discharges	1988	0.457	0.102
REGU	Medicare and Medicaid Discharges	1990	0.487	0.110

Note: Herfindahl Index was constructed based on the market shares of admissions of hospitals in 340 SMSAs.

the SMSA had any formal contract with any HMOs or PPOs, and a value of 1 indicates that all hospitals in the area had contracts with both HMOs and PPOs. Thus, the higher average of MAND in study hospital compared to the average in SMSAs indicates that more of the study hospitals are located in the market areas highly penetrated by managed care organizations.

The level of regulation was approximated by the proportion of Medicare and Medicaid discharges in the total discharges of the individual hospitals. The average percentage of HCFA discharges of the study hospitals was 46% in 1988 (ranging from 9% to 84%) and 49% in 1990 (ranging from 0% to 99%), indicating the increase of Medicare and Medicaid patients portion in the patients mix.

The descriptive statistics of environmental threat variables are presented in Table 4A. The three environmental threat indicators show minor changes over the study period. The converted Herfindahl Index increased about 1.0%; managed contract status decreased 1.1%; and the portion of Medicare and Medicaid discharges increased 1.1%.

Performance Variables

Both of the performance variables indicate improvement in the performance of the sample hospitals during the study period, as presented in Table 4B. The average mortality rate in the sample hospitals was 9.21 in 1988 and 8.99 in 1990. The average mortality rates are a little lower than the average for all hospitals (9.79 in 1988 and 9.59 in 1990) reported to HCFA. The

Table 4B
Descriptive Statistics of Performance Variables (n=832)

variables	Description	Year	Mean	sd
MORT	30-day Medicare mortality rate	1988	9.211	1.748
MORT	30-day Medicare mortality rate	1990	8.994	1.751
EFFI	DEA efficiency score	1988	0.502	0.220
EFFI	DEA efficiency score	1990	0.507	0.239

Note: The DEA efficiency scores were estimated using constant returns-to-scale surface, base oriented algorithm of the DEA.

mortality rate represents the percentage of each hospital's Medicare patients who died within 30 days of the admission. This figure includes the deaths that occurred out of hospital as well as in-hospital deaths, if they occurred within 30 days of last admission to a hospital. The mortality rate ranged from 1.7% to 21% in 1988 and from 0% to 20% in 1990, with standard deviation of 1.75 in both years, which is a substantial variation considering the significance of such an outcome.

Technical efficiency was estimated using the DEA. The DEA-generated efficiency scores, E_0, indicate the technical efficiency of the hospitals relative to the best practice frontier constructed from the observations in the sample. Twelve hospitals in 1988 and 17 hospitals in 1990 had a perfect efficiency value of one, establishing the efficiency frontier for each year. The average efficiency score was 0.502 in 1988 and 0.507 in 1990.

Organizational Slack

The average level of total slack was 4.40 in 1988 and 4.47 in 1990. The increase in total slack is due to the increase in available slack. Recoverable slack exhibits a minor decrease, from 2.36 in 1988 to 2.35 in 1990; available slack increased from 1.98 in 1988 to 2.06 in 1990. Considering general trends in the hospital industry during the study period, the increase in total slack level is unexpected. However, the increased available slack and decreased recoverable slack appear to be consistent with the study hypothesis on the relationship between

Table 4C
Descriptive Statistics of Organizational Slack Variables (n=832)

Code	Description	Year	Mean	sd
AS11	Available Slack	1988	40.85	90.27
AS21	Available Slack	1988	515.57	340.74
AS31	Available Slack	1988	297.81	167.66
TAS8	**Weighted Total of Available Slack**	**1988**	**1.98**	**1.21**
RS11	Recoverable Slack	1988	529.01	305.65
RS21	Recoverable Slack	1988	0.00597	0.00268
RS31	Recoverable Slack	1988	13.07	9.25
TRS8	**Weighted Total of Recoverable Slack**	**1988**	**2.36**	**1.07**
PS11	Potential Slack	1988	12.49	36.73
PS21	Potential Slack	1988	2.64	4.18
TPS8	**Weighted Total of Potential Slack**	**1988**	**2.09**	**3.01**
TS88	**Weighted Total Slack**	**1988**	**4.40**	**2.10**
AS12	Available Slack	1990	40.97	75.20
AS22	Available Slack	1990	531.06	358.66
AS32	Available Slack	1990	317.08	187.16
TAS0	**Weighted Total of Available Slack**	**1990**	**2.06**	**1.26**
RS12	Recoverable Slack	1990	520.60	285.21
RS22	Recoverable Slack	1990	0.00564	0.00271
RS32	Recoverable Slack	1990	14.27	10.81
TRS0	**Weighted Total of Recoverable Slack**	**1990**	**2.35**	**1.12**
PS12	Potential Slack	1990	13.69	10.81
PS22	Potential Slack	1990	2.63	4.07
TPS0	**Weighted Total of Potential Slack**	**1990**	**2.15**	**3.06**
TS90	**Weighted Total Slack**	**1990**	**4.47**	**2.20**

environmental threat and slack ratios. Average potential slack was changed from 2.09 in 1988 to 2.15 in 1990, increasing 0.97%. Table 4C presents descriptive statistics for the slack variables.

The total slack level in 1988 was used as the base in classifying hospitals as either high-slack hospitals or low-slack hospitals. The average total slack level is 7.42 in the high-slack hospitals (upper 10% of sample hospitals) and 2.14 in the low-slack hospitals (bottom 10% of sample hospitals).

Control Variables

Table 4D presents the descriptive statistics for the control variables. The control variables for operational characteristics were measured by case intensity (proportion of intensive special care days), patient age (proportion of Medicare discharges), HCFA case mix index, and average length of stay. These indicators had small changes over the study period. Case intensity (SEVR) decreased from 0.094 in 1988 to 0.093 in 1990. Patient age (AGEE) increased from 0.36 in 1988 to 0.38 in 1990. HCFA case mix index (CMIX) increased from 1.275 in 1988 to 1.305 in 1990. Average length of stay (ALOS) showed a minor decrease.

Institutional control variables are number of beds staffed, service mix index (number of services provided), and teaching status (Council of Teaching Hospitals membership). In the sample hospitals, 96 hospitals had fewer than 100 beds and 161 hospitals had more than 400 beds. The average number of staffed beds (*BEDS*) decreased from 284 beds in 1988 to 280 beds in 1990. The service mix index (SMIX) increased from 34.1 in 1988 to 42.0 in

Table 4D
Descriptive Statistics of Control Variables

Variables	Description	Year	Mean	sd
SEVR	Case Intensity	1988	0.094	0.061
AGEE	Patient Age	1988	0.360	0.092
CMIX	HCFA Case Mix Index	1988	1.275	0.139
ALOS	Average Length of Stay	1988	6.710	1.407
BEDS	Number of Bed	1988	284.103	174.786
SMIX	Service Mix	1988	34.139	9.478
SEVR	Case Intensity	1990	0.093	0.056
AGEE	Patient Age	1990	0.378	0.098
CMIX	HCFA Case Mix Index	1990	1.305	0.166
ALOS	Average Length of Stay	1990	6.644	1.440
BEDS	Number of Bed	1990	279.612	175.440
SMIX	Service Mix	1990	42.014	11.673
TICH	Teaching Status		0.095	
WEST	Western Region		0.114	
EAST	Eastern Region		0.322	
SOUT	Southern Region		0.216	
CENT	Central Region		0.372	
SMSA	SMSA Size		3.919	1.441

1990. Seventy-nine hospitals (9.5% of the 832 sample hospitals) are members of the Council of Teaching Hospitals.

The control variables for environment are SMSA size and region. The SMSA size variable has a mean of 3.9, ranging from 1 (under 100,000 population) to 6 (over 2,500,000 population). The sample hospitals are classified into four regions based on their location in the United States; Western region (WEST) has 95 hospitals (11% of the study hospitals); Eastern region (EAST) has 268 hospitals (32%); Southern region (SOUT) has 180 hospitals (21%); and Central region (CENT) has 310 hospitals (37%).

Analysis of Mean Difference

In order to test the statistical significance of the changes in the study variables over the study period, analysis of variance (ANOVA) was performed. Table 5 presents the ANOVA results of the two-year combined data with the class variable YEAR (1988 and 1990). Decrease in mortality rate is significant at the 0.05 level, but increase in efficiency measure is not significant. Among environmental threat measures the change in regulation (REGU) is significantly different at the 0.0001 level. The competition measures are not significantly changed. No statistically significant differences were found between the slack estimations for 1988 and for 1990. Out of the six control variables, the changes in patient age (AGEE), case mix index (CMIX), and service mix index (SMIX) are statistically significant at the 0.0001 level.

Table 5
ANOVA Significant Test of Mean Difference Between 1988 and 1990 (n=1664)

Variables	Mean 1988	Mean 1990	sd 1988	sd 1990	F	t
MORT	9.21	8.99	1.78	1.75	6.37	0.0117*
EFFI	0.50	0.51	0.22	0.24	0.16	0.6852
REGU	0.46	0.49	0.10	0.11	34.13	0.0001***
MAND	0.57	0.56	0.24	0.22	1.00	0.3167
HERF	0.46	0.49	0.10	0.11	0.20	0.6511
TS	4.40	4.47	2.10	2.20	0.49	0.4824
TAS	1.98	2.06	1.21	1.26	1.75	0.1865
TRS	2.36	2.35	1.07	1.12	0.01	0.9158
TPS	2.09	2.15	3.01	3.06	0.11	0.7368
SEVR	0.09	0.09	0.06	0.06	0.17	0.6867
AGEE	0.36	0.38	0.09	0.10	16.10	0.0001***
CMIX	1.28	1.31	0.14	0.17	28.36	0.0001***
SMIX	34.14	42.01	9.48	11.67	228.22	0.0001***
ALOS	6.71	6.64	1.41	1.44	0.92	0.3365
BEDS	284.10	279.61	174.79	175.44	0.27	0.6009

* Significant at 0.05 level or less
*** Significant at 0.0001 level or less

Environmental Threat and Slack

To investigate the impact of environmental threat on hospital slack level, the slack level in 1990 was treated as a dependent variable, while three environmental threat variables (HERF, MAND, and REGU) in 1988 were treated as regressors in the multiple regression analysis. The control variable AGEE was excluded from the analysis to eliminate multicollinearity, because of its high correlation with regulation (REGU). Table 6A presents estimated coefficients and t-values of environmental threat variables related to total slack and to slack ratio.

Consistent with the study hypothesis, the regulation level (REGU) was found to have a significant, negative effect on total slack level (β = -1.923, t = -2.60). Although they were not statistically significant, the competition variables show a mixed effect on total slack. The managed care variable has a negative effect and the converted Herfindahl Index has a positive effect on total slack. These results indicate that low concentration of hospital market (or high competition) in an area may influence positively on the level of slack by inducing the hospitals to engage in competition on service rather than on price. The managed care contracts, on the other hand, may require the hospitals to reduce their slack level by demanding discounted rates.

Among the control variables analyzed, average length of stay (ALOS), number of beds (BEDS), and Southern region (SOUT) were found to have significant, positive associations at the 0.05 or lower level. The positive association of average length of stay may indicate its association with the level of recoverable slack, which measured the level of resources committed per discharge in the current operation. Also, the significant, positive association of number of beds may indicate that the level of slack is not completely independent of hospital size.

The impact of environment on the ratio of available slack to total slack was tested by using the ratio as a dependent variable and the environmental threat variables as regressors. The model shows a somewhat low coefficient of multiple determination (R^2 = 0.09) with an F-value of 7.21. All organizational threat variables show positive effects, but the influences are not statistically significant.

Among the control variables, average length of stay (ALOS) is negatively associated with the slack ratio (β = -0.011, t = -2.99). The direction of influence is opposite to the direction in the model of the relationship between environment and level of total slack. The change of direction may indicate a strong association of ALOS with recoverable slack, which is a denominator of the slack ratio. On the other hand, bed size (BEDS) continues to have a positive association with the ratio (β = 0.0014, t = 2.11). Thus, the larger hospitals have a higher level of total slack, and a larger portion of available slack in their total slack as compared to the smaller hospitals.

Table 6A
Effect of Environmental Threat on Total Slack and Slack Ratio

Variables	Total Slack β	Total Slack t	TAS+ to TS++ ratio β	TAS+ to TS++ ratio t
HERF	**0.6557**	**0.94**	**0.0268**	**0.66**
MAND	**-0.1509**	**-0.43**	**0.0269**	**1.11**
REGU	**-1.9230**	**-2.60****	**0.0480**	**1.31**
SEVR	-0.2967	-0.22	0.0905	1.15
CMIX	1.1367	2.00*	0.0436	1.31
SMIX	0.0161	1.76	0.0013	2.34*
ALOS	0.1757	2.89**	-0.0106	-2.99**
BEDS	0.0014	2.11*	0.0001	3.08**
TICH	-0.4896	-1.79	-0.0314	-1.97*
EAST	-1.4794	-4.80***	-0.0099	-0.54
SOUT	0.8511	2.90**	-0.0025	-0.15
CENT	-0.5372	-1.99*	0.0038	0.24
SMSA	-0.0687	-0.76	-0.0047	-0.89
Adj R^2	0.22		0.09	
F	18.60***		7.21***	

* Significant at 0.05 level or less
** Significant at 0.01 level or less
*** Significant at 0.001 level of less

\+ Total available slack (TAS)
++ Total slack (TS)

Teaching status (TICH) is negatively associated with the ratio at the 0.05 level, indicating a lager portion of recoverable slack in total slack as compared to the hospitals that are not a member of CTH.

The same set of independent variables was regressed on each type of slack variable (Table 6B). The regulation variable (REGU) was found to have a significant, negative effect on recoverable slack at the 0.01 level. The effect of regulation variable and managed care variable on available slack, and the effect of the managed care variables on recoverable slack are also negative, but they are not statistically significant. On the other hand, the converted Herfindahl Index has positive effects on all of the three types of slack, but again the influences are not statistically significant. All of the three environmental threat variables have positive effects on potential slack. Although the positive effects are not statistically significant, they appear to indicate different characteristics of potential slack as compared to other types of slack.

For the control variables, average length of stay (ALOS) shows a significant, positive association with recoverable slack and an insignificant association with available slack, explaining its significant, negative association with slack ratio in the relationship of environment and slack ratio. On the other hand, average length of stay has a significant, negative association with potential slack. This result suggests that average length of stay has a negative association with hospital's financial

Table 6B
Effect of Environmental Threat on Three Types of Slack

Variables	TAS+ β	TAS+ t	TRS++ β	TRS++ t	TPS+++ β	TPS+++ t
HERF	**0.5156**	**1.28**	**0.1335**	**0.36**	**1.0462**	**0.98**
MAND	**-0.0654**	**-0.32**	**-0.0734**	**-0.40**	**0.1288**	**0.24**
REGU	**-0.7808**	**-1.84**	**-1.0670**	**-2.73****	**0.7916**	**0.70**
SEVR	0.4490	0.58	-0.7537	-1.06	0.7835	0.38
CMIX	0.6723	2.05*	0.4073	1.36	0.3790	0.43
SMIX	0.0101	1.91	0.0045	0.93	-0.0092	-0.65
ALOS	0.0497	1.42	0.1303	4.06***	-0.2981	-3.19**
BEDS	0.0012	3.29**	0.0002	0.58	0.0036	3.58**
TICH	-0.3656	-2.32*	-0.1089	-0.75	-0.1667	-0.40
EAST	-0.7563	-4.22***	-0.6975	-4.24***	-0.1477	-0.31
SOUT	0.3176	1.88	0.4808	3.10**	0.2333	0.52
CENT	-0.2518	-1.62	-0.3001	-2.10*	0.4747	1.14
SMSA	-0.0429	-0.82	-0.0249	-0.52	0.1401	1.01
Adj R^2	0.20		0.16		0.04	
F	17.21***		13.18***		3.82***	

* Significant at 0.05 level or less
** Significant at 0.01 level or less
*** Significant at 0.001 level or less

\+ Total Available Slack
++ Total Recoverable Slack
+++ Total Potential Slack

status, which was the proxy measure of potential slack. Size (BEDS) has a significant, positive association with available slack and with potential slack. However, contrary to the common expectation, its association with recoverable slack is not significant. The coefficient of multiple determination is 0.20 in the available slack model, 0.16 in the recoverable slack model, and 0.04 in the potential slack model.

Overall, regulation appears to be the dominant factor in explaining the relationship between environmental threat and slack. Considering that almost half of the discharges of the study hospitals were for Medicare and Medicaid patients, the influence of regulation on slack may be more profound than the influence of market competition in the local area.

Slack and Technical Efficiency

Table 7A presents the results for the relationship between total slack and efficiency, with and without the second order term (squared term of slack variable). Total slack is negatively related to technical efficiency (β = -0.024, t = -6.63). When the second order term is incorporated, its magnitude of negative effect increased (from β = -0.024 to β = -0.051), and it is significant at the 0.0001 level. The second order term (QTS) shows a significant (at the 0.05 level) positive relationship with technical efficiency (β = 0.003, t = 2.22). The results indicate that slack has a negative relationship with efficiency

Table 7A
Effect of Total Slack on Technical Efficiency

Variables	Without Square Term β	t	With Square Term β	t
TS+	**-0.0236**	**-6.63*** **	**-0.0508**	**-3.99*** **
QTS++	**--**	**--**	**0.0025**	**2.22* **
SEVR	-0.1341	-0.99	-0.1458	-1.10
AGEE	-0.3567	-4.46***	-0.3530	-4.43***
CMIX	0.4073	7.14***	0.4101	7.21***
SMIX	-0.0022	-2.36*	-0.0020	-2.23*
ALOS	-0.0750	-12.15***	-0.0752	-12.22***
BEDS	0.0003	5.10***	0.0003	5.16***
TICH	0.0171	0.62	0.0177	0.64
EAST	0.1005	3.41**	0.0954	3.23**
SOUT	0.0486	1.67	0.0474	1.64
CENT	-0.0087	-0.33	-0.0109	-0.41
SMSA	-0.0036	-0.74	-0.0034	-0.70
Adj R^2	0.33		0.34	
F	35.25***		33.08***	

* Significant at 0.05 level or less
** Significant at 0.01 level or less
*** Significant at 0.001 level or less

\+ Total Slack
++ Square term of the total slack

and that the pattern of influence is not linear; rather, its negative effect on efficiency becomes stronger as the level of slack decreases.

For the control variables, average length of stay (ALOS) was found to have a negative association with technical efficiency (β = -0.075, t = -12.15). This is consistent with the results of earlier study on the relationship between efficiency and length of stay (Becker, Shortell & Neuhauser, 1980). Patient age (AGEE) and the service mix index (SMIX) also show negative associations, with efficiency having t-values of -4.46 (p = 0.0001) and -2.36 (p = 0.0183), respectively. Number of beds (BEDS), case mix index (CMIX), and Eastern (EAST) location have a positive association with efficiency. The total variance explained is 0.33 in the model without second order term and 0.34 in the model with second order term.

The impact of slack on efficiency appears to be dominated by the impact of recoverable slack. When the three types of slack were used as independent variables (Table 7B), recoverable slack was found to have a strong, negative impact on efficiency (β = -0.060, t = -7.26). Potential slack, on the other hand, has a positive impact (β = 0.006, t = 2.44), indicating that a positive association exists between technical efficiency and financial status. The impact of available slack on technical efficiency is positive, but it is not statistically significant.

When second order terms are included in the model, the magnitude of the negative influence of recoverable slack on

Table 7B
Effect of Three Types of Slack on Technical Efficiency

Variables	Without Square Term β	t	With Square Term β	t
TAS	**0.0046**	**0.62**	**0.0039**	**0.19**
TRS	**-0.0594**	**-7.26*** **	**-0.1159**	**-4.29*** **
TPS	**0.0057**	**2.44***	**0.0122**	**2.29***
QAS+	--	--	**-0.0000**	**-0.01**
QRS++	--	--	**0.0097**	**2.35***
QPS+++	--	--	**-0.0004**	**-1.50**
SEVR	-0.1956	-1.48	-0.1899	-1.43
AGEE	-0.3866	-4.93***	-0.3988	-5.06***
CMIX	0.4068	7.30***	0.4029	7.24***
SMIX	-0.0023	-2.60**	-0.0024	-2.68**
ALOS	-0.0721	-11.93***	-0.0716	-11.83***
BEDS	0.0003	4.74***	0.0003	4.83***
TICH	0.0130	0.48	0.0158	0.58
EAST	0.1000	3.46**	0.0972	3.37**
SOUT	0.0571	2.01*	0.0562	1.98*
CENT	-0.0112	-0.43	-0.0109	-0.42
SMSA	-0.0031	-0.64	-0.0028	-0.59
Adj R^2	0.36		0.38	
F	34.58***		29.21***	

* Significant at 0.05 level or less
** Significant at 0.01 level or less
*** Significant at 0.001 level or less

\+ Square term of the total available slack
++ Square term of the total recoverable slack
+++ Square term of the total potential slack

efficiency increases (from β = -0.060 to β = -0.116), and its second order term shows a significant, positive relationship with efficiency, with a t-value of 2.35 (p = 0.019). The magnitude of positive effect of potential slack on efficiency increases (from β = 0.006 to β = 0.012), and its square term showed an insignificant, negative relationship, with a t-value of -1.50 (p = 0.133). Neither the second order term of available slack nor the second order term of potential slack is statistically significant. Thus, the significant second order term of total slack is due solely to recoverable slack.

The results for the effects of slack on technical efficiency at different levels of slack are presented in Table 7C and Table 7D. In the high-slack hospitals, recoverable slack was found to have a statistically significant (at the 0.01 level), negative effect on efficiency. However, its negative effect is not significant for the low-slack hospitals.

Of the control variables studied, average length of stay (ALOS) shows a negative association with efficiency, in both groups of hospitals. This result indicates that length of stay has a negative effect on efficiency that is independent of the effect of slack level. The association of patient age (AGEE) with efficiency is significant for the low-slack hospitals (t = -3.43). However, its association is not significant in the high-slack hospitals, with a positive estimated coefficient. On the other hand, the size of hospital (BEDS) shows an opposite

Table 7C
Comparison of Effect of Total Slack on Technical Efficiency in Different Levels of Slack

Variables	High-slack hospitals (n=82+) β	t	Low-slack hospitals (n=82++) β	t
TS	**-0.0588**	**-2.75*****	**-0.0184**	**-0.37**
SEVR	-0.0556	-0.10	-0.9939	-1.95
AGEE	0.0109	0.03	-0.8129	-3.43****
CMIX	0.1360	0.64	0.6523	2.75***
SMIX	-0.0025	-0.74	0.0006	0.20
ALOS	-0.1019	-3.65***	-0.0669	-3.88****
BEDS	0.0006	3.07***	-0.0001	-0.52
TICH	-0.0405	-0.34	0.0287	0.25
EAST	-0.0573	-0.38	0.0849	0.81
SOUT	-0.0485	-0.34	0.0993	0.80
CENT	-0.0484	-0.33	-0.0903	-0.86
SMSA	-0.0147	-0.70	-0.0022	-0.14
Adj R^2	0.27		0.28	
F	3.48****		3.62****	

*** Significant at 0.01 level or less
**** Significant at 0.001 level or less

+ Upper 10% of the study sample
++ Bottom 10% of the study sample

Table 7D
Comparison of Effect of Three Types of Slack on Technical Efficiency in Different Levels of Slack

Variables	High-slack hospitals (n=82) β	t	Low-slack hospitals (n=82) β	t
TAS+	**-0.0437**	**-1.61**	**0.0199**	**0.29**
TRS++	**-0.0674**	**-2.71*** **	**-0.1472**	**-2.12** **
TPS+++	**0.0062**	**0.70**	**-0.0006**	**-0.09**
SEVR	-0.3008	-0.51	-0.8838	-1.77
AGEE	0.0638	0.20	-0.8174	-3.54****
CMIX	0.1340	0.63	0.6640	2.84***
SMIX	-0.0024	-0.70	-0.0004	-0.13
ALOS	-0.1058	-3.77****	-0.0605	-3.48****
BEDS	0.0006	3.20***	-0.0001	-0.28
TICH	-0.0532	-0.43	0.0342	0.30
EAST	-0.0853	-0.57	0.0776	0.75
SOUT	-0.0796	-0.56	0.0740	0.61
CENT	-0.0768	-0.52	-0.0718	-0.69
SMSA	-0.0143	-0.67	-0.0109	-0.67
Adj R^2	0.27		0.32	
F	3.14****		3.71****	

** *Significant at 0.05 level or less*
*** *Significant at 0.01 level or less*
**** *Significant at 0.001 level or less*

+ Total Available Slack
++ Total Recoverable Slack
+++ Total Potential Slack

pattern of influence to that of AGEE. The association is significant and positive for the high-slack hospitals, but insignificant and negative for the low-slack hospitals. Thus, the larger hospitals with high slack are likely to be more technically efficient than the larger hospitals with low slack. This result suggests the role of slack in the large hospitals as a facilitator of efficient operation.

In the analysis with three types of slack, the negative effect of recoverable slack on efficiency is significant both in the high-slack hospitals (β = -0.067, t = -2.71) and in the low-slack hospitals (β= -0.147, t = -2.12). On the other hand, although its impact is not significant, the available slack in the low-slack hospitals has a positive impact on efficiency, but its impact is negative for the high-slack hospitals. The influence of potential slack on efficiency is not significant for either group of hospitals. These results explain the insignificant impact of total slack in the low-slack hospitals. The insignificant impact is due to the reversal in direction of the influence of available slack on efficiency, between the two groups of hospitals.

Slack and Quality of Care

Table 8A presents the results for the relationship between total slack and mortality rate. It appears that slack exerts a beneficial effect on quality of care. The mortality rate and total slack are negatively related (β = -0.102, t = -3.36). When the second order term is introduced, however, both total slack and its second order term are not significant, but the direction of impact is negative for both coefficients. The coefficient of multiple determination improves from 0.10 to 0.11 in the model with second order term. Of the control variables, hospital size (BEDS) has a significant, negative association with the mortality (β = -0.003, t = -4.35); all three of the regional variables (EAST, SOUT, and CENT) show a significant negative association with mortality rate at the 0.05 or lower level.

In the model with three types of slack (Table 8B), recoverable slack has a negative influence (β = -0.130, t = -1.82), but it is significant only at the 0.1 level. Available slack has a negative coefficient, and potential slack has a positive coefficient, but they are not statistically significant. When second order terms are introduced, none of the slack variables and their second order terms show a significant impact on mortality rate.

Table 8C compares the impact of total slack on quality of care, for different slack levels. Total slack has a significant, negative relationship with mortality rate (β = -0.320, t = -2.35) in the high-slack hospitals. In the low-slack hospitals, the influence of total slack is still negative, but it becomes insignificant, with a t-value of -0.69 (p = 0.4903).

Table 8A
Effect of Total Slack on Mortality

Variables	Without Square term β	t	With Square Term β	t
TS+	**-0.1020**	**-3.36****	**-0.0894**	**-0.82**
QTS++	**--**	**--**	**-0.0012**	**-0.12**
SEVR	-0.5948	-0.52	-0.5880	-0.51
AGEE	1.1503	1.69	1.1487	1.68
CMIX	0.0692	0.14	0.0680	0.14
SMIX	0.0065	0.82	0.0064	0.82
ALOS	-0.0011	-0.02	-0.0010	-0.02
BEDS	-0.0025	-4.35***	-0.0025	-4.35***
TICH	-0.1204	-0.51	-0.1206	-0.51
EAST	-0.8580	-3.40**	-0.8556	-3.39**
SOUT	-0.5093	-2.06*	-0.5087	-2.05*
CENT	-0.7740	-3.39**	-0.7729	-3.38**
SMSA	0.0667	1.59	0.0665	1.59
Adj R^2	0.10		0.11	
F	8.35***		7.70***	

* Significant at 0.05 level or less
** Significant at 0.01 level or less
*** Significant at 0.001 level or less

\+ Total Slack
++ Square term of the total slack

Table 8B
Effect of Three Types of Slack on Mortality

Variables	Without Square term β	t	With Square Term β	t
TAS+	**-0.0981**	**-1.50**	**-0.0054**	**-0.03**
TRS++	**-0.1296**	**-1.82**	**-0.1943**	**-0.82**
TPS+++	**0.0248**	**1.21**	**0.0506**	**1.08**
QAS	--	--	**-0.0180**	**-0.60**
QRS	--	--	**0.0116**	**0.32**
QPS	--	--	**-0.0019**	**-0.67**
SEVR	-0.6289	-0.54	-0.5575	-0.48
AGEE	1.1545	1.69	1.0755	1.56
CMIX	0.0738	0.15	0.0448	0.09
SMIX	0.0066	0.83	0.0059	0.74
ALOS	0.0018	0.04	0.0064	0.12
BEDS	-0.0025	-4.40***	-0.0025	-4.42***
TICH	-0.1457	-0.62	-0.1385	-0.59
EAST	-0.8647	-3.44**	-0.8555	-3.39**
SOUT	-0.4981	-2.01*	-0.4965	-2.00*
CENT	-0.7822	-3.42**	-0.7755	-3.39**
SMSA	0.0694	1.65	0.0701	1.67
Adj R^2	0.098		0.11	
F	7.41***		6.14***	

* Significant at 0.05 level or less
** Significant at 0.01 level or less
*** Significant at 0.001 level or less

\+ Total Available Slack
++ Total Recoverable Slack
+++ Total Potential Slack

Table 8C
Comparison of Effect of Total Slack on Mortality in Different Levels of Slack

Variables	High-slack hospitals β	t	Low-slack hospitals β	t
TS	**-0.3200**	**-2.35****	**-0.2729**	**-0.69**
SEVR	-0.3988	-0.11	-11.3139	-2.82***
AGEE	0.1226	0.06	3.9402	2.11**
CMIX	-4.7731	-3.52****	4.8106	2.57**
SMIX	0.0015	0.07	-0.0099	-0.40
ALOS	-0.0726	-0.41	0.1865	1.38
BEDS	-0.0017	-1.43	-0.0032	-1.43
TICH	-0.1605	-0.21	0.4273	0.48
EAST	-0.2120	-0.22	-0.7829	-0.95
SOUT	0.8250	0.92	0.1146	0.12
CENT	0.7126	0.76	-0.1510	-0.18
SMSA	0.1388	1.04	0.2428	1.90
Adj R^2	0.30		0.26	
F	3.98****		3.48****	

** Significant at 0.05 level or less
*** Significant at 0.01 level or less
**** Significant at 0.001 level or less

The results of three types of slack on the mortality rates with different levels of slack are presented in Table 8D. In the high-slack hospitals, available slack and recoverable slack have negative relationships with mortality rate, with t-values of -2.38 ($p = 0.0204$) and -1.92 ($p = 0.0596$), respectively. On the other hand, in the low-slack hospitals, recoverable slack and potential slack have significant negative relationships with mortality rate with t-values of -2.96 ($p = 0.004$) and -1.99 ($p = 0.050$), respectively. The impact of available slack on the mortality rate in low-slack hospitals and the impact of potential slack in high-slack hospitals are not significant.

The pattern of effect of slack on mortality rates for different levels of slack is similar to the pattern exhibited in the relationship between slack and efficiency. Available slack and recoverable slack each show a negative impact on both of the performance variables in high-slack hospitals, and recoverable slack and potential slack have negative relationships in the low-slack hospitals. This result appears to demonstrate the differential influence of the three types of slack on organizational performance. These results further suggest that slack has a distinctive effect on performance independent of the effects of other organizational structure variables.

For control variables, case mix (CMIX) shows a negative association with mortality rate in the high-slack hospitals; the association became positive and significant in the low-slack hospitals. For the low-slack hospitals, case severity (SEVR)

Table 8D
<u>Comparison of Effect of Three Types of Slack on Mortality in Different Levels of Slack</u>

Variables	High-slack hospitals β	t	Low-slack hospitals β	t
TAS+	**-0.4087**	**-2.38****	**0.2234**	**0.42**
TRS++	**-0.3013**	**-1.92***	**-1.5674**	**-2.96*****
TPS+++	**0.0482**	**0.86**	**-0.0982**	**-1.99***
SEVR	-0.6918	-0.18	-10.1137	-2.66***
AGEE	0.2622	0.13	4.0694	2.32**
CMIX	-4.9890	-3.68****	4.4095	2.48**
SMIX	0.0006	0.03	-0.0236	-1.00
ALOS	-0.0741	-0.42	0.2977	2.24**
BEDS	-0.0014	-1.16	-0.0025	-1.17
TICH	-0.3573	-0.46	0.6102	0.71
EAST	-0.3193	-0.34	-1.1164	-1.41
SOUT	0.6674	0.74	-0.3387	-0.36
CENT	0.6380	0.68	-0.0578	-0.07
SMSA	0.1428	1.07	0.1810	1.47
Adj R^2	0.31		0.34	
F	3.46****		4.01****	

* *Significant at 0.1 level or less*
** *Significant at 0.05 level or less*
*** *Significant at 0.01 level or less*
**** *Significant at 0.001 level or less*

\+ Total Available Slack
\++ Total Recoverable Slack
\+++ Total Potential Slack

shows a negative association, and patient age (AGEE) and length of stay (ALOS) each show a positive association with mortality rate at 0.05 or lower level. The coefficient of multiple determination is 0.31 for the high-slack hospital group and 0.34 for the low-slack hospital group.

Logistic Regression Analysis

Logistic regression is performed to investigate interaction effects of slack level and change in the slack level on performance. Of the 832 study hospitals, 791 hospitals are included in the logistic regression analysis. Forty-one hospitals are excluded because they did not have any change in total slack level, efficiency score, or mortality rate during the study period. The hospital classifications are based on the mean of the total slack levels in 1988 of the study hospitals. Of the 791 hospitals, 330 hospitals are above the mean and 461 hospitals are below the mean in total slack level. The two groups of hospitals are further classified according to the change in the level of total slack during the study period. Of the 330 hospitals with above-the-mean total slack, 143 hospitals show an increase and 187 hospitals show a decrease in their total slack. Of the 461 hospitals with below-the-mean total slack level, 273 hospitals increased and 188 hospitals decreased their total slack levels (Table 9A and Table 9B).

Table 9A
Changes in Efficiency Scores in Different Levels of and Changes in Total Slack

	Increased Total Slack		Decreased Total Slack		
	I	D	I	D	Totals
Above the Mean	70	73	119	68	330
Below the Mean	117	156	103	85	461
Totals	187	229	222	153	791

Notes: "I" indicates increase in efficiency scores.
"D" indicates decrease in efficiency scores.

Table 9B
Changes in Mortality Rates in Different Levels of and Changes in Total Slack

	Increased Total Slack		Decreased Total Slack		
	I	D	I	D	Totals
Above the Mean	56	87	82	105	330
Below the Mean	102	171	84	104	461
Totals	158	258	166	209	791

Notes: "I" indicates increase in mortality rates.
"D" indicates decrease in mortality rates.

Table 10 presents the results of logistic regression analysis on the relationship between the changes in total slack and the changes in performance in different levels of slack. The estimated coefficients indicate the direction and magnitude of the influence that changes (absolute values of the differences between the two time periods) in slack level have on the odds for the performance variables to decrease. Thus, a positive coefficient in the model of the slack-and-efficiency relationship indicates a positive influence by changes in slack on the odds of having lower efficiency score, while a positive coefficient in the model of the slack-and-quality-of-care relationship indicates a positive influence on the odds of having a reduced mortality rate. Odds ratio indicates the ratio of the odds for performance variables having value 0 (decrease in the performance variables) to the odds for the performance variables having value 1 (increase in the performance variables). Wald statistics, the ratio of the estimated coefficient to its estimated standard error, is used to test for the significance of the estimated coefficients. Score test is used to test the significance of the models.

Of the 143 above-the-mean, increased total slack hospitals, 70 hospitals have higher efficiency scores and 73 hospitals have decreased efficiency scores. Results of logistics analysis shows a negative coefficient of the variable, change in total slack, but it is not statistically significant. In this group of hospitals, the mortality rates increased in 56 hospitals and

Table 10
Effect of Changes in Total Slack on Performance in Different Levels of Total Slack

Model	Dependent Variable	Estimated Parameter	p-value	Odds
Above the Mean, Increased Slack χ^2=17.10, df=10	Change in Efficiency Score	-0.1135	0.4758	0.893
Above the Mean, Decreased Slack χ^2=10.25, df=10	Change in Efficiency Score	-0.0663	0.5429	0.936
Below the Mean, Increased Slack χ^2=17.76, df=10	Change in Efficiency Score	0.2393	0.0540*	1.270
Below the Mean, Decreased Slack χ^2=17.30, df=10	Change in Efficiency Score	-0.3274	0.3630	0.721
Above the Mean, Increased Slack χ^2=15.51, df=10	Change in Mortality Rate	0.3239	0.0695*	1.383
Above the Mean, Decreased Slack χ^2=8.13, df=10	Change in Mortality Rate	-0.0728	0.4767	0.930
Below the Mean, Increased Slack χ^2=18.88, df=10	Change in Mortality Rate	0.2580	0.0384**	1.294
Below the Mean, Decreased Slack χ^2=10.68, df=10	Change in Mortality Rate	-0.1504	0.6552	0.860

Notes: The Chi-square value of model is estimated using score test for overall model significance.
The p-value of indicators is the p-values of Wald statistics.

* Significant at 0.1 level or less
** Significant at 0.05 level or less

decreased in 87 hospitals. The increase of total slack has a significant, positive influence on the odds having a decreased mortality rate, with a p-value of 0.070. The positive coefficient indicates that in this group, the greater the increase in the total slack level, the more the hospital is likely to have decreased mortality rate. The odd ratio indicates that it is 1.38 times more likely that the mortality rate would be reduced in this group of hospitals.

In the group with hospitals above the mean and decreased total slack level, 119 hospitals have higher efficiency scores and 68 hospitals have lower efficiency scores. In this group, the effect of the change in total slack on efficiency scores is not significant, with a negative estimated coefficient. The insignificant result may be due to the counter-influence of available slack and recoverable slack on the efficiency score as observed in the multiple regression analysis for the model of the relationship between three types of slack and efficiency. In the model for the relationship between slack and quality of care, 82 hospitals have increased mortality rates and 105 hospitals have decreased mortality rates. The decrease in total slack level does not have a significant influence on mortality rate, and its estimated coefficient is negative.

Of the 273 hospitals below the mean with increased total slack, 117 hospitals have higher efficiency scores, and 156 hospitals have lower efficiency scores. Changes in total slack shows a significant, positive influence on the odds of having lower efficiency score, with estimated coefficient 0.2393 (p = 0.054). The positive coefficient indicates that the more increase in total slack, the more likely the hospital is to have a lower efficiency score. The odds ratio indicates that it is 1.27 times more likely to have reduced efficiency score. In this group, the mortality rates increased in 102 hospitals and decreased in 171 hospitals. The increase of total slack show a significant, positive influence on the odds of having a reduced mortality rate, with the odds ratio of 1.29.

Finally, in the group with hospitals below the mean and decreased total slack, 103 hospitals have higher efficiency scores and 85 hospitals have lower efficiency scores. The influence of decreased total slack is not significant on the odds of having a lower efficiency scores, with a negative coefficient. In this group of hospitals, the mortality rates increased in 84 hospitals and decreased in 104 hospitals. The estimated coefficient of total slack is insignificant and its direction of influence is negative.

Overall, the logistic regression analysis on the relationship between changes in total slack and changes in performance portrays a pattern of associations similar to the results of the multiple regression analysis. Change in total slack has negative relationships with efficiency scores and with mortality rates, regardless the level of slack of the hospital. The results indicate no significant interaction effects between the level of slack and the change in the level of slack on organizational performance.

Technical Efficiency and Quality of Care

Effect of technical efficiency on mortality rate is analyzed using multiple regression. Efficiency score in 1988 was treated as an independent variable, and mortality rate in 1990 was treated as a dependent variable. Efficiency score from the DEA was transformed to the natural log of the scores, in order to minimize the skewedness of its distribution. The model was analyzed with all hospitals, with the high-slack hospitals, and with the low-slack hospitals. Table 11 presents the results for the relationship between efficiency and quality of care.

The efficiency score is positively related to the mortality rate in the sample of all hospitals (β = 0.341, t = 2.72). Thus, the higher an efficiency score is the more likely to have a higher mortality rate. The direction of influence of the efficiency score on mortality rate is positive both in the high-slack hospitals and in the low-slack hospitals. However, the relationship is not significant in the model with the low-slack hospitals. In the high-slack hospitals, the positive effect of the efficiency score on mortality rate is significant at the 0.1 level.

Among the control variables, size (BEDS) shows a significant, negative association with mortality rate in the all-hospitals sample and in the high-slack hospitals. However, its

Table 11
Effect of Technical Efficiency on Mortality

Variables	All β	All t	High Slack β	High Slack t	Low Slack β	Low Slack t
EFFI+	**0.3431**	**2.72*** **	**0.5496**	**1.87***	**0.6011**	**1.20**
SEVR	-0.6289	-0.55	-1.2636	-0.34	-10.1184	-2.47**
AGEE	1.1258	1.65*	0.7349	0.35	4.3669	2.38**
CMIX	-0.1347	-0.28	-4.5667	-3.34***	4.6242	2.48**
SMIX	0.0075	0.95	0.0117	0.53	-0.0059	-0.24
ALOS	0.0430	0.78	0.0040	0.02	0.2225	1.58
BEDS	-0.0030	-5.17****	-0.0027	-2.10**	-0.0034	-1.51
TICH	-0.1025	-0.44	-0.4128	-0.02	0.3760	0.43
EAST	-0.9074	-3.58***	-0.6466	-0.43	-0.8624	-1.05
SOUT	-0.6445	-2.64***	0.6542	0.71	0.0519	0.05
CENT	-0.7820	-3.42***	0.2305	0.69	-0.1301	-0.16
SMSA	0.0826	1.93*	0.2414	1.65	0.2702	2.21**
Adj R^2	0.09		0.28		0.27	
F	7.99****		3.71****		3.49****	

* Significant at 0.1 level or less
** Significant at 0.05 level or less
*** Significant at 0.01 level or less
**** Significant at 0.001 level or less

\+ Log transformed efficiency score

influence is not statistically significant in the low-slack hospitals. These results may be explained in terms of the relationship between slack and performance. Size has a positive association with level of slack, as shown in the analysis of the relationship between slack and environment. On the other hand, slack has a negative relationship with mortality rate, as shown in the analysis of the relationship between slack level and performance. Therefore, the significant, negative association of size in the high-slack hospitals and the insignificant association in the low-slack hospitals results. From this it can be argued that the positive relationship of size and mortality rate may be a spurious one that would become insignificant when slack variable is introduced to the model.

Among the other control variables, case mix index (CMIX) is negatively associated with mortality rate in the high-slack hospitals, but the association becomes positive in the low-slack hospitals. This result may indicate the positive effect of slack on quality of care indirectly. Severity of case (SEVR) is negatively associated with mortality, and patient age (AGEE) and metropolitan statistical area size (SMSA) are positively associated in the low-slack hospitals. The coefficient of multiple determinations is 0.09 in the all-hospitals model, 0.28 in the high-slack hospitals model, and 0.27 in the low-slack hospitals model.

CHAPTER 6

SUMMARY AND DISCUSSION

In this chapter, the findings are summarized in terms of hypotheses testing. Following the summary, findings are discussed in relation to the theoretical implications for the property of organizational slack and the implications for health policy and hospital management. Finally, the limitations of the present study are acknowledged and suggestions are offered for future research.

Summary of Findings

In order to investigate the property of organizational slack, this study developed an integrated conceptual framework encompassing source of organizational slack, its impact on organizational performance, and its impact on the relationship between the performance indicators. Employing an open system theory, the study investigated the effects of environment on accumulation and deployment of slack resources. The effects of slack on organizational performance were investigated in terms of the influence on managerial decisions of the level of and the changes in slack. Finally, the impact of slack on the relationships between the performance indicators was examined by analyzing the effect of efficiency on the quality of care in hospitals with different levels of slack. The following sections summarize the findings in terms of testing hypotheses posited in this study.

Environmental Threat and Slack

The hypothesis on the relationship between environmental threat and slack level states that hospitals under increasing government regulation and market competition search for and reduce slack resources in order to ensure their survival.

H1: Environmental threat and level of slack in a hospital are negatively associated.

As indicated in the results of ANOVA, during the study period government regulation had exerted increasing influence on the study hospitals, resulting in increased environmental threat. The results of the data analysis support the hypothesis predicting the negative effect of environmental threat on slack level (Table 12). The regulation variable illustrates the adverse effect of environmental threat on organizational slack, resulting in a significant, negative effect on total slack and recoverable slack. The competition variables, although they are not statistically significant, show mixed influences on slack level. The different effects of the competition variables on level of slack appear to be due to the different nature of the measures as discussed in the previous chapter.

When the environment is threatening, the environmental uncertainty increases. In order to respond effectively to

Table 12
Summary of Relationships Between Environmental Threat and Organizational Slack

Envir. Variables	TS+	TAS++	TRS+++	TPS++++	Slack Ratio
Regulation	- S	- NS	- S	+ NS	+ NS
Converted Herfindahl	+ NS	+ NS	+ NS	+ NS	+ NS
Managed Care	- NS	- NS	- NS	+ NS	+ NS

Note: Statistical significance is based on a $p \le 0.05$.

+: Total slack
++: Total available slack
+++: Total recoverable slack
++++: Total potential slack

+: Positive effect on slack level
-: Negative effect on slack level
S: Statistically significant effect
NS: Statistically not significant effect

unexpected environmental changes, organizations attempt to increase their flexibility by increasing the proportion of available slack in their slack resources. Available slack provides flexibility in satisfying various internal and external demands, enabling the organizations to keep options open. Thus, the proportion of available slack in total slack would increase as environmental threat increases.

H2: The ratio of available slack to total slack is positively associated with the environmental threat.

The results show positive influences of all three of the environmental threat variables on the ratio of available slack to total slack. However, the influences are not statistically significant (Table 12).

Slack and Organizational Performance

In this study, a parabolic curvilinear relationship was posited between the level of slack and organizational performance, by arguing the existence of an optimal level of slack for achieving maximal performance. Slack is a source of resources for improving organizational performance. In hospitals, slack resources are sources for capital investment, flexibility in day-by-day operations, more qualified manpower, etc. However, excessive slack would cause a lack of accountability in managerial decisions and reduced aspiration for further improvement of performance, resulting in a decline in organizational performance. Thus, the hypotheses of downward opened parabolic relationships predict a significant, negative coefficient of the second order terms. In addition, a reversed direction of the effect of slack variables on performance (positive in the low-slack hospitals and negative in the high-slack hospitals) was expected between the excessively low-slack hospitals and the excessively high slack hospitals.

H3: Total slack and efficiency are curvilinearly related and the shape is a downward opened parabola.

H4: Total slack and quality of care are curvilinearly related and the shape is a downward opened parabola.

In the slack-and-efficiency model without the second order term, total slack shows a strong negative influence on efficiency (Table 13). When the second order term is introduced, the magnitude of the parameter of slack level increases and the second order term shows a positive relationship with technical efficiency. The positive direction of the influence of the second order term indicates that the negative impact of slack on efficiency become stronger as the level of slack decreases. These results contradict the hypothesis that predict a downward opened parabolic relationship (a negative coefficient of the second order term) between slack and efficiency (H_3). In the analysis with different levels of slack (Table 14A and Table 14B), total slack has a significant, negative effect on efficiency in the high-slack hospitals. However, total slack also has a negative effect on efficiency in the low-slack

Table 13
Summary of Relationships Between Organizational Slack and Efficiency Scores in All Sample Hospitals

Variables	Direction of Effect on Efficiency Scores	Statistical Significance
Total Slack	-	S
Available Slack	+	NS
Recoverable Slack	-	S
Potential Slack	+	S
Square of Total Slack	+	S
Square of Available Slack	-	NS
Square of Recoverable Slack	+	S
Square of Potential Slack	-	NS

Note: Statistical significance is based on a $p \leq 0.05$.

+: Positive effect on efficiency score
-: Negative effect on efficiency score
S: Statistically significant effect
NS: Statistically not significant effect

Table 14A
Summary of Relationships Between Organizational Slack and Efficiency Scores in High-Slack Hospitals

Variables	Direction of Effect on Efficiency Scores	Statistical Significance
Total Slack	-	S
Available Slack	-	NS
Recoverable Slack	-	S
Potential Slack	+	NS

Note: Statistical significance is based on a $p \leq 0.1$.

+: Positive effect on efficiency score
-: Negative effect on efficiency score
S: Statistically significant effect
NS: Statistically not significant effect

Table 14B
Summary of Relationships Between Organizational Slack and Efficiency Scores in Low-Slack Hospitals

Variables	Direction of Effect on Efficiency Scores	Statistical Significance
Total Slack	-	NS
Available Slack	+	NS
Recoverable Slack	-	S
Potential Slack	-	NS

Note: Statistical significance is based on a $p \leq 0.1$.

+: Positive effect on efficiency score
-: Negative effect on efficiency score
S: Statistically significant effect
NS: Statistically not significant effect

hospitals, thereby rejecting the hypothesis (H_3).

The results of the model with three types of slack show a dominant influence of recoverable slack on technical efficiency. Recoverable slack is negatively related to efficiency, and its second order term has a significant positive influence. The coefficient of recoverable slack is negative both in the high-slack hospitals and in the low-slack hospitals. Thus, the results of the relationship between recoverable slack and technical efficiency are not consistent with the prediction of hypothesis (H_3).

Although they are not statistically significant, available slack and potential slack exhibit a partial support on the hypothesis. Available slack has a negative effect on technical efficiency in the high-slack hospitals and a positive effect in the low-slack hospitals (corresponding to Hypothesis 3); however, its second order term has a positive coefficient (contradicting to Hypothesis 3). On the other hand, potential slack has a negative coefficient in second order terms, but the direction of influences at different levels of slack are opposite to those posited in the hypothesis (positive in the high-slack hospitals and negative in the low-slack hospitals).

Compared to the relationship between slack and efficiency, mortality rate and slack shows a more clearly linear relationship. Total slack level shows a significant, negative

Table 15
Summary of Relationships Between Organizational Slack and Mortality Rates in All Sample Hospitals

Variables	Direction of Effect on Mortality Rates	Statistical Significance
Total Slack	-	S
Available Slack	-	NS
Recoverable Slack	-	NS
Potential Slack	+	NS
Square of Total Slack	-	NS
Square of Available Slack	-	NS
Square of Recoverable Slack	+	NS
Square of Potential	-	NS

Note: Statistical significance is based on a $p \le 0.05$.

+: Negative effect on mortality rate
-: Negative effect on mortality rate
S: Statistically significant effect
NS: Statistically not significant effect

Table 16A
Summary of Relationships Between Organizational Slack and Mortality Rates in High-Slack Hospitals

Variables	Direction of Effect on Mortality Rates	Statistical Significance
Total Slack	-	S
Available Slack	-	S
Recoverable Slack	-	S
Potential Slack	+	NS

Note: Statistical significance is based on a $p \leq 0.1$.

+: Negative effect on mortality rate
-: Negative effect on mortality rate
S: Statistically significant effect
NS: Statistically not significant effect

Table 16B
Summary of Relationships Between Organizational Slack and Mortality Rates in Low-Slack Hospitals

Variables	Direction of Effect on Mortality Rates	Statistical Significance
Total Slack	-	NS
Available Slack	+	NS
Recoverable Slack	-	S
Potential Slack	-	S

Note: Statistical significance is based on a $p \leq 0.1$.

+: Negative effect on mortality rate
-: Negative effect on mortality rate
S: Statistically significant effect
NS: Statistically not significant effect

relationship with mortality rate (Table 15). When the second order term is introduced, both of the variables become statistically insignificant. The negative impact of total slack on mortality rate is significant in the high-slack hospitals and insignificant in the low-slack hospitals (Table 16A and Table 16B). Thus, the hypothesis (H_4) describing the parabolic relationship between slack and quality of care is not supported. In the model with three types of slack, none of the second order terms is significant.

In the comparison of high-slack and low-slack hospitals, the influence of recoverable slack on mortality rate is negative both in the high-slack hospitals and in the low-slack hospitals. The impact of potential slack, on the other hand, changes from an insignificant, positive impact in the high-slack hospitals to a significant, negative impact in the low-slack hospitals. However, contrary to the hypothesis (H_4), the available slack changes the direction of impact on mortality rate from a significant, negative impact in the high-slack hospitals to an insignificant, positive impact in the low-slack hospital. Thus, H_4 is not supported.

Interaction Effect of Level of Slack and Changes in Level of Slack on Performance

Hypotheses Five and Six are to examine the interaction effect of level of slack and change in the level of slack on hospital performance. These hypotheses were based on two assumptions: 1) there exists an optimal level of slack for achieving maximum organizational performance; 2) management strives to maintain the hospital's slack at optimal level. Thus, in the high-slack hospitals, the negative effects of excessive slack would be alleviated by reducing slack level, and the negative effects of lack of slack would be alleviated by increasing the slack level. On the other hand, further increase of slack in the high slack hospitals or further decrease of slack in the low slack hospitals would harm performance.

H5a: In the hospitals with high, decreased slack, the change in level of slack has a positive relationship with performance.

H5b: In the hospitals with low, increased slack, the change in level of slack has a positive relationship with performance.

H6a: In the hospitals with high, increased slack, the change in level of slack has a negative relationship with performance.

H6b: In the hospitals with low, decreased slack, the change in level of slack has a negative relationship with performance.

In the logistic regression analysis, the change in slack variable has a significant, positive coefficient in the group of hospitals with below-the-mean, increased slack. The positive coefficient indicates that the increased slack in this group of hospitals would adversely affect efficiency, and this result contradicts the hypothesis (H_{5b}). The influence of change in slack on the change in efficiency in other groups of hospitals is not statistically significant, however. In the above-the-mean hospitals, both of increase and decrease in slack affects efficiency positively. On the other hand, in the below-the-mean hospitals, decrease in slack affects efficiency positively.

In the models for the relationship between change in total slack and change in mortality rate, increase in total slack in the hospitals with below-the-mean slack, has a significant, positive coefficient. The positive coefficient indicates a positive impact on quality of care (decrease in mortality rate). Thus, this result is consistent with the posited relationship (H_{6b}). However, contrary to the hypothesis (H_{6a}), increased slack also affects the quality of care positively in the above-the-mean hospitals.

The coefficients of the change in slack are not significant in the hospitals with above-the-mean, decreased slack or in those with below-the-mean, decreased slack. The direction of the influence of the decreased slack on quality of care is negative (increase in mortality rate) in both groups. Overall, in the model of the relationship between change in total slack and change in quality of care, the increase in slack has a positive influence and decrease in slack has a negative influence on quality of care, regardless the level of slack of the hospitals. Based on these findings, this study concludes that the interaction effect of level of slack and change in slack is not significant.

Technical Efficiency and Quality of Care

The Hypothesis Seven (H_7) predicted a positive relationship between efficiency and quality of care in the high-slack hospital. The improvement of efficiency was predicted to affect the quality of care positively in this group of hospitals, because the management's voluntary efforts (not forced by environmental pressure) to improve efficiency may streamline the production process, resulting in a better quality of care. Thus, a positive relationship was expected between efficiency and quality of care in this group of hospitals. On the other hand, administrators in the low-slack hospitals are under the pressure of environmental demands to improve efficiency, because the buffer of organizational slack is lacking. Managerial efforts to improve efficiency may reduce the quality of care, because for the sake of improving efficiency, management may cut down on investment to improve quality. Thus, a negative relationship between efficiency and quality of care was expected in the low-slack hospitals.

H7: Efficiency is positively related with quality of care in the hospitals with high slack.

H8: Efficiency is negatively related with quality of care in the hospitals with low slack.

The results do not support the postulated change in directions of the influence of efficiency on quality of care at different levels of slack (Table 17). In the high-slack

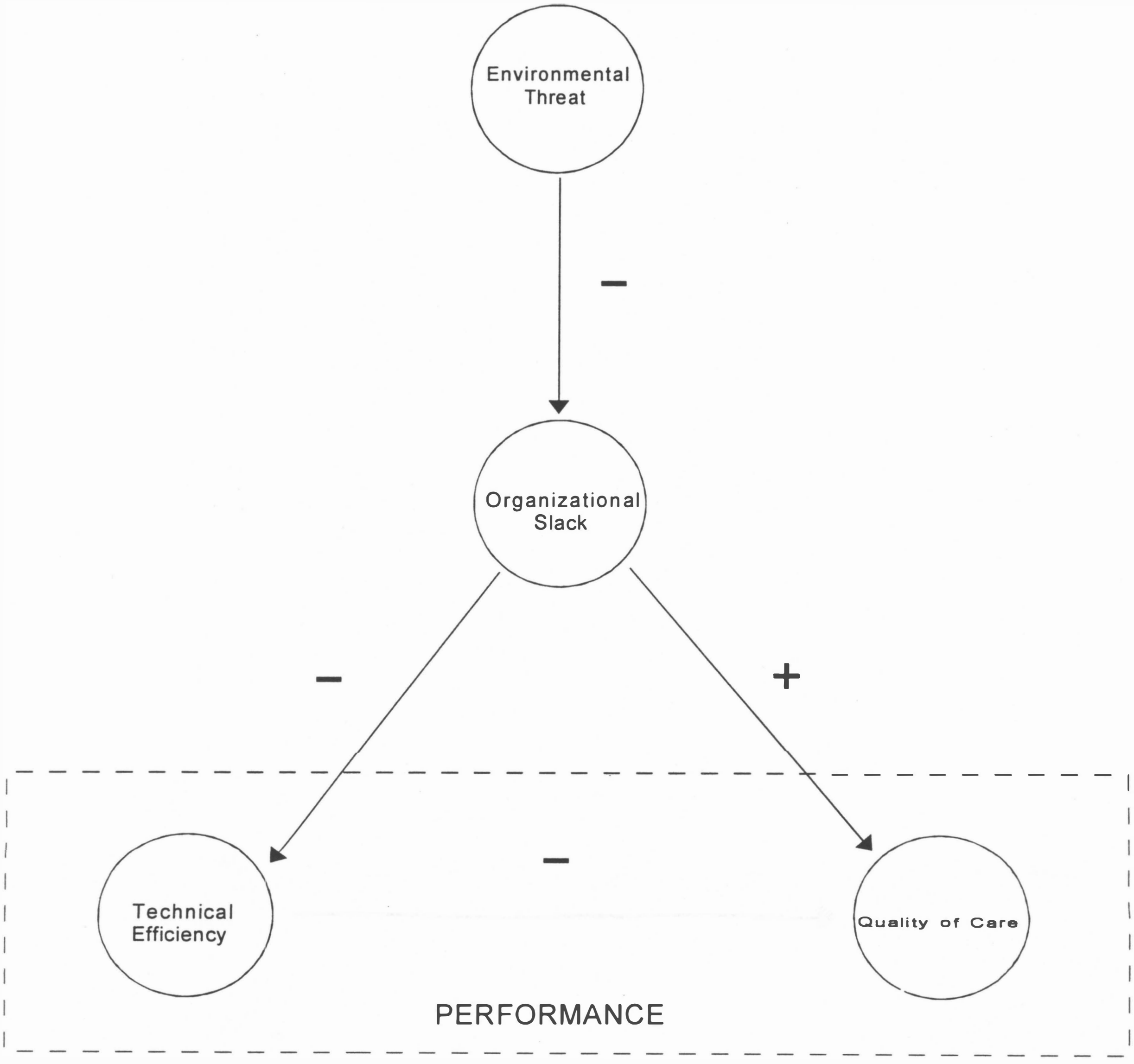
Table 17
Summary of Relationships Between Efficiency Scores and Mortality Rates

Hospital Group	Direction of Effect on Mortality Rate	Statistical Significance
All Hospitals	+	S
High Slack Hospitals	+	S
Low Slack Hospitals	+	NS

Note: Statistical significance is based on a $p \leq 0.1$.

+: Negative effect on mortality rate
-: Negative effect on mortality rate
S: Statistically significant effect
NS: Statistically not significant effect

Figure 4. Relationships among Environnmental Threat, Organizational Slack,Technical Efficiency, and Quality of Care



hospitals the relationship was found to be negative, rejecting the hypothesis (H_7). That is, efficiency score in 1988 is positively related to mortality rate in 1990. In the low-slack hospitals, the influence of efficiency is negative, but is not statistically significant. The result for all hospitals shows a strong negative effect of efficiency on quality of care.

Overall, the results support the hypotheses on the relationship between environmental threat and slack. The hypotheses between slack and performance, however, are not supported, because of the lack of support of data for the existence of an optimal level of slack in maximizing organizational performance. Instead, the results conclusively demonstrate a negative relationship between slack and technical efficiency, and a positive relationship between slack and quality of care (Figure 4).

Discussion and Implications

This study was motivated by the contradictory research reports on the relationship between quality of care and efficiency in hospitals. In order to understand the relationship in a theoretical perspective, this study investigated the relationship in the context of resource availability in individual hospitals. Resource availability was conceptualized by employing the concept of organizational slack. The following sections discuss the findings in terms of the theoretical implications for the concept of organizational slack and the implications for health policy and hospital management.

Organizational Slack in Hospitals

Slack has been portrayed as an enabling factor in organizational theory and as a source of inefficiency in economics theory. Thus, according to economics theory, organizational slack should be minimized to achieve optimal efficiency, but organizational theory suggests maintaining an appropriate level of slack in order to achieve optimal performance. The findings of this study suggest that slack is an important factor in achieving a high quality of care in hospitals, yet has adverse effects on technical efficiency - thereby supporting the arguments of both theories. Slack is an enabling factor for achieving effectiveness in an organization, which in the case of hospitals is a high quality of care, but it has a cost as the source of inefficiency. This conclusion is also indirectly demonstrated by the analysis of the relationship between efficiency and quality of care, which shows a negative association between the two constructs.

This study demonstrated that the three types of slack affect organizational performance differently. In the analysis of the relationship between efficiency and three types of slack, available slack does not have a significant effect; recoverable slack has a negative effect; and potential slack has a positive effect on efficiency. On the other hand, in the analysis of the relationship between quality of care and slack, recoverable slack had a significant positive effect (at the 0.1 level), but the effects of available slack and potential slack are not statistically significant.

Those results can be explained in terms of the distinctive characteristics of the three types of slack. Available slack is, by definition, slack that is available within the boundary of an organization, but not committed to the current operation. Thus, it may not significantly affect performance of the current operation. Recoverable slack, however, is the resources already deployed in the current operation, and thus significantly affects current performance. On the other hand, potential slack is the ability of an organization to borrow funds from capital markets, and so it is basically the indicator of the financial soundness of the hospital. Thus, potential slack may not directly affect a hospital's current performance. In this sense, the significant positive relationship between efficiency and potential slack may be attributed to the improvement of a hospital's financial status through more efficient operation, rather than to direct effects of high potential slack in improving efficiency. Therefore, the effects of available slack and potential slack on performance may be more indirect than direct, affecting performance through the recoverable slack.

Level of Slack and Hospital Performance

This study argued that excessively high slack in an organization causes lack of managerial control, resulting in sub-optimal performance, and that excessively low slack causes loss of opportunities to improve organizational performance. Based on these arguments, the existence of an optimal level of slack was deduced and a downwardly opened parabolic relationship was postulated between the level of slack and organizational performance.

The results cast doubt on the existence of an optimal level of slack in achieving optimal performance. Technical efficiency shows a negative relationship with recoverable slack both in the high-slack hospitals and in the low-slack hospitals. Furthermore, its second order term shows a significant positive direction, indicating that the negative effect of recoverable slack on efficiency is stronger as the level of slack decreases. Thus, the adverse effect of slack on efficiency was relatively high in the low-slack hospitals compared to the high-slack hospitals. The reduced adverse effect of slack on technical efficiency in the high-slack hospitals indicates that the beneficial effect of slack on efficiency argued by organizational theorists may exist. The high slack may allow the hospitals to use more options in minimizing inefficiency (or improving efficiency), compensating the burden of retaining the high slack.

The distinctive roles of different types of slack can be discussed in conjunction with level of slack, by noting the results of the relationship between slack and quality of care. In the analysis of that relationship, available slack has a significant, negative effect on mortality rate and recoverable slack has a negative, but insignificant effect, in the high-slack hospitals. These results may indicate that in the high-slack hospitals, where recoverable slack is at a saturated level, available slack may have an important role in improving quality of care, by providing flexibility in the current operation. In the low-slack hospitals, on the other hand, both recoverable slack and potential slack has a significant, negative effect on mortality rate. These results may indicate that in the low-slack hospitals, where there are limited resources in the current operation (lack of recoverable slack), the hospitals' ability to raise capital to invest in current operations may be an important factor in achieving high quality of care.

The results for the relationship between efficiency and quality of care, which indicate a negative effect of efficiency on quality of care, parallel the results for the relationship between slack and performance. In the analysis of the slack-and-performance relationship, slack has a negative effect on efficiency and a positive effect on quality of care. Therefore, a negative relationship between efficiency and quality of care results. On the other hand, the negative effect of efficiency on quality of care is significant in the high-slack hospitals, but it was not significant in the low-slack hospitals. This result may indicate the reduced influence of organizational slack on performance in the hospitals with low slack. In other words, it can be argued that the property of slack to have an adverse effect on efficiency and a positive effect on effectiveness does not appear in the low-slack hospitals because slack is relatively absent there. This result suggests that organizational slack is an important structural indicator that should be considered in the studies about the relationship between efficiency and quality of care in hospitals.

Change in Slack Level and Hospital Performance

This study argued that the changes in level of slack would affect hospital performance differently at varying levels of slack. The arguments for the relationship between change in slack level and performance focused on the management's ability to manipulate the level of slack. The high-slack hospitals are buffered from environmental pressure and the low-slack hospitals are vulnerable to environmental pressure. Because of this role of slack in the relationship between an organization and its environment, changes in slack level were predicted to have different implications for each group of hospitals.

The results show a negative relationship between changes in slack and changes in efficiency, and a positive relationship between changes in slack and changes in quality of care, regardless of the levels of slack. There are some indications that support the posited hypotheses, but they are not statistically significant. The cause of the insignificant results here seems to be methodological rather than theoretical. The classification of high-slack and low-slack hospitals was based on the mean of total slack. The posited relationships might hold if the level of slack were more variant.

Health Policy and Hospital Management Implications

In this study government regulation played a decisive role in determining slack level. That may be the result of more significant changes having occurred in the regulation indicator than in competition indicators, during the study period. However, given the nature of regulation using financial incentives, regulation may have more direct influence on the level of slack. As the results indicate, level of slack is negatively affected by regulation. Recoverable slack, which represents the resource level in current operations, was especially affected by regulation. Therefore, considering the significant positive effect of organizational slack on quality of care, the findings demonstrate the legitimacy of the concerns about quality care under the PPS.

The argument of a positive relationship between efficiency and quality of care does not hold in this study; rather, efficiency is negatively related to quality of care (positively related to mortality rate). The negative relationship is also demonstrated indirectly in the analysis of the relationship between slack and organizational performance in this study. The study speculates that the argument for a positive relationship may hold in regional, short-term situations. However, considering the property of slack as a measure of resource level in the organization as a whole, together with its influence on quality of care, the findings prompt the conclusion that organizational policies oriented toward efficiency will, over the long run, detrimentally affect quality of care.

This study demonstrates differing effects of various types of slack on performance. Administrators should consider the property of each type of slack and determine the appropriate composition of their organization's slack according to their current performance indicators. For example, the analysis of the relationship between slack and performance shows that, in hospitals at the saturated point of recoverable slack, available slack is significantly associated with quality of care, but the adverse effect of available slack on efficiency is not significant. Therefore, increase in the proportion of available slack in their slack composition may affect quality of care positively without adversely affecting efficiency in the hospitals with high recoverable slack.

In the relationship between performance and slack, this study concluded that organizational slack has a negative effect on efficiency and a positive effect on quality of care, and that the relationship is approximately linear. This study also demonstrates a negative relationship between efficiency and quality of care. These findings reinforce the judgement that health care policy and hospitals management should not be based solely on economic purpose. Private, profit-oriented organizations may pursue their goal by maximizing efficiency as far as it maximizes their profit. However, not-for-profit organizations, such as most hospitals and other public service organizations, have to consider the quality of their service, since the supply and demand law of economics does not check and balance the quality of service in such organizations. On the other hand, these organizations cannot disregard the limitations on their resources. Especially in health care service organizations under the current environmental pressures, the unlimited investment of resources for the sake of improving quality of care may be unacceptable as well as infeasible. In this regard, the findings here suggest that in management of hospitals and in policy decision making, the optimal level of slack should be searched at the points of intersection of the two curves: slack and efficiency curve and slack and quality-of-care curve. The slack level at the point of intersection of the two curves would be a useful barometer in making decisions in health care policy and hospital management.

Limitations and Future Research

In looking at the results of this research, questions are evident for which clear empirical evidence could not be provided because of the limitations of the study. The limitations of the study include the following.

First, in this study the theoretical model was built assuming direct effects of available slack and potential slack on organizational performance. However, as shown in the analysis, recoverable slack is the dominant indicator in the relationship between slack and performance, indicating the impact of resources actually deployed in current operations. Available slack and potential slack, by definition, are not the resources deployed in the current operations. Hence, available slack and potential slack may be affecting organizational performance indirectly through recoverable slack. Thus, developing an alternative theoretical model with an analytic design that will identify direct and indirect effects on performance of available slack and potential slack via recoverable slack may be more productive for studying the relationship between slack and performance.

Second, a study design that encompasses a two-year period may not be long enough, considering the study variables that were relatively stable over that period. The small changes in the study variables were one of the main reasons for the lack of significance in the logistic regression analysis.

Third, the classification of high-slack and low-slack hospitals is rather arbitrary. Especially in the logistic regression analysis, the mean was the basis for classifying the hospitals. The mean was used as the base to retain enough observations in each group to obtain conversion of a solution in the maximum likelihood model of logistic regression analysis, rather than based on the theoretical arguments.

Fourth, organizational slack was measured by hospitals' financial data reported to the HCFA. The financial data have been reported to the HCFA by hospitals for reimbursement purposes, and have not been audited, and therefore the credibility of the data is limited. Also, individual decision makers in an organization can perceive the organization's slack level differently. Strategic and operational decisions may be based on a perception rather than on the objective level of slack. Thus, direct measures of perceptions of the level of slack, by questionnaires directed to hospital decision makers, may be preferable to the objective measures used in this study.

Finally, the slack measures in this study become an index of slack level in the process of aggregating the slack indicators to estimate total slack, rather than being actual, interpretable measures. Future research should measure the level of slack in more interpretable ways, so that the results can suggest a hospital's appropriate level of slack in a practical way.

In future research, the task should focus on overcoming the limitations discussed above in order to obtain a clearer portrayal of the property of organizational slack. Building on further understanding of the property of slack, future research should provide more practical results that would be directly applicable in health care policy making and hospital management.

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