Strategic Management Journal, Vol. 18, 837–853 (1997)

ASSESSING ORGANIZATIONAL FITNESS ON A DYNAMIC LANDSCAPE: AN EMPIRICAL TEST OF THE RELATIVE INERTIA THESIS

MARTIN RUEF*
Department of Sociology, Stanford University, Stanford, California, U.S.A.

This paper proposes an empirical framework for evaluating the relative structural inertia *hypothesis, a central assumption of organizational ecology theories. In stark contrast to the tenets of strategic management, the relative inertia thesis claims that organizations are typically unable to match structural changes to their competitive environments in a timely fashion. The hypothesis is tested for the hospital industry in California during the 1980–90 time frame. Strategic movements in a competition 'landscape' are tracked using a variant of the Jaccard similarity coefficient, which has been applied in numerous studies of biological competition. Findings indicate that few hospitals are able to overcome inertial forces in adapting their service portfolios; furthermore, the ability of hospitals to strategically reposition themselves decreases markedly with provider density. Analyses also investigate the relation between organizational attributes (e.g., age, size, mission, and portfolio scope) and adaptability. Implications for both ecological and strategic theory are pursued.* © 1997 John Wiley & Sons, Ltd.

Strat. Mgmt. J. Vol. 18: 837–853, 1997
No. of Figures: 1. No. of Tables: 3. No of References: 59.

INTRODUCTION

In a recent review of organizational change theories, Barnett and Carroll (1995) distinguish between two major conceptualizations of the way organizations modify their internal routines. One conceptualization emphasizes the *process* of change—e.g., what conditions create an impetus for change; what steps are involved in modifying an organization; how quickly transformations are completed; what barriers to change exist; and how the survival chances of an organization are affected *during* the process. A large number of commentators within the strategic management literature have analyzed change in this regard, focusing on aspects as diverse as market incentives for change (Miller and Chen, 1994) and political constraints (Pfeffer, 1992). Ecological theorists have also examined this dimension of change extensively, placing particular emphasis on the implications of change processes for organizational survival (e.g., Barron, West, and Hannan, 1994; Haveman, 1992; Delacroix and Swaminathan, 1991). A central proposition driving this latter line of research has been Hannan and Freeman's (1984) reformulation of the *structural inertia* thesis, which contends that selection processes favor organizations with fairly static structures since they are seen as being both more reliable and accountable than their less inert counterparts.

A second conceptualization of organizational transformation focuses on the *content* of change—e.g., what features of the organization are modified; what advantages are gained (or lost) in terms of market position; how survival chances are affected *after* the change in features. These considerations have long been a staple

Key words: organizational change, structural inertia, organization–environment relations, selection process, hospitals
* Correspondence to: Martin Ruef, Department of Sociology, Stanford University, Stanford, CA 94306, U.S.A.

CCC 0143–2095/97/110837–17 $17.50

Received 4 April 1996
Revised 12 July 1996; Accepted 10 January 1997

among strategic management gurus of both the popular (Porter, 1980) and more academic (Shapiro, 1989) sort. Organizational ecologists, on the other hand, have been much less attracted to analyzing the content of change. In part, this may be due to an implicit ecological assumption of *relative structural inertia*, which posits that organizations are often unable to match the 'content' of their changes to environmental conditions in a timely manner (Hannan and Freeman, 1984: 151). If this proposition holds true, then the fit between organizational attributes and the environment will typically be random, and, consequently, further analysis of change content may well be a futile exercise.

As Barnett and Carroll make clear, both content and process dimensions are critical to the evaluation of organizational change, but most empirical studies focus on only one of these aspects. Two notable exceptions are Amburgey, Kelly and Barnett's (1993) study of Finnish newspapers and Barnett's (1994) study of telephone companies, which separate the effects of content and process changes. The results of these studies indicate that the *process* of organizational change increases the hazard of organizational failure in the short run (as predicted by the structural inertia theory) but that this hazard wears off over time; the studies remain open to the possibility that the *content* of change may provide long-run survival advantages.

In the present paper, we propose to extend these efforts in a number of ways. First, we offer a framework which directly assesses the success of change content with respect to the competitive environment faced by an organization. While past research, such as that of Amburgey and Barnett, has proxied this factor indirectly, it may be more fruitful to provide immediate evaluations of outcome metrics such as market differentiation. As a result, a fine-grained distinction between change process and content can be drawn and an empirical test of the relative structural inertia thesis is provided.

A second advantage of the present analysis involves overcoming the limitation of the Amburgey *et al*. framework to relatively discrete organizational changes. Barnett and Carroll reiterate the issue, noting that 'the model requires that changes occur among identifiable and fully measured states[;] otherwise, content effects . . . cannot be completely controlled' (1995: 228). From a theoretical standpoint, this imposes a fairly substantial constraint since 'continuous' change dynamics (such as those typified by shifts in marketing strategies or product lines) are immediately removed from consideration. These low-level activities are precisely those that many strategic management theorists consider to be most salient in an organization's attempt to map its change content to its environment. Accordingly, further evaluation of the relative structural inertia assumption seems to revolve around the resolution of this methodological impasse.

The paper proposes to test the thesis of relative structural inertia for the population of nonfederal California hospitals between 1980 and 1990. During the period, these hospitals were exposed to the kind of volatility which Schumpeter (1950) termed 'creative destruction,' where the advent of new technologies, regulations, and organizational forms threatens to shake an industry to its very foundations. We examine if organizational adaptation is possible under such adverse circumstances. Several arguments aside from the relative inertia proposition (i.e., evaluation of change content) will also be examined, including the extent to which ecological selection tends to preserve highly inert organizations (evaluation of change process), and the effects of organizational characteristics such as age, size, complexity, and mission on relative inertia.

ADAPTATION AND ENVIRONMENT

Any empirical discussion of change content must be prefaced by two related considerations: (1) what class of organizational characteristics is purportedly being modified; and (2) what are the environmental criteria which form the basis for judging the optimality (or 'fitness') of those characteristics. With respect to the first question, some commentators (Scott, 1992) have usefully argued that ecological and adaptation perspectives are complementary as opposed to conflicting, insofar as the former theories tend to focus on the static nature of core organizational components (e.g., Hannan and Freeman, 1989), while the latter theories often emphasize the malleability of bridging mechanisms, such as joint ventures or strategic alliances (e.g., Pfeffer and Salancik, 1978). The present paper accepts this provisional division of labor, but also seeks to push the boundaries of the debate by examining whether *core* characteristics of organizations are actually as difficult to adapt as many theorists have claimed.

One possible point of departure is the hierarchy of core components proposed by Hannan and Freeman (1984), including (1) organizational goals, (2) forms of authority, (3) core technology, and (4) marketing strategies. The components are enumerated from those which are least subject to modification (goals) to those which exhibit the greatest adaptability (marketing). Ecological theorists have typically seen adaptation in terms of fundamental reorganization; like Amburgey *et al.* (1993) and Barnett (1994), many of their formal models distinguish change as a separate organizational state, in which the stability of organizational activity suffers noticeably from the dismantling of an old structure and the construction of a new one (Hannan and Freeman, 1984: 159). These notions of radical reorientations may be seen to correspond to changes in organizational goals or authority structures (Tushman and Romanelli, 1985).

A good deal of organizational change does not conform to this image, however. Modifications of core product and service lines can occur fairly regularly, without introducing excessive disruption. Loose coupling may prevent the impact of new marketing strategies from percolating throughout an organization. As commentators within the organizational learning (March, 1981) and strategic management literatures (Miller and Chen, 1994) have noted, organizational change is frequently incremental. Such observations suggest an *a priori* scope condition for studying adaptation which differs in degree from that anticipated by students of ecological approaches:[1]

Scope Condition 1: Our assumptions (and corresponding propositions) are only held to be true for adaptations which involve no 'major' reorganizations—i.e., those involving neither fundamental changes in goals nor in the authority structure of an organization.

A test of the relative inertia thesis at this level must also identify what conception of the environment will be used to evaluate change content. Strategic management theorists have frequently emphasized market differentiation as one such criterion (Porter, 1980, 1985). For our purposes, employing differentiation as a metric of environmental fitness has two immediate advantages. First, it meshes nicely with ecological niche theory. While niche overlap between competitors (and competing populations) has been identified as a critical variable in both organizational (Hannan and Freeman, 1989) and biological theory (MacArthur, 1972), direct assessments of overlap are rare in the organizational literature. Operationalizing market differentiation in ecological terms can address this issue and provide greater compatabilities between ecological and strategic management approaches.[2]

A second advantage of market differentiation concerns its fairly direct relation to the remaining components in Hannan and Freeman's hierarchy (core technology and marketing strategy). Core technology, broadly construed here as principal competencies in production and service provision, may differentiate an organization from its competitors in an objective sense. Marketing strategy, which is concerned with the construction of a distinct organizational identity for the benefit of general public, operates in an analogous fashion in the subjective realm. Since information about core technologies (in the form of product/service portfolios) is generally more easily accessed from archival sources than marketing strategies, we will concern ourselves exclusively with the former aspect of core organizational activities.

Despite its advantages, there is also one complication with an environmental conception that employs market differentiation—namely, organizations are confronted with both *population-exogenous* and *population-endogenous* niches. The population-endogenous aspects correspond to market differentiation and overlap among organizations within a particular population. The population-exogenous aspects correspond to market differentiation and overlap with other organizational forms. Our study is primarily concerned with population-endogenous effects, both because these have been the main object of economic competition theory and because pragmatism usu-

[1] Scope conditions serve to qualify the limits of external validity for a set of propositions. Their use in the social sciences is discussed at length in Walker and Cohen (1985).

[2] Such complementarities are also anticipated in work on industrial organization theory (e.g., Bain and Qualls, 1987), which emphasizes the importance of both population density and product differentiation in models of market structure.

ally limits ecological studies to single populations. In the hospital industry, population-endogenous competition in the area of 'core technologies' not only has important implications for attracting a consumer base, but also for physician recruitment and philanthropy. From a broader empirical viewpoint, however, the decision to exclude the coevolutionary supply-side effects of other relevant organizational populations is fairly arbitrary. For instance, one might well consider the niche overlap that hospitals have developed with home health agencies, as third-party payers have sought to shift costs away from higher-priced acute-care facilities (cf. Shortell, Gillies, and Devers, 1995). With this in mind, we impose one additional scope condition:

Scope Condition 2: Our assumptions (and corresponding theorems) will only be tested for population-endogenous contexts.

THEORY

Relative structural inertia

Let us begin by assuming that any given organizational actor $O(x)$ possesses a group of production attributes $a(x)$, such that those attributes form a subset of the production attributes A found in the entire population of organizations ($a(x) \subseteq A$). The distribution of the population of organizations over all attributes A is referred to as the *social production space*. We will assume further that all attributes in $a(x)$ are linked to the survival of actor $O(x)$ in the following, straightforward manner: the more organizations $O(y)$ which possess a similar set of attributes as those of $O(x)$, the lower the survival chances of $O(x)$.[3] Stated more discursively:

Assumption 1: The lower the differentiation of an organization within the social production space, the lower its survival chances.

The assumption has been widely supported in studies of market differentiation. In the health care sector, for instance, Succi, Lee, and Alexander (1997) found that differentiation in terms of basic and high-tech services significantly reduced the mortality of rural hospitals.

Assumption 1 is mainly a test of construct validity as far as the measure of market differentiation goes. A more critical theoretical question concerns the movement of organizations within the social production space. Some of this 'movement' will be attributable to the dynamics of the production space itself (independent of changes in $a(x)$), as other organizations enter or exit the population, or alter their production attributes. It is certainly possible for a structurally inert organization to experience improvements in its strategic market position over time simply because competitors are selected out of the population.[4] We refer to this type of change as *ecological drift*. Adaptation, by contrast, involves favorable movement initiated by the focal organization itself. In order to consider adaptation independently from ecological drift, we define it to be the improvement of an organization's fitness over what it would have been if the organization was structurally inert. Given this definition, we can reiterate a claim which is commonly advocated in the strategic management literature:

Assumption 2: Over time, organizational actors are generally able to adapt their core activities in order to achieve greater differentiation within the social production space.

The assumption is broad and warrants further qualification. Several strategic management theorists have acknowledged the difficulty of organizational adaptation (Oster, 1982; Zajac and Shortell, 1989). Oster, for instance, investigates industry-specific barriers to mobility, including the role of advertising elasticity and differences between convenience and nonconvenience sectors. In the present study, we follow organizational ecologists in stressing more general (nonindustry-specific) factors which impede strategic positioning. Hannan and Freeman (1984: 151) list three issues which should be addressed in assessing the possibility of adaptation: what is the temporal pattern of environmental change,

[3] The criteria for judging the similarity of organizational attributes will be defined more formally in the section on *Data and measures* (q.v.).

[4] Clearly, it should be recognized that an organization's explicit decision *not* to change its structure can also be considered to be a type of adaptation. Capturing this type of strategic decision-making involves epistemic issues which are not dealt with in this paper.

how quickly and effectively can an organization scan and evaluate environmental signals, and how responsive is an organization's structure to reengineering efforts. The third issue calls for a refinement of the notion of structural adaptation itself, which has already been provided by our first scope condition (q.v.), limiting the change content to be considered in this study to low-inertia transformations. Combining that scope condition with the previous two assumptions yields the following empirical generalization, which serves as an alternative to the relative structural inertia thesis:

> *Proposition 1: When changes in core technologies or marketing strategies are attempted, organizations will (on average) engage in successful market differentiation in order to improve their survival chances.*

In responding to the other two issues raised by Hannan and Freeman, we adopt the perspective of information-processing theorists, who assert that organizational boundary scanning and interpretation mechanisms can usually evolve to meet the demands of highly turbulent and uncertain environments (Galbraith, 1977). Even in industries which are experiencing revolutionary change (such as the hospital population (Meyer, Goes, and Brooks, 1993)), we assume that the complexities of organizational learning do not automatically pose a hindrance to adaptation. Nevertheless, the market-scanning abilities of an organization will invariably be reduced when it faces a large number of competitors within its niche. High population density increases the uncertainty and complexity involved in determining what change content serves to ameliorate an organization's market position. Accordingly:

> *Proposition 2: An organization's ability to improve its market differentiation decreases in proportion to population density within its niche.*

Taken together, Propositions 1 and 2 suggest a possibility for reconciling the views of ecological and strategic management theorists on the efficacy of organizational change. Within low-density markets, organizations may be able to map change content in a way that permits adaptive strategic positioning, but such mapping may be reduced to (effectively) random change as relative inertia increases in dense markets.

Size, complexity, age, and mission

Having indicated some general propositions regarding relative structural inertia, we now turn to more specific relationships between an organization's characteristics and its ability to differentiate itself within the social production space. In this vein, Hannan and Freeman's (1984) theorems on *absolute* structural inertia suggest a number of extensions to our theory of *relative* structural inertia. Hannan and Freeman note that 'the level of structural inertia increases with size for each class of organizations' (1984: 158).[5] We believe the same holds true of movement within the social production space. For example, a large hospital will have a much harder time introducing new and (from its competitors' stance) unanticipated services than a smaller facility. The heightened visibility of the larger organization, coupled with its scale of operations, hinders attempts at timely strategic positioning. A smaller hospital, on the other hand, may shift the emphasis of its operations from inpatient to outpatient services and tap into new patient populations with less likelihood of attracting the attention of other provider organizations. In short:

> *Proposition 3: Larger organizations have less ability to adapt their position in the social production space than do smaller ones.*

As in Proposition 1, adaptation is considered to be tantamount to movement within the social production space which improves organizational fitness (which, in turn, improves survival chances). This does not preclude countervailing influences with respect to mortality (see Figure 1). The size of an organization may serve as an antecedent condition to at least two other latent processes which are linked to survival, one being the technical criterion of *efficiency* and the other being the institutional criterion of *legitimacy*. Economists associate efficiency with size

[5] Some empirical research (e.g., Haveman, 1993) has placed this contention in doubt, finding that larger organizations may engage in more change processes than small ones. Our argument is logically separate from this tradition, since it focuses on the content of change instead.

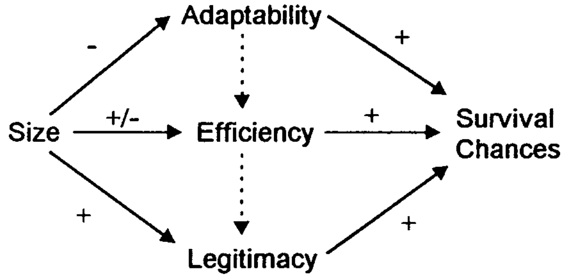

Figure 1. Countervailing influences of organizational size on survival

in an inverse 'U-shaped' fashion, through economies and diseconomies of scale (Feldstein, 1988).[6] A positive association between size and legitimacy has been noted by organization theorists, who stress the heightened visibility and social status that size conveys with respect to both the general public and other influential organizational actors (Dobbin *et al*., 1988; Fombrun and Shanley, 1990). Due to these considerations, the effect of size on mortality itself must remain indeterminate, although a set of empirically testable mediating processes has been offered.

Beyond the influence of organizational size, Hannan and Freeman indicate that 'the complexity of organizational arrangements may also affect the strength of inertial forces' (1984: 162). Within their formulation, complexity is defined as the extent to which links between organizational subunits tend to constitute hierarchical (simple) structures as opposed to nonhierarchical (complex) ones. Because this measure of complexity is rather difficult to operationalize, we advocate a different definition which holds complexity to be tantamount to the *scope* of an organization's operation, as proxied by the size of its product/service portfolio. When the scope of operations is large (i.e., the organization is a generalist), then adaptive movement within the social production space is enhanced. Generalists have greater flexibility in deciding which core technologies to divest and which new (and, potentially, unrelated) services to add. Specialists (e.g., a hospital which concentrates on drug rehabilitation) develop core competencies in a given area which hampers adaptive strategic positioning. Such relative structural inertia is partially due to what Levitt and March (1988) term competency traps, and partially due to the subjective understandings of identity that become attached to specialist organizations:

Proposition 4: Specialist organizations exhibit less ability to reposition themselves within the social production space than do generalist ones.

Another organizational characteristic receiving extensive treatment in the ecological literature is age (see Barron *et al*., 1994, for some recent developments). While young organizations are thought to be reasonably amenable to change due to a lack of well-defined routines and roles, structural inertia tends to set in with age (Hannan and Freeman, 1984). A number of analyses have shown that there is considerable support for this proposition when absolute inertia is considered (Amburgey *et al*., 1993; Halliday, Powell, and Granfors, 1993; Miller and Chen, 1994). We believe that the logic can also readily be extended to relative structural inertia. The ability of older organizations to adaptively reposition themselves in the social production space declines with time. This results from both increases in absolute inertia and a decrease in the ability of older organizations to monitor market competition. In the latter vein, Porac, Thomas, and Baden-Fuller (1989) suggest that managers form cognitive taxonomies of their competitors which may be quite distinct from those of external observers. Insofar as 'cognitive imprinting' occurs in organizations, we expect that the accuracy of *perceptions* of the environment will decrease with time, as will the adaptivity of responses to that environment. Thus, we posit that:

Proposition 5: Older organizations have less ability to initiate favorable movement within the social production space than young ones.

The caveat indicated for organizational size certainly applies here as well—potential countervailing effects of age (e.g., through efficiency or legitimacy outcomes) prevent us

[6] For populations such as U.S. hospitals, which have historically been significantly smaller on average (166 beds in 1981) than economies of scale might require (400–600 beds) (Starkweather, 1981), the correlation between size and efficiency may simply appear as a linear one.

from drawing any unequivocal relation with respect to organizational survival.[7]

One final characteristic which has largely been ignored by organization theorists in terms of its effect on organizational change is the overall mission of an organization. Clearly, the amount of resources an organization is willing to invest in environmental scanning and restructuring will be tied strongly to the mission of the organization, as will the types of environments which are considered. In an early monograph on the subject, Clark and Wilson (1961) describe the difference between *utilitarian* organizations, which attract support through material incentives, and *purposive* organizations, which attract support through their stated goals. If we take the tax status of organizations to be an indication of their missions, one might expect for-profits (utilitarian organizations) to be more active in adapting to the requirements of market environments than NPOs (purposive organizations). The latter types of organizations will have less ability to divest themselves of unprofitable services or products due to community embeddedness. For hospitals in particular, this issue has been probed by Shortell *et al*. (1986), who found that nonprofit providers had a greater tendency to maintain unprofitable services than for-profits. Furthermore, NPOs are less likely to devote resources toward identifying strategic positioning opportunities which will allow them to exploit new market niches. This leads us to advance the following, final proposition:

> *Proposition 6: For-profit organizations suffer from less relative structural inertia than their nonprofit counterparts in adapting within the social production space.*

DATA AND METHOD

Data

Organizational data records were collected from the annual hospital disclosure reports which are submitted to California's Office of Statewide Health Planning and Development (OSHPD). All told, these records included some 617 hospital organizations, with individual cases comprising 5927 organization-years. While federal (in particular, military and VA) hospitals were excluded from the population due to their highly specific niches, hospital specialists with less restricted markets (e.g., rehabilitation, psychiatric, and children's hospitals) were included in the analysis.[8]

During the 11-year period under study, there were 90 exits from our sample. Exit events included bankruptcies and acquisitions by other hospitals, but excluded entry into *multihospital systems* (MHSs).[9] Over the short timespan, a simple comparison of the number of exits with the total number of organizations in the population pays tribute to the Schumpeterian process of creative destruction, which was noted earlier. Attrition claims almost 15 percent of the hospitals during the decade.

Independent and control variables

With respect to population-endogenous factors, ecological research has usually viewed overall population density as driving competition and legitimation processes, which in turn are linked to mortality (Hannan and Freeman, 1989). Recent efforts have focused on the various geographic levels of analysis that competition and legitimation may operate on (e.g., Hannan *et al*., 1995; Hannan and Carroll, 1992; Swaminathan and Wiedenmayer, 1991), examining density-

[7] Such countervailing effects may also help explain the inconsistent empirical evidence that has accumulated on age-dependent mortality processes (see Barron *et al*., 1994). While mature organizations may be less adaptive than their younger counterparts, a positive relation could be expected between age and legitimacy, and a curvilinear relation may hold between age and efficiency. The aggregate effect exercised by age with respect to survival can therefore be parsed into a number of component influences—adaptability being just one of them.

[8] The selection of hospital types included in the sample is purposefully broad so as to capture most acute-care facilities which *might* have some niche overlap with nonfederal general hospitals. Naturally, many of these organizations will not be competing with each other and this should be reflected by the effects of our market differentiation metric.

[9] Research by Longo and Chase (1984) has shown that a hospital's decision to join an MHS tends to be qualitatively different than either a merger or outright demise, with the latter two events usually being recognized as organizational 'failures' and the former event being seen as an organizational 'success.'

dependent effects that are apparent at the local, regional, national, and cross-national levels, within *a priori* boundaries defined by the theorists. For organizational forms with geographically specific niches, these operationalizations of density can sometimes be inappropriate. Policy experts often identify health care markets at the county, city, or SMSA levels. When competition is reduced to local levels of analysis, reliance on political or census boundaries is necessarily artificial since consumers will travel readily across jurisdictions which might be rigidly imposed by theorists (cf. Garnick *et al*., 1987; Duffy, 1992). Accordingly, *local densities* based on market radii should be invoked to consider geographic market saturation.

In calculating local population densities, we used a variable-radius approach, which scales market regions based on consumer concentration. Patients in urban regions have been found to be more sensitive to hospital distances than those in suburban or rural areas (Succi *et al*., 1997). For rural areas, a 35-mile radius is typically used since it serves as the federal government's criterion for deciding whether a hospital effectively has a monopoly (Office of Technology Assessment, 1990). For urban and suburban areas, we applied 10- and 15-mile radii, respectively.

Some organization-level variables which have been analyzed in conjunction with hospital mortality are size, age, for-profit status, and membership in multiorganizational systems (Williams, Hadley, and Penttengill, 1992; Longo and Chase, 1984). With respect to size, we employed the most common measure used in hospital economies-of-scale studies, which has been the number of patient beds (Feldstein, 1988). Age was operationalized as the number of years since hospital founding; for those organizations undergoing equal-status mergers, the time clock of the new (merged) organization was set to zero in order to reflect a potential 'liability of newness.'

Several additional variables were collected in order to assess their impact on the evolution of organizational adaptation. Service scope (Proposition 4) was measured in terms of the number of services offered by a hospital from a standardized OSHPD list. Linkages between hospitals were entered as a control variable; linkage is indicated by membership in multihospital systems, where system hospitals are officially defined by the American Hospital Association as 'nonfederal and nonstate hospitals that are either leased, under contract management, legally incorporated, or under the direction of a board that determines the central direction of two or more hospitals' (Ermann and Gabel, 1984). This broad conception of multihospital systems allows for considerable variation in the types of governance structures they involve. Generally speaking, though, the decision to join a hospital systems lies midway between acquisitions/mergers and looser trade associations on the continuum of bridging strategies (Shortell, 1988; Starkweather, 1981).

Population-exogeneous environment

In order to control for basic changes in the population-exogeneous environment, additional data were selected from the county-level Area Resource File (ARF) provided by the Department of Health and Human Services. Health care demand was proxied by the consumer density (number of residents per square mile) in the county served by a hospital, the proportion of senior citizens (Medicare recipients) in that county, as well as a per-capita income measure. The latter variable was adjusted for inflation at 1980 levels.

During the period studied, the most significant change in the regulatory environment of our sample was the federal introduction of PPS (the Prospective Payment System) on October 1 of 1983. This legislation moved Medicare from retrospective to prospective reimbursements, decentralizing oversight of facility efficiency and planning from the federal to the organizational level (ProPAC, 1989). Nonparametric exploratory analyses reveal that the rates of hospital mortality in California *increased* following PPS.[10] Furthermore, there is good reason to believe that hospital adaptation was affected by the regulation (Zajac and Shortell, 1989). Accordingly, period effects for the pre-PPS (1980 to September 1983) and post-PPS (October 1983 to 1990) eras will be entered as controls into some of our models.

[10] Nelson–Aalen estimates of the mortality hazard rate (cf. Tuma and Hannan, 1984) were obtained for this purpose.

Service portfolios and market differentiation

The core organizational attribute considered by the study was the hospital service mix and the resulting level of market differentiation. Earlier efforts by health economists (e.g., Berry, 1977) applied factor analyses to identify the main orthogonal dimensions which accounted for service heterogeneity. Initially, this study used a similar approach to construct niche hypervolumes based on the daily and ancilliary services offered by hospitals in a geographic locale. However, as has been noted by biological ecologists (Litvak and Hansell, 1990; Legendre and Legendre, 1983), many factor-analytic techniques are based on fairly crude similarity metrics which gloss over important nuances in niche exploitation. For example, given presence–absence data on a set of acute-care services, should two hospitals which lack a given service be weighted as being as equally similar as two hospitals which provide that service? Rather than using matching coefficients in such circumstances, biologists have often used metrics which remove mutual absences from the equation (Legendre and Legendre, 1983). One of the most popular of these metrics is Jaccard's similarity coefficient (s):

$$s(m,n) = \frac{a}{a + b + c} \tag{1}$$

The coefficient can be applied to hospitals in a pairwise fashion to assess how densely packed their regions of the social production space are. Given a set of services m for one hospital and a set of services n for another, a represents the number of mutual presences in both service portfolios, b represents the number of services possessed by the first hospital and not by the second, and c represents the number of services in the second hospital's portfolio which are not in that of the first. The resulting differentiation metric ranges from 0 (indicating no service niche overlap) to 1 (indicating full service competition).[11]

Although the Jaccard coefficient remedies one of the problems faced by other similarity metrics, it still fails to account for asymmetrics in competitive effects. Thus, a hospital with a fairly large service portfolio would experience the same amount of competition from a given niche overlap as its much smaller competitor. By the same token, the Jaccard does not address the fact that an organization's ability to exploit alternative service markets can ameliorate its competitive position. In order to correct this shortcoming, we propose a pairwise asymmetric similarity coefficient ($s2$) which is operationalized as the ratio of an organization's service niche to the total service niche occupied by it and its competitor:

$$s2(m,n) = \frac{a + c}{a + b + c} \tag{2}$$

The competition metric is computed based on the revenue-producing service centers which are indicated in the OSHPD facility reports. There are 51 possible services, ranging from basic surgical acute treatment to specialty services such as nuclear medicine and cardiac catheterization. An aggregate metric is created by considering the mean level of competition that a hospital experiences with respect to other hospitals in its geographic niche. Like the basic Jaccard coefficient, the aggregated measure varies from 0 to 1 and allows market differentiation to be considered independently from geographic differentiation. Summary statistics and zero-order correlations for all independent variables appear in Appendix 1.

Estimation methods

Event history analysis was used to analyze hospital mortality processes. Due to the left-censored nature of the data (i.e., the fact that all hospitals cannot be observed from their founding dates), some precautions had to be taken to prevent estimates from being statistically biased (Tuma and Hannan, 1984). In order to minimize parametric assumptions and accommodate left-censoring, we employed a semiparametric approach with the following Cox (1972) specification:

[11] Obviously, the metric makes a simplifying assumption in assigning equal weight to every service. When a large number of services are involved (over 50 in our case) and the importance ascribed to each type of service does not display an excessive amount of variance, the assumption is clearly reasonable. We also tested an alternate metric which weighted services by mean revenues (considered across the population), and found that it was no better at predicting hospital exits than its unweighted counterpart.

$$r(t) = h(t)\ \exp(\mathbf{X}(t)\beta) \qquad (3)$$

where $r(t)$ is the transition rate, $h(t)$ is an unspecified baseline rate (which controls for temporal variation), $\mathbf{X}$ is a vector of covariates, and β is the corresponding vector of coefficients. Conditional partial likelihood (PL) estimation of the Cox model produces unbiased estimates, even when left-censoring is present (Guo, 1993). Consequently, we apply this estimation technique to all of our survivor models.

Some previous modeling efforts investigating organizational change have extended survivor specifications to incorporate both the (potentially disruptive) effects of change processes and the (potentially adaptive) effects of change outcomes (Amburgey *et al*., 1993). Unfortunately, these specifications rely on reasonably discontinuous change events (Barnett and Carroll, 1995). When change is incremental, econometric techniques may be more appropriate for analyzing the success or failure of outcomes—in the present case, the movement of hospitals within the social production space. Two types of econometric models which have commonly been used to deal with pooled cross-sectional designs are the covariance model (also known as the *fixed effects* model) and the *random effects* model (Kmenta, 1986). A fixed effects model incorporates a separate intercept for each cross-sectional unit (hospital facilities, in our case). Given that t indexes each year and i indexes the cross-sectional units, this model can be represented as:

$$\begin{aligned} Y_{it} &= \beta_1 X_{it,1} + \dots + \beta_K X_{it,K} \\ &\quad + \lambda_1 Z_{it,1} + \dots + \lambda_N Z_{it,N} + \epsilon_{it} \end{aligned} \qquad (4)$$

where λ is the vector of intercepts for all cross-sectional units and $Z_{it,i} = 1$ for the ith unit (0 otherwise). One problem with this formulation is that it results in a substantial loss of degrees of freedom due to the cross-sectional dummy variables. An alternate (random effects) specification eliminates the dummies and splits the regression disturbance into two independent components—one associated with the cross-sectional units (u_i) and another with time (v_t), i.e.:

$$\epsilon_{it} = u_i + v_t \qquad (5)$$

with $u_i \sim N(0,\sigma_u^2)$ and $v_t \sim N(0,\sigma_v^2)$. This two-component error model is readily estimated using generalized least-squares methods (cf. Kmenta, 1986). Hausman's test statistic (Greene, 1992) can be applied to judge whether a fixed or random effects model is most appropriate for any particular equation.

RESULTS

We began the survivor analysis by assessing the construct validity of our conception of social production space. The first two columns of Table 1 indicate the results which were obtained using Rohwer's (1994) Transition Data Analysis (TDA) program, with the first model excluding the Jaccard measure of market differentiation and the second including the measure. The asymmetric similarity coefficient turns out to be highly significant ($p < 0.01$), even after numerous other organizational variables have been controlled for. Mortality among hospitals in highly competitive niches ($s2 = 1$) is almost nine ($e^{2.15}$) times that of hospitals enjoying no service competition. This verifies our first assumption (q.v.) and also indicates that market differentiation serves as a reasonable dependent variable to consider the adaptive capabilities of hospital organizations.

The initial two models yield some additional findings. Consistent with previous research within organizational ecology in general (cf. Barron *et al*., 1994; Singh and Lumsden, 1990) and studies of hospital closure in particular (Longo and Chase, 1984), exit from the population is negatively related to hospital size. As noted earlier, this evidence of a liability of smallness does not translate into a liability of adaptivity (even if Proposition 3 is accepted), since organizational size has an effect on a number of contradictory processes with respect to mortality. We also find that local market density exercises a modest (and, as expected, positive) influence on exit rates—however, this effect is only significant in Model 1, which excludes the measure of market differentiation. Generally speaking, the density measure seems to be a weak indicator of competition once service portfolios are taken into account.[12]

A third survivor model tests the common eco-

[12] More standard ecological operationalizations of density (e.g., total number of hospitals in California) were also evaluated, but consistently performed worse than the local density metric

Table 1. Effects of market differentiation and change on exits from California's hospital population, 1980–90

Variable	Model 1	Model 2	Model 3
Age	0.0040 (0.0053)	0.0048 (0.0051)	0.0043 (0.0051)
Size (log beds)	−1.0112 (0.1785)***	−0.8549 (0.1925)***	−0.9023 (0.1936)***
For-profit ownership	−0.0838 (0.3352)	−0.2230 (0.3343)	−0.3185 (0.3386)
Government ownership	−0.1747 (0.4476)	−0.2517 (0.4580)	0.2437 (0.4616)
System affiliation	0.5039 (0.3159)	0.4194 (0.3128)	0.3969 (0.3118)
Organizational density	0.0102 (0.0057)#	0.0085 (0.0058)	0.0084 (0.0058)
Market differentiation	–	2.1460 (0.7940)**	2.2954 (0.8063)**
Service changes	–	–	0.1786 (0.0607)**
Per-capita income	0.0888 (0.0692)	0.0929 (0.0711)	0.1064 (0.0720)
Population density	0.0415 (0.0525)	0.0250 (0.0532)	0.0288 (0.0536)
Senior population	−0.0876 (7.1212)	1.5732 (7.4773)	1.3393 (7.4966)
Number of cases	4416	4416	4416
Log likelihood	−327.2	−322.4	−318.9
Degrees of freedom	9	10	11

#$p < 0.10$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$ (two-tailed tests)
Data sources: OSHPD, ARF

logical proposition that the *process* of organizational change is disruptive, and may increase mortality rates. A simple count variable, which indicates the number of hospital service additions and deletions during the current year, is entered into the equation. Consistent with the Amburgey *et al*. (1993) model, the number of service changes has a significant positive effect on hospital exits ($p < 0.01$), increasing the mortality rate by almost 20 percent for every service alteration. The finding supports the ecological claim that the process of organizational change may erode the technical reliability or institutional accountability of an organization, even when such change is performed at the level of the service portfolio. Of course, this is not to say that the *content* of changes will not ultimately improve an organization's position within the social production space, but, that nonincremental changes, in particular, pose immediate survival threats.

The more general question of whether the hospital organizations have successfully adapted within a dynamic environment still remains open. In seeking an answer, we conducted a series of trend analyses which investigated the evolution of hospitals' competitive positions within the social production space. Models were estimated with LIMDEP (Greene, 1992) for three types of dependent variables: (1) overall market differentiation, (2) market differentiation due to ecological drift, and (3) differentiation accounted for by organizational adaptation alone (Table 2, models 1–3 respectively). Since the number of mutual absences in two competing service portfolios may bias the adaptation measure (see Appendix 2), a control for this variable was included in the third model. Variation between facilities was controlled for by entering a dummy variable for all hospitals into the cross-sectional time-series analysis (within a fixed effects specification). Each model also included terms for local density and a density–time interaction; the latter variable was used to test the proposition that increases in the number of other organizations occupying a focal organization's competitive niche would reduce adaptive capabilities.

The first column of Table 2 displays the findings for overall market differentiation. Most notably, the trend variable is significantly negative ($p < 0.001$), indicating that hospitals do tend to move to less crowded regions of the social production space over time. The initial model also indicates that density negatively affects the ability of organizations to differentiate themselves over time. As noted earlier, these results are not sufficient to validate Assumption 2 (or Proposition 2), since they conflate adaptation with ecological drift. The second column considers the effects of drift alone on the competitive positions of hospitals. The dependent variable is computed by using the same asymmetric Jaccard coefficient as model 1, except that each organization's ser-

Table 2. Market differentiation trends in California's hospital population, 1980–90

Variable	Model 1	Model 2	Model 3
Intercept (overall)	0.6112 (0.0115)***	0.6159 (0.0115)***	−0.0046 (0.0021)*
Linear trend (annual)	−0.0070 (0.0004)***	−0.0048 (0.0003)***	−0.0001 (0.0001)
Trend × density[a]	0.0143 (0.0011)***	0.0120 (0.0010)***	0.0009 (0.0003)***
(Organizational) density[a]	0.0054 (0.0249)	0.0068 (0.0239)	−0.0190 (0.0050)***
Mutual absences	–	–	0.0001 (0.0000)***
Hausman statistic[b]	0.0001	0.0001	0.0001
Number of cases	5896	5896	5896
Log likelihood	8594	9183	16985

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$ (two-tailed tests)
[a]These coefficients are scaled by a factor of 100.
[b]The Hausman is significant when a fixed effects model is favored over a random effects one.
Data source: OSHPD

vice portfolio is held constant over the period in question—i.e., we act as if the strong form of the structural inertia thesis holds true. The negative linear trend coefficient demonstrates that hospitals typically experience an improvement in fitness *independently* of their own adaptive efforts. Such favorable ecological drift can be attributed to a number of factors, including service portfolio changes made by other hospitals to mitigate competition (e.g., increased collective diversity), or exits from the market niche in question and a corresponding resistance of new organizations to enter the market of an established hospital. Not surprisingly, the effects of ecological drift tend to be less favorable in densely populated health care markets (N.B. density–time interaction).

In order to investigate the evolution of hospital adaptation itself, the model was reestimated using the difference of the aggregate competition and ecological drift measures (and controlling for mutual absences). With this dependent variable, we *no* longer find a significant negative time trend (column 3). Although hospitals are able to achieve some increased market differentiation over time, very little is attributable to their own adaptive efforts. The result provides consequential counterevidence to Assumption 2, which asserted that organizations can, on average, successfully alter their core technologies to maneuver to less densely packed production space niches. Furthermore, we find that increases in local market density tend to obliterate the marginal improvements in differentiation that are achieved through strategic repositioning—as the information-processing demands associated with monitoring numerous competitors (and potential competitors) increase, mapping change content to environmental conditions becomes a random, if not maladaptive, process.

Given that adaptive organizations may be the exception, rather than the rule, it is of special interest to identify those types of organizations which are most capable of strategic change. A final analysis was deployed to clarify the correlation between various organizational characteristics and adaptation (Table 3). The adaptation variable was detrended by computing 1-year lagged difference scores. Generally speaking, negative scores indicate improvements in a hospital's competitive position, while positive scores indicate a worsening competitive stance. A first-order autocorrelation coefficient (rho) was also entered into each equation after being derived from the standard Durbin–Watson statistic in a two-stage least-squares procedure.

Model 1 displays the results for the key theoretical variables of interest. As predicted by Proposition 3, larger hospitals are less able to successfully modify their service portfolios in order to maximize survival chances. The finding parallels other studies which have found analogous results with respect to absolute inertia (Halliday *et al*., 1993; Delacroix and Swaminathan, 1991). We also receive support for Proposition 4—generalists (organizations with a broad service scope) have a much easier time adapting within the social production space than specialists. This can be attributed to the competency traps developed by specialists, as well as the wider array of portfolio choices which are available to generalist organizations.

Table 3. Hospital characteristics affecting adaptation, 1980–90

Variable	Model 1	Model 2
Intercept (1980–83)	–0.0068 (0.0023)**	–0.0069 (0.0023)**
Period 2 (1984–92)	0.0022 (0.0008)**	0.0021 (0.0008)**
Size (log beds)	0.0023 (0.0006)***	0.0021 (0.0006)***
Service scope	–0.0004 (0.0000)***	–0.0004 (0.0001)***
For-profit ownership	–0.0017 (0.0009)*	–0.0012 (0.0009)#
System affiliation	0.0003 (0.0008)	0.0003 (0.0008)
Age ($\times$ 100)	–	0.0035 (0.0014)**
Mutual absences	0.0002 (0.0001)#	0.0001 (0.0001)#
Rho	–0.1819 (0.0147)***	–0.1829 (0.0147)***
Number of cases	4494	4494
Log likelihood	9725	9729
Degrees of freedom	7	8

#$p < 0.10$; *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$ (one-tailed tests)
Data source: OSHPD

We find that for-profit hospitals have a greater ability to adapt their portfolios when compared with NPOs and government-owned facilities (Proposition 6). The lack of community embeddedness or eleemosynary orientation on the part of the investor-owned facilities may explain their success in negotiating the competitive landscape. The other significant effect in Model 1 is associated with the period of Prospective Payment Systems (1984–present). The regulation appears to have complicated adaptive efforts by hospitals, especially by restricting federal payment for certain classes of services (cf. ProPAC, 1989).

A second model (column 2) was estimated to investigate the influence of age on relative structural inertia. As the results indicate, older organizations have significantly less likelihood of achieving adaptive market differentiation than their younger counterparts (consistent with Proposition 5). All other factors being held equal, the second model predicts that a newly formed for-profit hospital (age = 0), with a small bed count (c. 20) and median portfolio size (17 services), will achieve adaptive market differentiation at the level of 0.0086 in one year. In conjunction with the survivor analysis, this translates into about a 2 percent reduction in mortality chances. Even under these idealized organizational conditions, the returns to portfolio adaptation are rather modest.

DISCUSSION

The objectives of this paper have been threefold: (1) to empirically evaluate the ability of organizations to overcome relative structural inertia; (2) to assess risks associated with change processes in the technological core; and (3) to test the effects that various characteristics might exercise on the adaptability of organizations. In the process of addressing these objectives, we have found considerable support for 'selection' views on change in organizational populations. Examining population-wide modifications of service portfolios, we discovered that hospitals moved to less crowded regions of the social production space, but that most of this favorable movement is due to ecological drift as opposed to adaptation. In accordance with the theory of relative structural inertia, the analysis found that successful adaptation among hospital organizations is rare—the mapping between change content and population-endogenous conditions is frequently random. Furthermore, the analysis discovered that the problems associated with relative inertia tend to increase with population density.

While these results may seem sobering to strategic management theorists, they must be qualified by the fact that we have not chosen an easy 'straw man' for this analysis. The recent turbulence in the health care sector makes it an obvious target for ecological arguments. On the one hand, as Zajac and Shortell (1989) and others (Meyer *et al.*, 1993) have argued, conditions of hyperturbulence have clearly not been sufficient to render hospitals inert—hospitals do change strategies and (*in the aggregate*) do so in a nonrandom fashion. However, when the outcomes of strategic movements of individual hospitals are considered, the results obtained by Zajac and Shortell on profitability (1989: 425), as well as our findings on niche overlap, emphasize the limited performance advantages gained from adaptation within volatile environments. Additional research will have to be conducted to determine if organizations in more placid environments suffer from similar levels of relative inertia.

Other findings of this study involved a confirmation of the implications of (absolute) structural inertia for organizational survival and the identification of a number of antecedents to relative inertia. With respect to absolute inertia, we determined that the number of service changes had a significant impact on the danger of organizational mortality. This is consistent with several studies which have examined the detrimental effects of change processes. We also found that organizational size, age, and service scope were important characteristics affecting a hospital's ability to overcome relative structural inertia. Adaptivity increased with size, as one might expect, but decreased with the scope of an organization's service portfolio (i.e., the degree of generalism). The latter finding is consistent with a 'law of proportions,' indicating that the difficulty of adding or removing services may be linked to the proportion that those services represent within the entire organizational portfolio. Relative structural inertia also increased with organizational age. While some of this effect may be linked to absolute inertia (i.e., a general resistance to change), it is likely to be compounded by the fact that employees and managers in mature organizations may have more old-fashioned ideas about their competitive environment—in turn, this can lead to poor matches between portfolio adaptations and the environment contingencies when change is attempted.

CONCLUSION

To a large extent, the findings reported here must be regarded as being preliminary. Our conception of the environment has, of necessity, been a narrow one, focusing on technical supply-side factors which are endogenous to the population under study. Extensions to the model might evaluate how service portfolio adaptations in other relevant health care populations (e.g., home health agencies or nursing homes) affect the hospital industry. Given the present health policy drive to move patients outside of traditional acute-care facilities, this area of inquiry may be a rich one for both theoretical and practical reasons. Alternatively, one could investigate whether hospitals also compete on the basis of 'symbolic portfolios,' consisting of those accreditations, licenses, and linkages that may be important in the institutional domain. Critical questions include whether the adaptation of these nontechnical attributes corresponds to the dynamics which are inherent in the modification of service portfolios, and how strategic considerations may play a role in this institutional process (cf. Oliver, 1991).

The interplay of organizational changes at different inertial levels (marketing strategies, bridging strategies, core technologies, authority structure, and goals) also deserves a closer look. To what extent do adaptations at one level force adaptations at another? More importantly, how do connections between the levels of organizational structure influence overall relative inertia and survival chances? These issues are of particular interest in the health care sector, where the impact of recent merger activities and systems affiliations on the adaptative capabilities of individual facilities is still far from clear. Future research should clarify how different types of interorganizational linkages (e.g., loosely vs. tightly coupled associations) impact adaptivity.

On the whole, our results do not suggest an acceptance or rejection of either adaptive (e.g., strategic management) or ecological perspectives, but, rather, present avenues of further theoretical refinement and complementarity. Strategy theorists must be attentive to the barriers to (and hazards of) organizational adaptation, even at the level of the technological core. Connecting these dynamics to their impact on other core characteristics (as well as peripheral linkages with other organizations) remains one of the central tasks of the strategic literature. Ecologists have been vindicated, to some extent, by this paper's assessment of relative structural inertia. However, the thesis should be examined empirically for other organizational populations and various levels of environment turbulence—it is only on this basis that we can determine the true scope of applicability for ecological arguments.

ACKNOWLEDGEMENTS

I would like to thank W. Richard Scott, Michael Hannan, members of the Medical Organizations Workshop, members of the Workshop on Organizational Ecology, and anonymous SMJ referees for their helpful criticisms on earlier versions of this paper.

REFERENCES

Amburgey, T., D. Kelly and W. Barnett (1993). 'Resetting the clock: The dynamics of organizational change and failure', *Administrative Science Quarterly*, **38**, pp. 51–73.

Bain, J. and P. D. Qualls (1987). *Industrial Organization: A Treatise*. JAI Press, Greenwich, CT.

Barnett, W. (1994). 'The liability of collective action: Growth and change among early telephone companies'. In J. Baum and J. Singh (eds.), *Evolutionary Dynamics of Organizations*. Oxford, New York, pp. 337–354.

Barnett, W. and G. Carroll (1995). 'Modeling internal organizational change', *Annual Review of Sociology*, **21**, pp. 217–236.

Barron, D., E. West and M. Hannan (1994). 'A time to grow and a time to die: Growth and mortality of credit unions in New York City, 1914–1990', *American Journal of Sociology*, **100**, pp. 381–421.

Berry, R. (1977). 'On grouping hospitals for economic analysis'. In L. Weeks and H. Berman (eds.), *Economics in Health Care*. Aspen Systems, Germantown, MD, pp. 181–188.

Clark, P. and J. Wilson (1961). 'Incentive systems: A theory of organizations', *Administrative Science Quarterly*, **6**, pp. 129–166.

Cox, D. (1972). 'Regression models and life-tables', *Journal of the Royal Statistical Society*, **34**, pp. 187–220.

Delacroix, J. and A. Swaminathan (1991). Cosmetic, speculative, and adaptive organizational change in the wine industry: A longitudinal study', *Administrative Science Quarterly*, **36**, pp. 631–661.

Dobbin, E., L. Edelman, J. Meyer, W. R. Scott and A. Swidler (1988). 'The expansion of due process in organizations'. In L. Zucker (ed.), *Institutional Patterns and Organizations: Culture and Environment*. Ballinger, Cambridge, MA, pp. 71–98.

Duffy, S. (1992). 'Do competitive hospitals really adopt technology faster? An analysis of the influence of alternative relevant market definitions', *Eastern Economic Journal*, **18**, pp. 187–208.

Ermann, D. and J. Gabel (1984). 'Multihospital systems: Issues and empirical findings', *Health Affairs*, **3**, pp. 50–64.

Feldstein, P. (1988). *Health Care Economics*. Wiley, New York.

Fombrun, C. and M. Shanley (1990). 'What's in a name? Reputation building and corporate strategy', *Academy of Management Journal*, **33**, pp. 233–258.

Galbraith, J. (1977). *Organization Design*. Addison-Wesley, Reading, MA.

Garnick, D., H. Luft, J. Robinson and J. Tetreault (1987). 'Appropriate measures of hospital market areas', *Health Services Research*, **22**, pp. 69–90.

Greene, W. (1992). *LIMDEP*. Econometric Software, Bellport, NY.

Guo, G. (1993). 'Event-history analysis for left-truncated data'. In P. Marsden (ed.), *Sociological Methodology*. Basil Blackwell, Cambridge, MA, pp. 217–243.

Halliday, T., M. Powell and M. Granfors (1993). 'After minimalism: Transformations of state bar associations from market dependence to state reliance, 1918 to 1950', *American Sociological Review*, **58**, pp. 515–535.

Hannan, M. and G. Carroll (1992). *Dynamics of Organizational Populations: Density, Legitimation, and Competition*. Oxford University Press, New York.

Hannan, M. and J. Freeman (1984). 'Structural inertia and organizational change', *American Sociological Review*, **49**, pp. 149–164.

Hannan, M. and J. Freeman (1989). *Organizational Ecology*. Harvard University Press, Cambridge, MA.

Hannan, M., G. Carroll, E. Dundon and J. Torres (1995). 'Organizational evolution in a multinational context: Entries of automobile manufacturers in Belgium, Britain, France, Germany, and Italy', *American Sociological Review*, **60**, pp. 509–528.

Haveman, H. (1992). 'Between a rock and a hard place: Organizational change and performance under conditions of fundamental environmental transformation', *Administrative Science Quarterly*, **37**, pp. 48–75.

Haveman, H. (1993). 'Organizational size and change: Diversification in the savings and loan industry after deregulation', *Administrative Science Quarterly*, **38**, pp. 20–50.

Kmenta, J. (1986). *Elements of Econometrics*. Macmillan, New York.

Legendre, L. and P. Legendre (1983). *Numerical Ecology*. Elsevier, New York.

Levitt, B. and J. March (1988). 'Organizational learning', *Annual Review of Sociology*, **14**, pp. 319–340.

Litvak, M. and R. Hansell (1990). 'A community perspective on the multidimensional niche', *Journal of Animal Ecology*, **59**, pp. 931–940.

Longo, D. and G. Chase (1984). 'Structural determinants of hospital closure', *Medical Care*, **22**, pp. 388–402.

MacArthur, R. (1972). *Geographical Ecology: Patterns in the Distribution of a Species*. Princeton University Press, Princeton, NJ.

March, J. (1981). 'Footnotes to organizational change', *Administrative Science Quarterly*, **26**, pp. 563–577.

Meyer, A., J. Goes and G. Brooks (1993). 'Organizations reacting to hyperturbulence'. In G. Huber and W. Glick (eds.), *Organizational Change and Redesign: Ideas and Insights for Improving Performance* Oxford University Press, New York, pp. 66–104.

Miller, D. and M.-J. Chen (1994). 'Sources and consequences of competitive inertia: A study of the U.S.

airline industry', *Administrative Science Quarterly*, **39**, pp. 1–23.

Office of Technology Assessment (1990). *Health Care in Rural America.* U.S. Government Printing Office, Washington, DC.

Oliver, C. (1991). 'Strategic responses to institutional processes', *Academy of Management Journal*, **16**, pp. 145–179.

Oster, S. (1982). 'Intraindustry structure and the ease of strategic change', *Review of Economics and Statistics*, **64**, pp. 376–383.

Pfeffer, J. (1992). *Managing with Power.* Harvard University Press, Boston, MA.

Pfeffer, J. and G. Salancik (1978). *The External Control of Organizations.* Harper, New York.

Porac, J., H. Thomas and C. Baden-Fuller (1989). 'Competitive groups as cognitive communities: The case of Scottish knitwear manufacturers', *Journal of Management Studies*, **26**, pp. 397–416.

Porter, M. (1980). *Competitive Strategy: Techniques for Analyzing Industries and Competitors.* Free Press, New York.

Porter, M. (1985). *Competitive Advantage: Creating and Sustaining Superior Performance.* Free Press, New York.

ProPAC (Prospective Payment Assessment Commission) (1989). *Medicare Prospective Payment System and the American Health System: Report to Congress.* ProPAC, Washington, DC.

Rohwer, G. (1994). *Transition Data Analysis* (TDA) *5.7*, working paper, Institut fur Empirische und Angewandte Soziologie, University of Bremen, Germany.

Schumpeter, J. (1950). *Capitalism, Socialism and Democracy.* Harper & Row, New York.

Scott, W. R. (1992). *Organizations: Rational, Natural, and Open Systems.* Prentice-Hall, Englewood Cliffs, NJ.

Shapiro, C. (1989). 'The theory of business strategy', *RAND Journal of Economics*, **20**, pp. 125–137.

Shortell, S. (1988). 'The evolution of hospital systems: Unfulfilled promises and self-fulfilling prophesies', *Medical Care Review*, **45**, pp. 177–214.

Shortell, S., E. Morrison, S. Hughes, B. Friedman, J. Coverdill and L. Berg (1986). 'The effects of hospital ownership on nontraditional services', *Health Affairs*, Winter, pp. 97–111.

Shortell, S., R. Gillies and K. Devers (1995). 'Reinventing the American hospital', *The Milbank Quarterly*, **73**, pp. 131–160.

Singh, J. and C. Lumsden (1990). 'Theory and research in organizational ecology', *Annual Review of Sociology*, **16**, pp. 161–195.

Starkweather, D. (1981). *Hospital Mergers in the Making.* Health Administration Press, Ann Arbor, MI.

Succi, M., S.-Y. Lee and J. Alexander (1997). 'Effects of strategic positioning and competition on rural hospital closures', *Health Services Research*, **31**, pp. 679–699.

Swaminathan, A. and G. Wiedenmayer (1991). 'Does the pattern of density dependence in organizational mortality rates vary across levels of analysis? Evidence from the German brewing industry', *Social Science Research*, **20**, pp. 45–73.

Tuma, N. and M. Hannan (1984). *Social Dynamics: Models and Methods.* Academic Press, New York.

Tushman, M. and E. Romanelli (1985). 'Organizational evolution: A metamorphosis model of convergence and reorientation'. In L. Cummings and B. Staw (eds.), *Research in Organizational Behavior*, Vol. 7. JAI Press, Greenwich, CT, pp. 171–222.

Walker, H. and B. Cohen (1985). 'Scope conditions: Imperatives for evaluating theory', *American Sociological Review*, **50**, pp. 288–301.

Williams, D., J. Hadley and J. Pettengill (1992). 'Profits, community role, and hospital closure: An urban and rural analysis', *Medical Care*, **30**, pp. 174–187.

APPENDIX 1: DESCRIPTIVE STATISTICS AND ZERO-ORDER CORRELATIONS ($N = 5927$)

Variable	Mean	S.D.	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Organizational												
(1) Age (years)	41.97	28.61										
(2) For-profit ownership	0.36	0.48	−0.30									
(3) Government ownership	0.19	0.39	0.11	−0.37								
(4) Service scope	17.13	8.76	0.37	−0.38	−0.00							
(5) Size (beds)	177.49	206.11	0.36	−0.24	0.10	0.55						
(6) System affiliation	0.56	0.50	−0.02	0.36	−0.32	−0.03	−0.03					
Environmental												
(7) Organizational density	24.80	25.98	0.02	0.30	−0.29	0.02	0.18	0.12				
(8) Market differentiation	0.58	0.24	−0.12	0.32	−0.14	−0.39	−0.12	0.15	0.20			
(9) Income ($1000s)	11.71	2.25	0.09	0.16	−0.23	0.11	0.18	0.15	0.27	0.12		
(10) Population density	1504.32	2598.95	0.29	0.00	−0.14	0.11	0.23	0.01	0.23	0.09	0.48	
(11) Senior population (%)	10.74	2.09	0.13	−0.18	0.17	0.02	−0.04	0.09	−0.32	−0.18	−0.16	0.14

Data sources: OSHPD, ARF.

Table A1. Hypothetical organizations and competition calculations

	Period 1	Period 2	ED	AD	MA
Organization A	0 1 0 0 0 (0.50)	0 1 0 1 0 (0.58)	0.66	–0.08	1.5
Organization B	0 0 0 1 0 (0.50)	0 0 0 1 1 (0.58)	0.66	–0.08	1.5
Organization C	1 0 0 0 0 (0.50)	1 0 1 0 0 (0.50)	0.66	–0.16	2.0

Zajac, E. and S. Shortell (1989). 'Changing generic strategies: Likelihood, direction, and performance implications', *Strategic Management Journal*, **10**(5), pp. 413–430.

APPENDIX 2: ASYMMETRIC JACCARD COEFFICIENT

Like its namesake, the Jaccard similarity coefficient (cf. Legendre and Legendre, 1983), our asymmetric Jaccard removes mutual absences from its calculations, since these may imply market niche similarity where none exists. Nevertheless, such absences can still influence the metric indirectly when ecological drift is analyzed. As an example, one could consider three competing organizations with a maximum portfolio size of five services (see Table A1).[13] Each organization starts with a single service; when none of these services overlap, the organizations will all have an initial mean competition metric of 0.50. Now, let us assume that each organization adds one service in the next time period. Organization **A**'s addition is performed in a manner that overlaps with Organization **B**'s existing portfolio. Organization **C** manages to exploit a market niche that is still untouched by the other two competitors. The result is an increase in competition for **A** and **B** (to 0.58), and a maintenance of the status quo for **C**. If we now compute the ecological drift coefficient (ED) for each organization, we find that all would have been subject to an even higher level of competition (0.66) if they had not changed at all. As a result, each organization appears to have engaged in successful adaptation (AD)—at a differentiation level of –0.08 for organizations **A** and **B**, and –0.16 for **C**.

Whether such 'keeping up with the Joneses' should be considered adaptive is a debatable point. A stronger criterion for adaptation might consider the changes made by **A** and **B** to be non- or maladaptive, while the change made by **C** would be considered to be slightly adaptive. Such a criterion would involve correcting for either the temporal difference in average portfolio sizes or in mutual absences. For instance, if we take the mean change in mutual absences (MA) encountered by each organization, we find that the first two have a mean change of 1.5 between the periods, while Organization **C** has a change of 2.0. If the behavior of **A** and **B** is assessed as being *non-adaptive*, the correction would simply involve a factor of +0.053 for each mutual absence. This leaves **A** and **B** with adaptation scores of 0.0 and **C** with a score of –0.053 $(-0.016 + 2 \times 0.053)$.

These considerations seem to suggest that a statistical control for mutual absences needs to be included in empirical studies which assess adaptive change. Following the results of a series of Monte Carlo simulations (available from the author), we note that such a correction effectively removes erroneous identification of adaptive trends when portfolio modifications are made at random. Consequently, the same correction for mutual absences (CMA) is made in the present study.

[13] Note that the methodology reviewed here relies on the fact that there is no strong inherent limitation on the total number of services which could be acquired by an organization in an industry. This condition may not hold for industries where diversification is limited by regulatory constraints (e.g., banking and utilities).