

Hospital Mergers and Market Overlap

Geoffrey R. Brooks and V. Grace Jones

Objective. To address two questions: What are the characteristics of hospitals that affect the likelihood of their being involved in a merger? What characteristics of particular pairs of hospitals affect the likelihood of the pair engaging in a merger?

Data Sources/Study Setting. Hospitals in the 12-county region surrounding the San Francisco Bay during the period 1983 to 1992 were the focus of the study. Data were drawn from secondary sources, including the Lexis/Nexis database, the American Hospital Association, and the Office of Statewide Health Planning and Development of the State of California.

Study Design. Seventeen hospital mergers during the study period were identified. A random sample of pairs of hospitals that did not merge was drawn to establish a statistically efficient control set. Models constructed from hypotheses regarding hospital and market characteristics believed to be related to merger likelihood were tested using logistic regression analysis.

Data Collection. See Data Sources/Study Setting.

Principal Findings. The analysis shows that the likelihood of a merger between a particular pair of hospitals is positively related to the degree of market overlap that exists between them. Furthermore, market overlap and performance difference interact in their effect on merger likelihood. In an analysis of individual hospitals, conditions of rivalry, hospital market share, and hospital size were not found to influence the likelihood that a hospital will engage in a merger.

Conclusions. Mergers between hospitals are not driven directly by considerations of market power or efficiency as much as by the existence of specific merger opportunities in the hospitals' local markets. Market overlap is a condition that enables a merger to occur, but other factors, such as the relative performance levels of the hospitals in question and their ownership and teaching status, also play a role in influencing the likelihood that a merger will in fact take place.

Key Words. Hospitals, horizontal mergers, market structure, market definition, market overlap

The landscape of hospital ownership and affiliation before the 1980s stands in sharp contrast to that of the early 1990s. In the pre-1980s era, the terrain was marked by large numbers of freestanding hospitals, independent of but coexisting with other hospitals. By the early 1990s, many of these hospitals

had merged with others, had rationalized operations, and had entered into networks of hospitals, insurers, and physician groups (Meyer, Goes, and Brooks 1993). In the United States as a whole, 195 formal mergers and consolidations took place between 1980 and 1991: most of the mergers involved not-for-profit hospitals, and most involved hospitals in the same community (Anderson 1992).

Given the range of choices for dealing in collaborative ways with competitive pressures, it is important to gain some understanding of why particular arrangements are chosen over others, and why particular partners are chosen. This article describes a study of mergers between hospitals in the context of their spatially localized markets. The study has two parts. First, it tests whether hospitals that engage in mergers tend to be those that either face high levels of rivalry in their markets or have low market shares. Second, it develops and tests propositions that mergers between particular pairs of hospitals are associated with characteristics of the pairs, specifically, the degree of preexisting market overlap between the hospitals and the preexisting difference in performance between the hospitals.

DETERMINANTS OF HOSPITAL MERGERS

This study is concerned with horizontal mergers¹ in the hospital industry, that is, mergers between hospitals or groups of hospitals with similar product sets (and not mergers between hospitals and insurers, or between a hospital and a long-term care facility, for example). It should be recognized that two distinct issues are in question here. The first is the need to identify the characteristics and circumstances of hospitals that affect the likelihood of their involvement in a merger—an issue focused on the individual hospital, without regard to the characteristics of any potential merger partners. The second issue lies in

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Address correspondence and requests for reprints to Geoffrey R. Brooks, Ph.D., Assistant Professor of Management, Department of Management, University of Pennsylvania, Philadelphia, PA 19104-6370. V. Grace Jones, M.P.H. is a doctoral student in the Department of Health Care Systems, University of Pennsylvania. This article, submitted to *Health Services Research* on January 24, 1995, was revised and accepted for publication on May 29, 1996.

identifying the characteristics of pairs of hospitals that affect the likelihood of their engaging in a merger.

Particularly since the early 1980s, hospitals have been engaging in a variety of forms of association with one another. A merger is the most formal and conclusive form of association, while short-term operating agreements to transfer certain patients or to use certain facilities are perhaps the least formal. In between are joint ventures, cooperative bidding and contracting, and other types of alliances.

ASSOCIATIONS BETWEEN HOSPITAL CHARACTERISTICS AND MERGER ACTIVITY

In studying the first issue—identification of characteristics of hospitals and their circumstances that affect the likelihood of their being involved in a merger—previous research suggests two major factors: *opportunity to enhance market power* and *opportunity to enhance efficiency*. Each factor and related research hypotheses are developed in the following paragraphs.

The theoretical premise that has driven a good deal of the work seeking to understand mergers between hospitals is that a hospital, by engaging in a horizontal merger, attempts to improve its profitability potential by increasing its market power (Allen 1992). This premise is drawn from the broader context of the structure-conduct-performance (SCP) framework of industrial organization economics in which the performance of firms in a market is related to the structure of the market, based on the assumption that market power is a direct function of market structure. A merger between two firms in the same market is held to alter the structure of the market in a way that will make the market power of the combination greater than that of either of the combining firms. Firms encountering very little rivalry will have little to gain in terms of market power from a horizontal merger; but as the degree of rivalry encountered by a particular firm in its market increases, so too will its incentive to engage in a horizontal merger with a competing firm.

Hypothesis 1. The likelihood that a hospital will engage in a horizontal merger will be positively related to the degree of rivalry it encounters in the market that it serves.

If firms merge because they seek to enhance their market power, then firms with smaller shares of their markets will be more likely to engage in a merger because, given a particular merger partner, they have more to gain in enhancing market power than a firm with a large market share. Generally,

then, the larger the market share of a firm, the less likely it will be to engage in a horizontal merger.

Hypothesis 2. The likelihood that a hospital will engage in a horizontal merger will be negatively related to its share of the market that it serves.

A substantial body of work in the SCP literature, including that of Demsetz (1973), Ravenscraft (1983), and Rhoades (1985) has established a view that the key determinant of firm performance is not market power, but firm efficiency. Relative efficiency can arise from a wide range of attributes in terms of which one firm can exhibit superiority over another (Scherer and Ross 1990). An attribute frequently held to be a major route to efficiency is the utilization of potential economies of scale by individual firms (Demsetz 1973; Ravenscraft 1983; Scherer and Ross 1990). If firms are to realize higher profits relative to other firms in their industry, they must exploit economies of scale to a greater extent than their competitors. Larger firms, employing informed and rational managers, will tend to utilize available economies of scale and thus to achieve greater levels of efficiency than smaller firms. This is particularly true when it is recognized that economies of scale are available beyond the technical production function. Whereas small firms may often be large enough to meet industry minimum economic scale levels in production, large firms can extract efficiency benefits due to scale from other operating or nonoperating areas, such as advertising, administration, or research and development. Consequently, a firm's relative size in the market in which it competes can be used as a proxy for its relative efficiency.

Smaller firms are likely to benefit more than larger firms from the increase in relative efficiency (i.e., relative to their most efficient competitors) potentially associated with a merger. Two effects support this expectation. First, in a situation where per unit long-run average total cost is a declining function of output, the relative cost impact of a merger with a given partner will be greater for a smaller firm than for a larger firm. Second, if the long-run average cost curve declines relative to output before reaching some level of constant returns to scale, and if the firms in question operate in the region of declining returns to scale, then, too, will the relative cost impact of a merger with a given partner be greater for a smaller firm than for a larger firm.

Studies of scale effects in the context of hospitals have failed to provide conclusive evidence of the nature or extent of economies of scale in acute care hospitals. There is some agreement that as traditionally configured and operated, the long-run average total cost per unit for acute care hospitals

reaches a minimum at a scale of somewhere between 200 and 400 operating beds (Feldstein 1993, 217–30). Given that most acute care hospitals in the United States are smaller than the probable inflection point of the long-run average cost curve,² most stand to benefit in cost terms from an increase in scale. Applying this to hospitals, smaller hospitals should be more likely to seek to engage in a horizontal merger than larger hospitals, *ceteris paribus*.

Hypothesis 3. The likelihood that a hospital will engage in a horizontal merger will be negatively related to its size.

In the next section, the second general issue relating to the determinants of hospital horizontal mergers is addressed. The second issue relates to the characteristics of pairs of hospitals that affect the likelihood that a particular pair will engage in a merger.

ASSOCIATION BETWEEN MERGING PAIR CHARACTERISTICS AND MERGER ACTIVITY

Mergers are designed to effect some sort of gain for the parties involved. From the perspective of a *particular pair of firms*, the expected gains from a horizontal merger can come from a number of sources. They might be due to an increase in market power that the combination holds relative to the merger participants individually. The expected gains might also be due to improvements in operating efficiency, following rationalization and consolidation of operations. Finally, efficiency gains might be realized because one of the parties to the merger is performing poorly and might be expected to benefit from the infusion of management expertise from a better-performing partner (Brealy and Myers 1991). In sum, we might expect that a merger between a particular pair of firms would be more likely where one or more of the following is true:

- The market power of the pair of firms is greater jointly than severally.
- Opportunities exist for rationalization and consolidation of activities.
- One of the parties to the merger is performing poorly relative to the other.

In markets with localized competition, consumers are faced with a spatially related cost associated with use of any particular supplier. In the case of hospitals, this cost is driven by travel time, physical geographic features (such as rivers, hills, or shorelines), socioeconomic factors, and physician referral patterns, and it can be substantial. Because hospitals operate in localized markets, the intensity of competition between a hospital and each

of its potential competitors is likely to be some function of the competitors' distance from the focal hospital. Consequently, each hospital's served market must be defined idiosyncratically, and the degree of rivalry between a given pair of hospitals can be represented by the degree of overlap between their served markets.³ Since intensity of rivalry between two firms before they merge is a measure of the degree of improvement in market power they can jointly expect after the merger, the overlap between the markets that the two firms serve can be used to measure the enhancement in market power that would result from a merger. Market overlap can also be used to measure the degree of efficiency improvement that might result from a merger between two hospitals. With little or no overlap between their served markets before a merger, two hospitals will generally not be able to consolidate facilities or staffs without losing patients. On the other hand, if the degree of overlap is high, consolidation of facilities and staffs is likely to be relatively easy, and consolidation is likely to be rewarding due to improved efficiency.

In the case of hospitals, then, both efficiency and market power considerations lead to an expectation that market overlap will be positively related to the propensity for a pair of hospitals to merge. Developing a theoretical model of merger propensity in the context of spatially localized market conditions, Levy and Reitzes (1992) come to a similar conclusion: that the likelihood of a merger between pairs of firms will be related to the degree of overlap between their spheres of competitive influence.

Hypothesis 4. The likelihood of a horizontal merger between a pair of hospitals will be positively related to the degree of overlap between the markets that they serve.

The likelihood of a merger between a pair of firms is also expected to be related to the difference between their levels of operating performance. The greater the difference, the greater the opportunity for improvement in performance of the more weakly performing partner if it is assumed that the difference is due to variation in managerial competence across the pair.

Hypothesis 5. The likelihood of a horizontal merger between a pair of hospitals will be positively related to the difference between their levels of operating performance.

While market overlap and performance difference might severally increase the likelihood of a merger between a particular pair of firms, the combined effect of high market overlap and a high degree of performance difference is likely to be more than simply additive. It is expected that merger

likelihood will be related to the product of the market overlap and the difference in performance of the hospital pair.

Hypothesis 6. The likelihood of a horizontal merger between a pair of hospitals will be related to the interaction between the degree of overlap between the markets that they serve and the difference between their levels of operating performance.

METHOD

SAMPLE AND SOURCES OF DATA

Data were collected on a population of 110 hospitals in the 12-county region surrounding the San Francisco Bay in California for the period 1983 to 1992.⁴ Metropolitan areas lying within this region are San Francisco, San Jose, Oakland, and Sacramento. The region includes both densely populated areas (in San Francisco, San Mateo, Santa Clara, and Alameda Counties) with large concentrations of hospitals in urban settings, and sparsely populated areas (Napa, Sonoma, and Solano Counties) with sole providers in rural communities. Ten of the 110 hospitals had for-profit status at some point during the study period. By 1992, however, three of the ten had merged with not-for-profit hospitals and had thereby assumed not-for-profit status, and another had ceased operation as an acute care general hospital.

Incidences of mergers were identified using the Lexis/Nexis database, which contains full-text stories from newspapers (national, regional, and local), magazines, and trade publications. Mergers, tracked from the time initial discussions were reported in the press, were deemed to have occurred upon approval by the boards of both parties of the legal consolidation of ownership. In all, 17 mergers meeting this definition were identified. Editions of the *Guide to the Health Care Field*, published by the American Hospital Association (AHA) were used to verify that no mergers were missed.

Data employed in defining and comparing hospital markets were drawn from the patient discharge database maintained by the California Office of Statewide Health Planning and Development (OSHPD). Patient data were available for the years 1983 through 1990. Financial data on the hospitals were drawn from OSHPD's annual financial disclosure reports. Financial data for the years 1981–1982 through 1990–1991 were used.

The set of potential merger participants was defined as all general acute care hospitals that existed in the 12-county region at any time between 1983

and 1992, excluding hospitals owned by the Kaiser organization, and those owned by federal, state, or local governments.⁵ As a result of these exclusions, the number of potential merger participants was reduced to 76.

MARKET DEFINITION

Various approaches to resolving the market definition issue have been used in studies of competition among hospitals. A consensus (largely implicit) has emerged that general short-stay hospitals constitute a coherent supplier set, and the debate has focused on the issue of geographic market definition rather than on issues relating to product definition. Garnick et al. (1987) have defined a framework for classifying approaches to market definition:

Hospital market areas can be defined from two perspectives: an individual hospital perspective and that of the overall market. From each perspective, empirical definitions can be based on geopolitical boundaries, distance between hospitals, and patient-origin data. (p. 69)

They note that the approach to market definition appropriate to a particular study depends on the research issue at hand (to determine whether to use the individual hospital or the overall market perspective) and on whether historical or potential competition is being studied (to determine which data—geopolitical boundaries, distance between hospitals, or patient-origin—to use). This study takes the individual hospital perspective, since the research issue is concerned with the incentive for a focal hospital to merge with a potential competitor. The approach to market definition used here is similar in many respects to that used by Zwanziger, Melnick, and Mann (Zwanziger and Melnick 1988; Zwanziger, Melnick, and Mann 1990). Patient-origin data are used, since the study covers past merger events. The weighting procedure that is employed to measure market overlap is described in the next section.

The choice of patient origin data to define markets was driven by the fact that data on supplier-consumer links allow direct representation of the construct of interest, while interhospital distance and geopolitical boundaries are only indirect and incomplete representations. Geopolitical boundaries, such as county or city boundaries, are often misleading, particularly in a multicity, multicounty area such as that surrounding the San Francisco Bay (Brooks 1995). As pointed out earlier, markets are localized when spatially related factors impose on consumers a cost that varies from supplier to supplier. In the case of the hospitals in this study, the relevant set of spatially related factors for a given patient includes direct distance between hospitals, but also includes the nature and location of transportation infrastructure and

geographic features such as the Berkeley Hills, the Santa Cruz Mountains, and the Bay. Patterns of patient-hospital associations are influenced further by physician referral patterns and by distinctive traditional hospital clienteles.

VARIABLES

Variables Employed in Tests of Hypotheses 1, 2, and 3

Rivalry for a focal hospital is measured as the weighted average supplier (hospital) concentration, using the Herfindahl index,⁶ across all zip codes of residence of all patients admitted to the focal hospital *excluding* the focal hospital from the calculation. Weighting is by patient admission volume to the focal hospital. The effect of excluding the focal hospital is to measure the concentration of the competing hospitals that the focal hospital faces. Shepherd (1972) pointed out that conventional use of market concentration measures such as the Herfindahl index combines the effects of market share and rivalry into a single statistic. Separate measurement of rivalry and market share avoids the frequently encountered high collinearity between market share and market concentration when both firm share and market competitive conditions are of interest. This approach is similar to that employed by Cool, Dierickx, and Jemison (1990, 513).

The market share of a focal hospital is measured as the share that the focal hospital has of patient admissions from each zip code area, averaged (weighted by focal hospital patient volume) across all zip code areas from which patients are admitted to the focal hospital.

Hospital size was measured as the number of a hospital's licensed beds. Annual revenues and number of patient admissions are other measures of hospital size, but neither is a direct measure of the size of a hospital's productive capability. Since Hypothesis 3 is motivated by expected relationships between scale-related efficiency and incentive to merge, the number of licensed beds, providing the most direct measure of scale, is the preferred measure of size.

Variables Employed in Tests of Hypotheses 4, 5 and 6

The market overlap between two hospitals is a measure of the degree to which the markets served by each hospital coincide. In the context of hospitals, market overlap can be measured in various ways: in terms such as service types offered, source of payment for services, or spatial location of patients, or in combinations of these ways. The focus of this study is on spatial or geographic overlap, but the analysis could be extended to incorporate other overlap measures.

The market overlap for a given pair of hospitals is defined here to be the sum of the presence of each in the market of the other. The presence of a competing hospital in the market of a focal hospital is defined to reflect two factors: first, the importance for the focal hospital of the submarkets in which the competitor is present; and second, the volume of consumer demand that is satisfied by the competing hospital in those submarkets. It should be recognized that market presence will be asymmetric across a dyad of competing hospitals.

Given the nature of the data being used in this study, submarkets are defined as zip code areas, and volume of consumer demand is measured as the number of inpatient admissions to a hospital. An index of competitor market presence (*CMP*) for a focal hospital (*f*) with respect to any competing hospital (*c*) can then be calculated as follows:

$$CMP_f = \sum_z \{(A_{zf}/TA_f) * (A_{zc}/TA_c)\}$$

where

\sum_z = sum over all zip code areas from which the focal hospital admits patients.

A_{zf} = number of admissions from a particular zip code area to the focal hospital.

A_{zc} = number of admissions from a particular zip code area to the competing hospital.

TA_f = total number of admissions from all zip code areas to the focal hospital.

The first component, A_{zf}/TA_f , captures the importance of the zip code area to the focal hospital. The second component, A_{zc}/TA_c , captures the importance to the focal hospital of the competing hospital's activity in that zip code area. The *CMP* index will be asymmetric for a pair of hospitals. In other words, the importance of hospital A with respect to hospital B will be different from the importance of hospital B with respect to A, because A and B will differ in size, and in patterns of geographic dispersion of admissions. The measure of market overlap for the pair should therefore take both CMP_A and CMP_B into account. The statistic used here to do so is:

$$LCMP_{sum} = \log(CMP_A + CMP_B)$$

The log of the sum of the *CMP* indexes is taken to correct for the skewness in the distribution of the *CMP* index values.⁷ Given a sample of hospitals drawn from a wide geographic area, the presence of one hospital

in the market of another will in most cases be low. However, in a few cases (hospitals for which considerable market overlap does exist), CMP values will be high.

Performance is measured as pre-merger return on sales (ROS), and is assessed as the mean ROS for the three years prior to the year in which the merger took place.⁸ Specifically, ROS is calculated as net income from operations as a percentage of gross patient revenue, using the California OSHPD's reporting definitions of these terms. For tests of Hypotheses 4 and 5, the performance difference between two hospitals was measured as the absolute value of the difference between their mean ROS values for the three years prior to the merger.

CONTROLS

Population growth rate is likely to be an important variable influencing the relationship between market overlap and affiliation activity. Since affiliation activity is held here to be a response to competitive pressures, and competitiveness is considered to be related to market growth rate (Scherer and Ross 1990), market growth rate is expected to affect the overlap-affiliation relationship. A quotation from an interview with an executive of a San Francisco hospital illustrates that the relationship between market growth and the competitiveness of the market is keenly felt by hospital decision makers: "The biggest problem is that [this] area, unlike, say, Contra Costa County, has no growth, per se. So what you're left with is the 'tenement-rat' syndrome, where everyone eats the patients off of everyone else." (Paton 1988a). The growth rate in each hospital's market was estimated by measuring the population change between 1980 and 1990, using census data, for each of the zip code areas that contributed at least 2 percent of the hospital's admissions in 1988, subject to the constraint that the zip code areas used for this purpose should collectively account for at least 50 percent of total 1988 admissions for the hospital. The year 1988 was used because it lies at the midpoint of the study period. The relative importance of each zip code area as a source of patients for a hospital is accounted for by calculating a weighted average growth rate, with number of admissions from each zip code area as the weighting factor. In testing Hypotheses 3 and 4, the population growth rate for each hospital pair is calculated as the mean of the growth rates for each hospital in the pair.

Differences in hospital ownership are expected to present obstacles to mergers. The hospitals in the study fall into one of four ownership categories: church-operated nongovernment not-for-profit; other nongovernment not-for-profit; hospital district or authority; and investor-owned (for-profit).

Ownership or sponsorship of a hospital by a church-affiliated organization may present a barrier to merger with a hospital that is not so affiliated. There are also barriers—primarily legal and institutional—to mergers between hospitals across the other categories. Such barriers may make cross-category mergers less likely than within-category mergers. A variable, called “ownership difference,” was constructed to assign an observation a value of 0 if both hospitals were in the same category, and a value of 1 if they were in different categories.

Finally, differences in teaching status may influence the likelihood that a merger will take place between two hospitals. Hospitals affiliated with medical schools are likely to have missions and priorities different from those of non-teaching hospitals, and such differences may make a merger between hospitals of differing teaching status less likely. A counter argument can also be made, however. Teaching hospitals are typically large and heavily staffed with specialists. An incentive for them to merge with non-teaching hospitals might arise from a desire to capture a flow of referrals to maintain adequate utilization levels. As in the case of ownership difference, a variable to reflect difference in teaching status was constructed so that an observation was assigned a value of 0 if both hospitals were in the same teaching status category, and a value of 1 if they were in different categories. The variables reflecting differences in ownership and teaching status were employed as controls in testing Hypotheses 4, 5, and 6.

ANALYSIS

Tests of the hypotheses were conducted using logistic regression analysis, with incidence or nonincidence of a merger being the dichotomous outcome variable. Seventeen instances of mergers between hospitals occurred during the period 1983 through 1992 in the selected 12-county region. With 76 hospitals and the ten-year period of study, the total number of potential merger events is very large (approximately 29,000),⁹ and the incidence of a merger constitutes a rare event. Given the small number of observed events, a matched-pair approach to the analysis would limit model specification flexibility and the power of statistical tests. Mantel (1973) has shown that in such circumstances, analysis of a data set comprising the complete set of events and a random sampling of non-events leaves the likelihood estimates of model parameters unaffected in the context of logistic regression, except for an additive constant.

Ury (1975) compared the statistical efficiency of study designs in which cases or events are matched with k controls, as compared to standard matched pair studies. He showed that where the number of potential controls (i.e., the number of non-mergers in this study) is large, the relative statistical efficiency of event/non-event comparisons rises rapidly with increasing k , where k is the number of sampled non-events per observed event. Given the specifics of this study, the relative statistical efficiency of the null hypothesis H_0 , "no case-control difference," rises to 80 percent at $k = 4$, then increases asymptotically with increasing k . The relative statistical efficiency for k of 5 and 6 is 83 percent and 86 percent, respectively.

A random sampling of 102 non-events ($k = 6$) was drawn. After elimination of 14 of these, due to nonexistence of a hospital in the year in question or to unavailability of data, the sample was reduced to 88 non-events, or controls ($k = 5.2$). Including the 17 observations of mergers during the period, a total of 105 actual and potential merger events was used in the study. For tests of Hypotheses 1, 2, and 3, the characteristics of merging and non-merging hospitals were assessed individually, so that the data set represented 210 individual hospital observations. Tests of Hypotheses 4, 5, and 6 related to hospital pairs, so that the data set contained 105 observations of hospital pairs. The models tested in the study were:

MODEL 1: (Tests of H1, H2, and H3; $n = 210$)

Incidence of merger = f (log of rivalry, market share, size, ROS, population growth).

MODEL 2: (Tests of H4, H5, and H6; $n = 105$)

Incidence of merger = f (log of overlap index, absolute ROS difference, ownership difference, population growth, overlap/ROS interaction).

RESULTS

Tables 1 and 2 present descriptive statistics and Pearson product-moment correlations between variables employed in testing Hypotheses 1, 2, and 3, and 4, 5, and 6, respectively.

Table 3 presents the results of the logistic regression analysis used to test Hypotheses 1, 2, and 3. The results indicate that no relationship was found between merger incidence and any of the predictor variables in Model 1: the rivalry faced by hospitals in the markets that they serve or their share of their markets. This finding is contrary to the expectations stated in Hypotheses 1

Table 1: Descriptive Statistics and Bivariate Pearson Correlations of Variables for Model 1

<i>Variables</i>	<i>Means</i>	<i>s.d.</i>	1	2	3	4	5
Merge indicator	0.16	0.37					
Log rivalry	7.12	0.31	0.11				
Market share	21.54	13.63	-0.10	-0.63***			
Size (beds)	256.80	156.23	0.09	0.20**	-0.31***		
Population growth	0.13	0.11	-0.05	-0.23**	0.34***	-0.33***	
ROS	0.03	0.06	-0.05	-0.09	-0.18**	0.05	-0.01

* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 2: Descriptive Statistics and Bivariate Pearson Correlations of Variables for Model 2

<i>Variables</i>	<i>Means</i>	<i>s.d.</i>	1	2	3	4	5
Merge dummy	0.16	0.37					
Log overlap	0.77	2.40	0.55***				
Absolute ROS difference	0.05	0.06	-0.01	-0.02			
Difference in ownership	0.41	0.49	0.27**	0.12	-0.19*		
Population growth	0.13	0.09	-0.06	-0.20*	0.00	0.10	
Difference in teaching status	0.23	0.42	-0.12	0.15	-0.09	0.15	-0.23*

* $p < .05$; ** $p < .01$; *** $p < .001$.

and 2. It is also evident in Table 3 that no relationship was found between hospital size and the likelihood that it would engage in a merger with another hospital. This finding fails to support the expectation that the likelihood of engaging in a merger will be negatively related to hospital size.

Table 4 presents the results of the logistic regression analyses used to test Hypotheses 4, 5, and 6. The results indicate that a strong relationship does exist between the incidence of mergers between particular pairs of hospitals and the degree of overlap between the markets that they serve. As stated in Hypothesis 4, the greater the overlap between markets served, the greater the likelihood of a merger between two hospitals. While the performance difference between two hospitals is found to be significantly related to the likelihood that they will merge, the sign on the variable "absolute ROS difference" is negative, and not positive as proposed in Hypothesis 5. This result indicates that within the population tested in this study, a hospital pair was more likely to merge if the performance levels of the two were similar rather than dissimilar. Hypothesis 6, that merger incidence is related to the interaction between market overlap and performance difference, is

Table 3: Results of Logistic Regression Analysis for Model 1

Variable	Model 1	
	Parameter Estimate	Wald Chi-Square
Intercept	-7.112	1.389
Log of rivalry index	0.750	0.862
Market share	-0.008	0.153
Size (beds)	0.001	0.763
ROS	-1.739	0.306
Population growth	-0.080	0.002
Model chi-square	4.263	
Degrees of freedom	5	
% Correct predictions	83.81	

* $p < .05$; ** $p < .01$; *** $p < .001$.

Table 4: Results of Logistic Regression Analysis for Model 2

Variable	Model 2	
	Parameter Estimate	Wald Chi-Square
Intercept	-1.895	2.107
Log of overlap index	0.738	5.807*
Absolute ROS difference	-160.801	4.427*
Interaction: overlap \times ROS difference	27.631	4.335*
Ownership difference	-1.888	7.818**
Average population growth	-1.394	0.074
Difference in teaching status	0.936	2.621
Model chi-square	54.85***	
Degrees of freedom	6	
% Correct predictions	93.33	

* $p < .05$; ** $p < .01$; *** $p < .001$.

supported by the significantly positive coefficient on the interaction term in the test of Model 2. An analysis of the significant interaction found between market overlap and performance difference shows that the interaction serves to accentuate the direction of the main overlap and performance effects.¹⁰ In other words, even after controlling for market overlap and performance difference, merger likelihood was highest where high market overlap and low performance difference coincided. The implication of this result is that for hospitals that do have a high degree of market overlap, performance differences do matter: the more similar the performance levels of the two hospitals, the more likely the merger.

The significant and negative coefficient on the variable "ownership difference" in tests of both Models 2 and 3 confirms the expectation that merger likelihood is greater for hospitals in the same ownership category than for hospitals with different types of owners. The variable representing difference in teaching status was not found to be significantly related to the likelihood of merger incidence.

CONCLUSIONS AND OBSERVATIONS

The results of this study bring into sharp relief a key distinction made at the beginning of this article: that an understanding of reasons why hospitals merge with other hospitals requires attention both to factors that predispose *particular hospitals* to merge and to factors that predispose *particular pairs* of hospitals to merge.

The central finding is that mergers between hospitals are not driven directly by considerations of market power or efficiency as much as they are by the existence of specific merger opportunities in the hospitals' local markets. This suggests that general expectations about factors likely to drive mergers between firms are severely constrained, in the case of hospitals, to be only locally effective. Wilke and Choi (1988) found that over the period 1981 to 1985, no consistent set of factors distinguishing acquired from nonacquired hospitals could be found. The result of the Model 1 test in this study, which focused on individual hospitals and not hospital pairs, supports Wilke and Choi's conclusion, extending it over the longer and more recent 1983 to 1992 period.

It should be noted that, overall, these findings are not inconsistent with market power or efficiency explanations of mergers, because merger partners with whom large market overlap exists do offer opportunities for increasing market presence as well as for improving efficiency. A newly formed hospital system with enhanced market presence may be able to exercise market power in setting prices, particularly with respect to patients who pay out-of-pocket and indemnity insurers who pay posted prices. However, a hospital or system's market presence may provide it with bargaining power—relative even to large payers, if such payers cannot provide access to their beneficiaries without contracting with the system. Market power would be expected to become more important for hospitals as the number and market power of large purchasers of hospital services increase. The formation of hospital systems that control a substantial share of a local market is one way for suppliers to

achieve countervailing power when faced with oligopsonist buyers.¹¹ Such a situation arose during the period of this study, for example, after California implemented a selective contracting program for its Medicaid patients in the early 1980s. Melnick and Zwanziger (1988) report that enrollment in California PPOs grew from 0.25 million in 1983 to over 6 million by July 1986. The findings in this study are consistent with the merging of suppliers (hospitals) to increase local market power in the face of increased power being exerted by purchasers.

Although no direct link was found between the potential for improved economies of scale and the propensity to merge (result of the test of Hypothesis 3), the finding that market overlap is strongly related to the likelihood of a merger between a particular pair of hospitals leaves open the possibility that while potential economies of scale are important in merger decisions, such economies of scale are contingent on the existence of market overlap. As noted earlier, evidence on economies of scale in acute care general hospitals suggests that the long-run average cost curve, while probably U-shaped, is shallow, with a minimum in the region of 200–400 beds. Economies of scale may, however, be available for some individual services and activities: services such as open heart surgery and obstetrics, which have high fixed labor costs as well as substantial capital requirements, are generally believed to have threshold volumes below which both the cost per case and the quality suffer¹²; specialized expertise can be shared between the merged hospitals; nursing and other clinical specialists can be used to train personnel at both facilities; finally, when volumes are combined, it may become feasible to offer services that could not be efficiently offered by either hospital as a freestanding facility.

In addition to efficiencies from rationalizing individual programs, Feldstein (1993) suggests that other activities may not be subject to the diseconomies of coordination, communication, and control that apparently overwhelm economies of scale beyond the 400-bed level. These include access to lower bond issue costs, reduced malpractice premiums, and increased purchasing power relative to suppliers. The results of this study suggest that these last factors, which would be largely independent of market overlap, are in themselves not sufficient to overcome the increased costs associated with a formal hierarchical structure.

The test of Model 2 (both the performance difference main effect and the interaction effect) shows that the general expectation that mergers serve, at least prospectively, as a means to improve the performance of weakly performing firms through the transfer of management expertise from better-

performing firms may not be appropriate in the context of hospitals. The result might be explainable by the notion that, faced with a choice of merger partners and severe pressure on resources and returns, hospital executives tend to avoid entering into a merger relationship with an institution that is experiencing much weaker performance. If this is true, then performance differences between merging hospitals would tend to be smaller than those of the control pairs of nonmerging hospitals. Anecdotal evidence from our interviews with the CEOs of two weakly performing San Francisco hospitals in 1988 would support this conclusion. Both had been seeking a merger partner as a way to stem their losses, but neither had been able to interest any of the stronger institutions. A hospital executive, commenting on mergers in the 1990–1991 period, noted that “these mergers certainly help the ‘Cadillac hospitals’, but they leave other hospitals out in the cold” (Rauber 1991). When the money-losing Alta Bates Hospital and the profitable Children’s Hospital in San Francisco discussed a merger in 1987, the deal was reported to have been delayed until Alta Bates could return to profitability (Paton 1988b). A conclusion to be drawn, and potentially to be studied in future research, might be that environmental munificence will moderate the relationship between the performance difference of firms and their propensity to merge: in conditions where resources are severely constrained, a merger is made less likely by a large performance difference.

An abiding weakness of studies of relationships between competitive conditions and firm behavior and performance has been that markets are frequently defined inappropriately—in some cases too broadly and in others too narrowly (Scherer and Ross 1990, 423–24). In the case of hospitals, these results suggest that the appropriate approach to market definition is to view markets more narrowly than is usually the case. A conclusion from this study is that market overlap is an enabling condition for a merger to occur, but that other factors, such as the relative performance levels of the hospitals in question and their ownership and teaching status, also play a role in influencing the likelihood that a merger will in fact take place.

As with all retrospective analysis, past behavior is far from a perfect predictor of future actions. However, to the extent that national or state policy on health insurance generates increased buyer concentration, the pressures on pairs or groups of hospitals with high market overlap to merge may well increase. The potential losses associated with being an unsuccessful bidder with a major purchaser could be catastrophic for many hospitals. One way for providers to ensure that purchasers must negotiate is to be a dominant

or sole source in a specific area. The alternative to merging, that is, collusive pricing agreements between organizationally separate providers, is likely to be inherently unstable where high market overlap exists, and would have high policing costs. Hospitals that wish simply to be able to provide access over a large region (“ringing the Bay” in the San Francisco region), may find that forming a “dynamic network,” as described by Miles and Snow (1986), would be a more efficient approach than engaging in horizontal mergers, since market overlap in such situations is likely to be relatively low. Networks allow providers to come together based on the geographic area that needs to be covered, while maintaining local control and avoiding the inefficiencies associated with additional layers of hierarchy.

A central problem in the San Francisco Bay region, as in many other regions in the United States, is the persistently high degree of overcapacity,¹³ combined with great institutional resistance to closing down hospital facilities. Instances of hospital closure being achieved after a merger under the guise of rationalization have come to the fore since the period covered by this study. In essence, closure of facilities seems to be politically easier to achieve within a broader corporate structure than in isolation, because the surviving corporate entity can provide erstwhile stakeholders of the closed facility with guarantees that would not otherwise be possible. Future studies of mergers in markets in which hospitals are being closed should account for this interplay.

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NOTES

1. A distinction is sometimes drawn between mergers and acquisitions or takeovers. Technically, a merger entails the formation of a third legal entity to assume the assets and liabilities of the merging firms. An acquisition entails assumption by one firm of the assets and liabilities of another. In this study, the term “merger” is employed to include both meanings.

2. In 1989, 70 percent of U.S. community hospitals had fewer than 200 beds, and 84 percent had fewer than 300 beds. The mean hospital bed size was 171 beds (American Hospital Association 1989–1990).
3. One might think of the market a hospital serves as a three-dimensional mound with two dimensions representing geographic space and the third representing the importance of each geographic point as a source of admissions for the hospital. Market overlap can be thought of as the space defined by the intersection between two hospital market mounds.
4. The counties are San Francisco, San Mateo, Santa Cruz, Santa Clara, Alameda, Contra Costa, Sacramento, Yolo, Solano, Napa, Sonoma, and Marin.
5. Kaiser and government-owned hospitals operate under conditions sufficiently different from those of other hospitals (for-profit and non-profit) that they are not viewed as part of the population of interest in this study. One merger, the acquisition of French Hospital by Kaiser in 1989, was excluded as a result of this constraint on the sample. No government-owned hospitals were involved in mergers during the period of the study.
6. The Herfindahl index, also called the Hirschman-Herfindahl index, is a measure of both the relative sizes and the dispersion of sizes of firms in a population. As normally applied, it is calculated as the sum of the squares of the market shares of all firms in the market, and takes on values between 0 and 10,000. (A market with an index of 10,000 would be a monopoly).
7. The choice between log of sum and sum of logs amounts to a choice between whether market overlap as an attribute of a pair of hospitals is an additive or a multiplicative function of the pair's CMP values. With no reason to expect a multiplicative function, we used the simpler additive function. Prompted by a reviewer's comments, we reanalyzed the data using LCMP as a sum of logs: the regression results are not materially different.
8. For control cases, in which mergers did not occur, the same period was used (i.e., the three years prior to the year of the "non-event").
9. There are $76!/(2![(76 - 2)!]) = 2,850$ unique hospital pairs, each of which has ten opportunities to merge during the study period. Consequently, there would be 28,500 values for each of the variables LCMP, ROS difference and ownership difference.
10. Using the coefficients derived for Model 2 (Table 4), merger probabilities were calculated using low, medium, and high values for market overlap and ROS difference, creating a nine-cell matrix of probabilities. Probabilities increased with increasing market overlap and decreasing ROS difference across all cells of the matrix.
11. Such systems were identified by Luke and Begun (1988) as market-oriented systems, as opposed to historical or investment-oriented systems.
12. The guidelines governing P.L. 93–641, the 1973 National Health Planning Act, stipulated a minimum of 200 open heart procedures and a minimum of 1,500 births annually.
13. Statewide, the mean occupancy rate in California has fluctuated between 54 and 57 percent during the period 1986–1987 to 1990–1991 (OSHDP 1992).

REFERENCES

- Allen, R. 1992. "Policy Implications of Recent Hospital Competition Studies." *Journal of Health Economics* 11 (3): 347-51.
- American Hospital Association. 1989, 1990. *Hospital Statistics*. Chicago: AHA.
- Anderson, H. J. 1992. "AHA Lists Hospital Merger Activity for 12-year Period." *Hospitals* 66 (12): 62-63.
- Brealy, R., and S. Myers. 1991. *Principles of Corporate Finance*, 4th ed. New York: McGraw-Hill.
- Brooks, G. R. 1995. "Defining Market Boundaries." *Strategic Management Journal* 16 (summer): 535-49.
- Cool, K., I. Dierickx, and D. Jemison. 1989. "Business Strategy, Market Structure and Risk-Return Relationships: A Structural Approach." *Strategic Management Journal* 10 (6): 507-522.
- Demsetz, H. 1973. "Industry Structure, Market Rivalry, and Public Policy." *Journal of Law and Economics* 16 (April): 1-9.
- Feldstein, P. J. 1993. *Health Care Economics*, 4th ed. Albany, NY: Delmar Publishers.
- Garnick, D. W., H. S. Luft, J. C. Robinson, and J. Tetreault. 1987. "Appropriate Measures of Hospital Market Areas." *Health Services Research* 22 (1): 69-89.
- Levy, D. T., and J. D. Reitzes. 1992. "Anticompetitive Effects of Mergers in Markets with Localized Competition." *The Journal of Law, Economics and Organization* 8 (2): 427-40.
- Luke, R. D., and J. W. Begun. 1988. "Strategic Orientations of Small Multihospital Systems." *Health Services Research* 23 (5): 597-618.
- Mantel, N. 1973. "Synthetic Retrospective Studies and Related Topics." *Biometrics* 29 (September): 479-86.
- Melnick, G. A., and J. Zwanziger. 1988. "Hospital Behavior under Competition and Cost Containment Policies." *Journal of the American Medical Association* 260 (18): 2669-75.
- Miles, R. E., and C. Snow. 1986. "Organizations: New Concepts for New Forms." *California Management Review* 28 (3): 62-73.
- Meyer, A. D., J. G. Goes, and G. R. Brooks. 1993. "Organizations Reacting to Hyperturbulence." In *Organizational Change and Redesign*, edited by G. P. Huber and W. H. Glick, pp. 66-111. New York: Oxford.
- Office of Statewide Health Planning and Development (OSHPD). 1992. *Individual Hospital Financial Data for California*. Sacramento, CA: State of California, OSHPD.
- Paton, H. 1988a. "Kendall Anderson Takes a Gamble on Big Medicine in Contra Costa." *San Francisco Business Times*, 13 June.
- . 1988b. "Alliances Alone May Not Rescue Some Hospitals." *San Francisco Business Times*, 25 January.
- Rauber, C. 1991. "Merger Door May Open at Alta Bates." *San Francisco Business Times*, 27 September.
- Ravenscraft, D. J. 1983. "Structure-Profit Relationships at the Line of Business and Industry Level." *Review of Economics and Statistics* 65 (February): 22-31.

- Rhoades, S. A. 1985. "Market Share as a Source of Market Power: Implications and Some Evidence." *Journal of Economics and Business* 37 (4): 343-63.
- Scherer, F. M., and D. Ross. 1990. *Industrial Market Structure and Economic Performance*. Boston: Houghton Mifflin.
- Shepherd, W. G. 1972. "The Elements of Market Structure." *Review of Economics and Statistics* 54 (February): 25-37.
- Wilke, C. L. F., and T. Choi. 1988. "Changing Criteria for Hospital Acquisitions." *Health Care Management Review* 13 (3): 23-34.
- Ury, H. K. 1975. "Efficiency of Case-Control Studies with Multiple Controls per Case: Continuous or Dichotomous Data." *Biometrics* 31 (September): 643-49.
- Zwanziger, J., and G. A. Melnick. 1988. "The Effects of Hospital Competition and the Medicare PPS Program on Hospital Cost Behavior in California." *Journal of Health Economics* 7 (4): 301-20.
- Zwanziger, J., G. A. Melnick, and J. M. Mann. 1990. "Measures of Hospital Market Structure: A Review of the Alternatives and a Proposed Approach." *Socio-Economic Planning Science* 24 (20): 81-95.