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ORGANIZATIONAL INERTIA AND MOMENTUM: A DYNAMIC MODEL OF STRATEGIC CHANGE

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This study provides an empirical test of Hannan and Freeman's theory of structural inertia. We examined the changes organizations undertook in response to a major environmental change. In addition, we examined the effects of the organizational changes on organizational survival. Contrary to inertia theory predictions, discontinuous environmental change was not associated with an increased probability of organizational change. Further, organizational change was unrelated to an organization's chances of survival. We evaluate inertia theory in light of these findings and suggest a revised formulation of the concept of inertia.

A large body of diverse literature and research is devoted to understanding organizational change. The concept of organizational change is very broad; consequently, researchers have looked at it from a variety of perspectives. For example, some researchers have looked at the identification of the need for change, studying the precipitating factors (Child & Kieser, 1981; Meyer, 1982) and the interpretive processes involved (e.g., Bartunek, 1984; Dutton & Duncan, 1987; Milliken, 1990).

For others, the focus of investigation has been the process of implementing organizational change, with issues including how change occurs (Kanter, 1983; Quinn, 1980), who initiates it (Robbins & Duncan, 1988; Tichy & Ulrich, 1984), and what constrains it (Aldrich & Auster, 1986; Boeker, 1989; Pettigrew, 1985; Staw, Sandelands, & Dutton, 1981; Stinchcombe, 1965).

Other theorists have grappled with understanding the nature of change and have devised dichotomous distinctions, including first-order and second-order change (Watzlawick, 1978), piecemeal and quantum change (Miller & Friesen, 1984), and continuous and discontinuous change (Hinings & Greenwood, 1988; Tushman & Romanelli, 1985).

Still other researchers have examined how organizations change in an-

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ticipation of or in response to environmental threats and opportunities (e.g., Child, 1972; Hedberg, Nystrom, & Starbuck, 1976; Pfeffer & Salancik, 1978).

Finally, population ecology has contributed to our understanding of organizational change. Many early studies assumed that change occurs primarily through the foundings and failures of organizations and secondarily through changes made by existing organizations.[1] Recently, however, the focus of population ecology has shifted: in the current view, changes made by organizations are as important as founding and failure processes to an understanding of organizational change (e.g., Singh, Tucker, & Meinhard, 1988).

The study reported here was in the spirit of Singh and colleagues (1988) and explored the importance of change in existing organizations. Its main research questions, which were originally posed in Hannan and Freeman's (1984) formulation of structural inertia theory, were: (1) Does the probability of organizational change increase in response to environmental change? (2) Does the probability of organizational change decrease over an organization's life cycle? and (3) Does the probability of organizational failure increase as a result of organizational change? We looked for answers to those questions in a setting in which we expected both structural inertia and need for change to be strong: the U.S. airline industry during the years 1962–85.

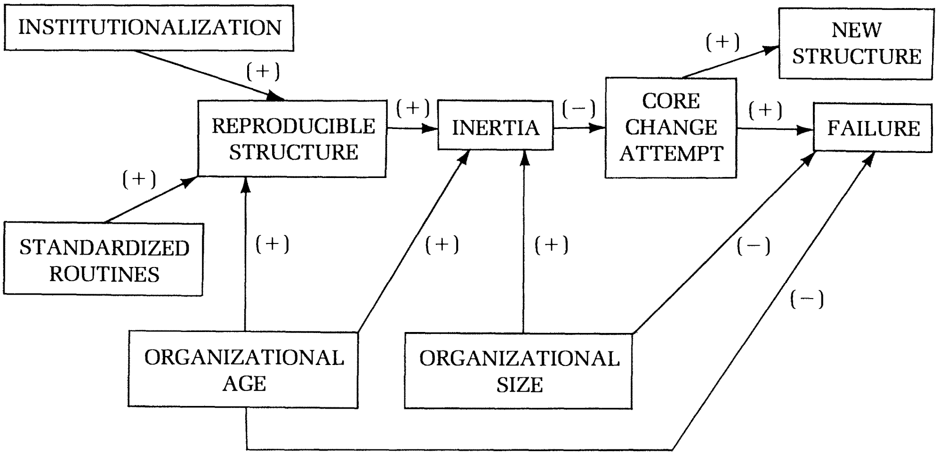
STRUCTURAL INERTIA THEORY

Figure 1 displays a basic view of structural inertia theory. Hannan and Freeman (1984: 153) argued that formal organizations have two important advantages over other collective actors: their abilities to perform reliably and to account rationally for their actions. Reliable performance means that organizational products and services are delivered at the time and quality level promised. Organizational members, investors, and clients may value organizational reliability over efficiency. Eastern Airline's shuttle service provides a historical example of this preference. Eastern guaranteed every shuttle passenger a seat, a guaranteed performance level that required keeping reserve aircraft in case additional service was needed. On June 12, 1961, Eastern provided an aircraft to carry one passenger who could not be accommodated on the regularly scheduled flight. The subsequent publicity and news coverage more than made up for the financial loss on this flight (Davies, 1972: 542).

The second cited advantage of formal organizations, accountability, means that organizations can document how resources are used and the decisions and rules behind particular outcomes. Pressures for accountability are especially strong when an organization's products and services involve significant risk (Hannan & Freeman, 1984: 153). For example, in our society we want sick people to be treated by a licensed doctor using accepted medical procedures; whether they recover completely may be less important

[1] Carroll (1987) and Hannan and Freeman (1989) provide reviews of this research.

FIGURE 1
A Basic View of Structural Inertia Theory



than a care provider's ability to demonstrate that doctors in their employ adhered to accepted forms of treatment and care (Meyer & Rowan, 1977).

Organizational reliability and accountability require organizational structures that are reproducible, or stable over time. Formalizing goals and standardizing patterns of activity stabilize organizational structure (Hannan & Freeman, 1984: 154; Nelson & Winter, 1982). At the same time that institutionalization and standardization offer the advantage of reproducibility, they generate strong pressures against change because organization members seek to maintain the status quo that protects their interests (Hannan & Freeman, 1984: 154–155). Thus, the very characteristics that give an organization stability also generate resistance to change.

Clearly, not all organizational features are alike; some are more central than others to an organization's identity. In consideration of those differences, Hannan and Freeman classified organizational structures as "core" and "peripheral":

> We classify items of structure according to their bearing on resource mobilization. From the perspective of resource mobilization, the *core* aspects of organization are (1) its stated *goals*—the bases on which legitimacy and other resources are mobilized; (2) *forms of authority* within the organization; (3) *core technology*, especially as encoded in capital investment, infrastructure, and the skills of members; and (4) *marketing strategy* in a broad sense—the kinds of clients (or customers) to which the organization orients its production and the ways in which it attracts resources from the environment (Hannan & Freeman, 1984: 156; emphases added).

Peripheral structures protect an organization's core from uncertainty by buffering it and by broadening the organization's connections to its environment. Examples of buffering and broadening techniques include horizontal and market-extension mergers, joint ventures, and interlocking directorates (Aldrich, Staber, Zimmer, & Beggs, 1989; Hannan & Freeman, 1984: 157; Scott, 1987: 182–198).

Hannan and Freeman (1984: 156) contended that constraints on change in the core features of organizations are very strong. In comparison to the probability of change in peripheral organizational features, the probability of change in core features is low (Hannan & Freeman, 1984: 157). Hannan and Freeman did not suggest that organizations never change. Instead, they defined inertia relative to environmental change: "Structures of organizations have high inertia when the speed of reorganization [core feature change] is much lower than the rate at which environmental conditions change" (1984: 151).

According to inertia theory, structural inertia varies with organizational age and size. Because old organizations have had time to formalize relationships and standardize routines (Stinchcombe, 1965), structural stability increases monotonically with age. The other side of this increasing stability is increasing resistance to change: inertia also increases monotonically with age (Hannan & Freeman, 1984: 157). Consequently, the probability of change in core features declines with age.

Size is also associated with resistance to change (Hannan & Freeman, 1984: 158). As organizations increase in size, they emphasize predictability, formalized roles, and control systems (Downs, 1967: 158). Organizational behavior becomes predictable, rigid, and inflexible (Quinn & Cameron, 1983: 34–35). Consequently, the probability of change in core features declines with size.

In addition to their arguments about the determinants of change in the core features of organizations, Hannan and Freeman also discussed the effect of structural change on the probability of failure. They argued that because organization members, investors, and clients favor organizations that exhibit reliable performance and because attempts at change disrupt organizational reliability, at least temporarily, change in core features increases the probability of failure (Hannan & Freeman, 1984: 159–160). In other words, changing core features is hazardous: "Although organizations sometimes manage to change positions on these dimensions [core features], such changes are both rare and costly and seem to subject an organization to greatly increased risks of death" (Hannan & Freeman, 1984: 156).

Hannan and Freeman did not specify how to model the effects of change on failure, but we consider those effects to be cumulative. The negative effects of disruption from change accumulate as organizational reliability is reduced further with each disruption. This view is consistent with Hannan and Freeman's statement that "organizations that frequently try to reorganize may produce very little and have slight chances of survival" (1984: 155). We tested this argument by examining the effects of cumulative change on the probability of failure.

Organizational complexity, or "the patterns of links among subunits" (Hannan & Freeman, 1984: 162), are also important. Because organizational complexity increases the duration of a change attempt, and the probability of failure should increase with that duration, complexity is predicted to increase the probability of failure (Hannan & Freeman, 1984: 160–162).

According to inertia theory, the occurrence of a peripheral feature change such as a merger is not associated with an increase in the probability of failure (Hannan & Freeman, 1984: 157). Attempts to change peripheral features do not raise questions about organizational identity and do not disrupt organizational operations. Therefore, peripheral feature change may decrease the probability of failure or, in the worst case, cause a small but insignificant increase in its probability.

To date, there has been little empirical work on the probability of change in core features; even less attention has been given to the effects of changes in core features on the probability of failure. An understanding of both is required to provide an adequate test of inertia theory. This study offers the first empirical test of both issues.

PRIOR RESEARCH ON THE DETERMINANTS OF CHANGE IN CORE FEATURES

Environmental Change and the Probability of Change in Core Features

By definition, when inertia is present the speed of change in the core features of an organization is lower than the rate of environmental change (Hannan & Freeman, 1984: 151). But because substantial work is involved in measuring rates of environmental change, we chose to study a single discontinuous environmental change.

Singh, Tucker, and Meinhard's (1988) study was based on a similar decision. Those authors estimated the probability of change in the core features of 389 voluntary organizations in Toronto. For an observation period covering the years 1970–82, they operationally defined environmental change with two variables that corresponded to two legislative periods. They found that the occurrence of both legislative periods was associated with an increase in the probability of core feature change. Baum (1990) also studied core feature change. His study of 756 day care centers in Toronto covered the period 1971–89. Environmental change, as measured by increases in the cost of capital to small businesses, was associated with a decrease in the probability of core feature change.

Those two studies modeled environmental change in two different ways: Baum's measure allowed environmental change to be detected annually, but Singh and colleagues' measures did not, instead denoting periods of change of several years' duration. Perhaps this difference is one reason for the studies' conflicting conclusions about the relationship between environmental change and the probability of core feature change. We used the time-period approach to capture environmental change.

Organizational Age and the Probability of Change in Core Features

Both in Singh and colleagues' (1988) population of voluntary organizations and in Baum's (1990) population of day care centers, the probability of core feature change increased with organizational age. It should be noted that both voluntary social service organizations and day care centers are relatively young organizational forms. Although definition of an organization's oldness depends on the age of the organizational form it belongs to, it is important to test the relationship between age and the probability of change in both old and young organizational populations. Thus, we complemented the two studies cited by examining a relatively old organizational form.

Organizational Size and the Probability of Change in Core Features

Both Singh and colleagues (1988) and Baum (1990) controlled for organizational size in their studies of core feature change. In the first study, a positive relationship emerged between organizational size, measured as the size of a board of directors at founding, and the probability of core feature change. In the second, a positive relationship emerged between size, measured as the licensed capacity of a day care center, and the probability of one kind of core feature change, but there was a negative relationship between size and the probability of another core feature change. Although Baum's measure of organizational size has the advantage of changing as organizations contract and expand, both Baum's and Singh's measures suffer from range restriction. We considered it important to test the relationship between size and the probability of change in a population of organizations with the potential to become quite large and did so in our study.

Prior Change in Core Features and the Probability of Change in Core Features

There is a gap between inertia theory and other theoretical arguments about organizational change in regard to the idea of momentum in change processes (e.g., Miller & Friesen, 1984). When organizations repeat changes that they have experienced in the past, their change processes are said to have momentum. Organizations "reinforce or extend their past structures and strategy-making practices, adhering to previous directions of evolution" (Miller & Friesen, 1984: 28).

A way to test for momentum is to include in an analysis an organization's history of changes by type, counting the cumulative number of each type of change experienced by each organization. If change processes exhibit momentum, the cumulative number of prior changes of a given type should have a positive effect on the probability of a change of the same type.

Amburgey and Miner's (1989) findings from a study of merger activity among *Fortune* 500 firms support this argument. They found that prior mergers were associated with an increase in the probability of mergers of the same type. We suggest that although Hannan and Freeman did not include prior changes in their theoretical model, a complete understanding of change requires a variable designed to capture an organization's history of changes. These historical variables have the added benefit of capturing, albeit crudely, some information on organizational learning, management values related to change, and implementation capabilities. Therefore, our analysis includes the cumulative number of changes experienced by each airline.

PRIOR RESEARCH ON THE EFFECTS OF CORE AND PERIPHERAL CHANGE ON THE PROBABILITY OF FAILURE

Change in Core Features and the Probability of Failure

Hannan and Freeman (1984) predicted that core feature change will increase the probability of organizational failure. Singh, House, and Tucker (1986) were the first to test that relationship. Two of their core feature changes, change in service area and in sponsorship, were associated with increased probability of failure. However, two other core changes, change in goals and in structure, were not so associated. A second study of the relationship, Haveman (1990), generated a similar pattern. Three core feature changes made by savings and loan associations in California had positive effects on the probability of failure, but five core changes were unrelated to it.

Our study is based on the assumption that the hazardous effects of core feature change increase with repeated exposure to such change. Therefore, we investigated the cumulative effects of change on failure.

Change in Peripheral Features and the Probability of Failure

Hannan and Freeman's (1984) exposition of structural inertia includes the assumption that peripheral feature change occurs with less difficulty and less disruption than core feature change. Peripheral feature change should not be associated with an increase in the probability of failure but if it is, its deleterious effect should be significantly less than that of core feature change. Singh, Tucker, and House (1986) included a test of the effect of peripheral feature change, finding that one such change—a change in chief executive—was associated with a decrease in the probability of failure among voluntary organizations. In our study, we examined one peripheral feature change, merger. Following Aldrich and colleagues (1989), we argue that horizontal and market-extension mergers affect an organization's periphery by broadening organizational boundaries without affecting the fundamental nature of the organization. Other types of mergers, such as vertical integration, product extension, and conglomerate mergers, affect organizational cores, and we used those mergers as core feature changes in this study.

HYPOTHESES

To examine our first two questions—whether the probability of organizational change increases in response to environmental change and whether the probability of organizational change decreases over an organization's life cycle—we estimated the probability of change in one of Hannan and Freeman's (1984: 156) core features: product-market strategy. Following Tushman and Romanelli (1985: 183), we argued that fundamental changes in product-market strategic orientation occur when organizations change from specialism to generalism, or broaden their niches, and when they change from generalism to specialism, or narrow their niches.

Changes in strategic orientation were examined at two levels of operation: business and corporate. Therefore, our analysis includes four dependent variables: (1) a change from specialism to generalism at a business level, (2) a change from generalism to specialism at a business level, (3) a change from specialism to generalism at a corporate level, and (4) a change from generalism to specialism at a corporate level. We predicted the effects of the independent variables on those probabilities of change as follows:

> *Hypothesis 1: The probability of change in strategic orientation increases with the occurrence of environmental change.*
>
> *Hypothesis 2: The probability of change in strategic orientation decreases with organizational age.*
>
> *Hypothesis 3: The probability of change in strategic orientation decreases with organizational size.*
>
> *Hypothesis 4: The probability of change in strategic orientation increases with prior experience with such change.*

We also examined the effects of organizational change on the probability of failure, defining failure as an organization's ceasing operations and disbanding or as its acquisition and merger into the operations of a new parent organization.[2]

> *Hypothesis 5: The probability of failure increases with cumulative changes in strategic orientation.*

The test of Hypothesis 1 addresses our first research question: Does the probability of organizational change increase in response to environmental change? Hypotheses 2, 3, and 4 correspond to our second research question: Does the probability of organizational change decrease over an organization's life cycle? The test of Hypothesis 5 addresses the third research question: Does the probability of organizational failure increase as a result of organizational change?

[2] To test the possibility that organizations that disappear because they are acquired differ from organizations that disappear because they cease operations, we conducted two analyses: one that included all airlines regardless of how they failed, and one that excluded acquired airlines. That exclusion did not affect the results, so we kept acquired airlines in the analysis.

RESEARCH DESIGN

Data Collection

We used the U.S. certificated air carrier industry as our research population for two reasons. First, air carriers are appropriate for a test of structural inertia theory because they face strong pressures to perform reliably and account rationally for their actions. According to inertia theory, reliability and accountability are associated with resistance to change.

Second, the industry is appropriate because of the changes that have occurred in its environment. From 1938 to 1978, the Civil Aeronautics Board (CAB) controlled industry entries, exits, and pricing. Deregulation, on October 24, 1978, removed those regulatory controls and was a discontinuous environmental change that affected the industry's competitive environment (Lang & Lockhart, 1990: 106).

A variety of archival sources were used to provide data for measures of the theoretical constructs. The Civil Aeronautics Act of 1938 required certificated air carriers to file detailed operating and financial reports, which the U.S. Department of Transportation makes available to researchers. Other studies have relied on these data as a primary source of information (e.g., Byrnes, 1985; Caves, 1962; Davies, 1972; Fruhan, 1972; Meyer, Oster, Morgan, Berman, & Strassmann, 1981; Taneja, 1976, 1979). In addition to the Department of Transportation data, we used corporate annual and "10-K" reports, *Moody's Transportation Manual*, *Aviation Daily*, and *Air Transport World* as sources and cross-references for sources. These data provide time-series observations compatible with our event-history technique (Tuma & Hannan, 1984).

By 1985, the end of our observation period, 178 air carriers had been certificated and had filed reports with the CAB, which grouped them into seven distinct groups: (1) domestic trunk lines, (2) local service, or regional, airlines, (3) intra-Alaskan airlines, (4) intra-Hawaiian airlines, (5) all-cargo airlines, (6) helicopters, and (7) supplementals, airlines authorized to provide nonscheduled passenger and charter services. Except for 42 air carriers that lacked sufficient time-series data on organizational size, we included all air carriers in the study ($N = 136$).

Event histories were compiled for each airline. Event histories are data structures that include information on the number, timing, and sequence of events of interest—changes in strategic orientation and failure. The event histories begin on June 30, 1962, or at the time of founding for airlines founded after that date. Although our analysis begins with 1962, the oldest airline in our records dates back to 1926. To minimize the effects of left-censoring (Tuma & Hannan, 1984) as much as possible, we used actual founding dates. However, data on airlines founded before 1926 and on organizational events before 1962 were still missing, presenting us with sample selection bias (Heckman, 1979). Therefore, caution should be used when interpreting the results of our analyses.[3]

Each history continued until the date the airline failed. When an organization is alive at the end of an observation period, the case is right-censored; in those cases, we recorded the date June 30, 1985. We assumed that the censored cases occur randomly, where the time of occurrence is drawn from a uniform distribution (Kaplan & Meier, 1958; Tuma & Hannan, 1978).

Dependent Variables

Marginal intensity functions (Bremaud, 1981) were the dependent variables used in the analysis of the probability of core feature change. The intensity function, $r(t)$, represents the limit of the probability of an event's occurring at time t, given some observation of the past. The equation that expresses the probability at time t of core feature change is $r(t) = \exp(\underline{BX})$, where $\underline{X}$ equals a vector of independent variables at time t and $\underline{B}$ equals a vector of estimated parameters that represent the effects of the independent variables on the probability of change.

The hazard function $h(t)$ was the dependent variable in the analysis of the probability of failure. The hazard function represents the instantaneous probability of an event's occurring at time t, given that the event has not occurred before t. It is defined as the limit of the probability of failure during a time interval as the interval approaches zero (Tuma & Hannan, 1984: 58) and is expressed as

$$h(t) = \lim_{\Delta t \to 0} \frac{Pr(failure\ at\ t,\ t + \Delta t \mid alive\ at\ t)}{\Delta t}$$

Independent Variables

Industry deregulation. We measured deregulation with a dummy variable that takes a value of 1 for the period October 24, 1978, through June 30, 1985, and a value of 0 otherwise. This measure was an independent variable in the change analysis and a control variable in the failure analysis.

Organizational age. To calculate the age of an airline, we subtracted the time of founding from the time of any change in strategic orientation or failure. Airline foundings were recorded as the date of certification by the CAB for airlines founded during the regulated period and as the first date of flying operations for airlines founded before regulation or after deregulation. We used age as an independent variable in the change analysis and as a control variable in the failure analysis.

Organizational size. Airlines with subsidiaries were required by the

[3] We were not able to correct for sample selectivity because we lacked information on the entire population. Population data are required to employ Heckman's (1979) technique.

CAB to report only total airline assets instead of total organizational assets. Therefore, we were unable to obtain total organizational assets for airlines with subsidiaries. We used the available data on total airline assets, and we used the natural logarithm of airline assets at the time of any change in strategic orientation or of failure as an indicator of the size of an airline. Total assets are reported in quarterly financial reports, and we used the figure for the preceding quarter nearest to the time of an event as the measure of organizational size. Organizational size was an independent variable in the change analysis and a control variable in the failure analysis.

Cumulative changes in strategic orientation. To measure business-level changes, we used data on product mix. An airline's product mix, defined in terms of what it carries, can consist of any combination of passengers, mail, express (parcels), and cargo (heavy freight). We recorded a change from specialism to generalism at the business level when a single-product airline became a multiproduct one and recorded a change from generalism to specialism at the business level when a multiproduct airline became a single-product one.

To test the momentum idea in the change analysis and the cumulative effects of change in the failure analysis, we constructed two cumulative change variables. These variables capture the cumulative number of changes in strategic orientation at the business level that each airline had experienced up to the time of a change or failure. Because airlines report product mix data monthly to the CAB, business-level core feature changes can occur only at the end of a month. Thus, every airline had two cumulative business-level variables that were updated monthly.

To measure corporate-level change, we used airline acquisition data. Airlines are free to engage in related diversification, unrelated diversification, and divestiture. We recorded a change from specialism to generalism at the corporate level when airlines (1) changed from no diversification to related diversification, (2) changed from no diversification to unrelated diversification, or (3) changed from either related or unrelated diversification to a pattern of both related and unrelated diversification. We recorded a change from generalism to specialism when an airline's pattern of divestiture resulted in its (1) divesting all related subsidiaries, (2) divesting all unrelated subsidiaries, or (3) divesting all subsidiaries.

Following the same logic used for the business-level change variables, we constructed two corporate cumulative change variables. These variables capture the cumulative number of changes in strategic orientation at the corporate level that each airline experienced up to the time of a change or failure. Because we acquired data on the exact timing of acquisitions and divestitures, our corporate-level core feature changes could occur on any day of the observation period. Thus, each airline had two cumulative corporate-level variables that were updated daily. Cumulative changes were used as independent variables in both the change and failure analyses.

Cumulative changes in peripheral features. One type of peripheral change was a control variable in the failure analysis. We recorded the occurrence and timing of horizontal and market-extension mergers and used the cumulative number of such mergers at the time of failure.

Organizational specialism. Prior research has shown that the width of an organizational niche accounts for differential survival (e.g., Carroll, 1985; Hannan & Freeman, 1989: 104), where niche width refers to the variety of resources an organization utilizes. An airline's resource utilization can be examined by looking at the distribution of products in the product mix. Airlines can carry any combination of passengers, mail, freight, and cargo. To capture resource utilization, we calculated the percentage of the total that the largest product line contributed to the total product mix and used this as a control variable in the failure analysis. The smaller this percentage, the more even the distribution of products in the product mix and the more generalized the airline. A specialist airline has one product line at the time of failure; a generalist airline has more than one product line at the time of failure. We used the data for the preceding month nearest to the time of failure.

Modeling Approach

A multivariate point-process model was used to estimate the probabilities of the four changes in strategic orientation and the probability of failure. A multivariate point-process model is a particular type of stochastic model developed for "situations where discrete 'point' events occur in a one-dimensional continuum, usually time" (Amburgey, 1986: 191). When there are multiple, repeatable events like organizational changes, a multivariate point-process model defines the events in a common state space. When the multiple events are defined as such and each type of event is considered separately, each member of the family of processes is called a "marginal process" (Amburgey, 1986). In this study, the marginal processes are defined by the four changes in strategic orientation and organizational failure.

If change and failure are random events, each marginal process consists of a constant-rate Poisson process (Kalbfleisch & Prentice, 1980) that serves as the null hypothesis. The alternative hypothesis for each marginal process is that change and failure are not random events but instead are log-linear functions of our independent variables.

A maximum-likelihood method was used to estimate the effects of the independent variables on the probabilities of change and failure. We performed parameter estimation with the statistical program RATE (Tuma, 1980) and used F-tests to assess the significance of the coefficients of the individual variables and likelihood-ratio tests to assess the significance of the hierarchically nested models. The likelihood ratio, H, is the ratio of the model under the null hypothesis to the model under the alternative hypothesis. The term $-2 \log H$ is chi-square distributed with k degrees of freedom, where k is the number of additional parameters in the alternative hypothesis (Tuma & Hannan, 1984: 122).

RESULTS

We documented 178 airline foundings and 86 airline failures in the entire certificated air carrier industry between April 1926 and July 1985. Figure 2 charts annual foundings and failures for the observation period. As would seem likely, passage of the Airline Deregulation Act of 1978 had a significant effect on the industry: both foundings and failures increased dramatically; but, as will emerge below, and contrary to popular opinion, the failure *rate* did not increase.

Table 1 provides descriptive statistics on organizational characteristics and changes for the ending conditions of each organization. The average age in the population is 15 years, and the logarithm of the average size is $1.47 million in total assets (the mean value of total assets was $50,402,345, with a standard deviation of $97,823,165). All the organizational changes occurred an average of less than once per airline. Many airlines did not experience any changes over the observation period, but some airlines experienced several changes. The average index of organizational specialism is approximately 91, indicating that the average airline derived 91 percent of its revenue from the largest product in its product mix.

Table 2 reports the determinants of changes in strategic orientation. Standardized coefficients are reported.

The first column under each variable contains the test of Hannan and

FIGURE 2
Annual Foundings and Failures, U.S. Certificated Air Carrier Industry 1962–85

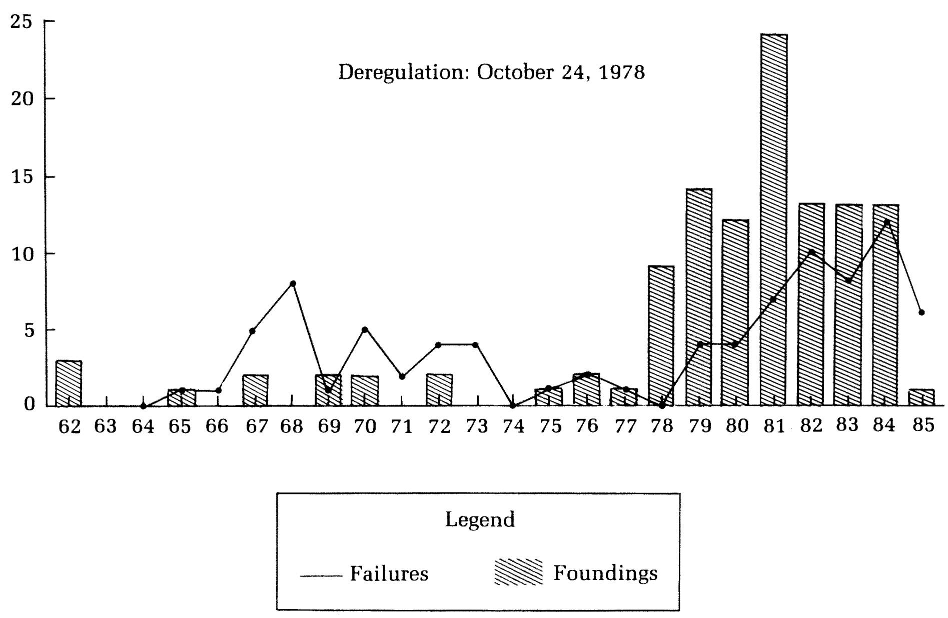


TABLE 1
Means, Standard Deviations, and Correlations[a]

Independent Variables	Means	s.d.	1	2	3	4	5	6	7	8
1. Industry deregulation	0.84	0.36								
2. Organizational age	15.03	16.91	−.14							
3. Organizational size[b]	14.72	2.37	.20*	.61*						
4. Cumulative business-level specialism	0.15	0.48	−.04	.06	−.03					
5. Cumulative business-level generalism	0.18	0.47	.04	.01	−.00	.79*				
6. Cumulative corporate-level specialism	0.07	0.31	.04	.41*	.25*	.17*	.11			
7. Cumulative corporate-level generalism	0.25	0.62	.04	.63*	.51*	.10	.02	.63*		
8. Cumulative peripheral feature changes[c]	0.19	0.49	.16*	.23*	.28*	−.09	−.12	.24*	.33*	
9. Organizational specialism	90.62	14.49	.21*	−.37*	−.08	.07	.02	−.14	−.18*	−.04

[a] $N = 136$.
[b] This measure was a natural logarithm.
[c] Horizontal and market-extension mergers were measured.
* $p < .05$

TABLE 2
Effects of Organizational Characteristics, Organizational Changes, and Deregulation on Change in Strategic Orientation[a]

	Business-Level Specialism		Business-Level Generalism		Corporate-Level Specialism		Corporate-Level Generalism	
Variables	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Industry deregulation	−1.6460*	−.2050	−.5479	−.7421	−2.5820*	−3.1470*	−2.6320*	−2.1040*
	(.5526)	(.5796)	(.4997)	(.6737)	(.8499)	(.9126)	(.4666)	(.4645)
Organizational age	−.0002*	−.0003*	−.0002*	−.0000	.0002	.0000	−.0000	−.0001*
	(.0000)	(.0000)	(.0000)	(.0000)	(.0001)	(.0001)	(.0000)	(.0000)
Organizational size	−.0013	.1518	−.0588	−.4135*	−.0731	.3399	.2897*	.0273
	(.1276)	(.1656)	(.1100)	(.1365)	(.2019)	(.2234)	(.1161)	(.1447)
Cumulative business-level specialism		2.8910*		−1.8970*		−1.2990		−.6631
		(.5614)		(.4129)		(1.1500)		(1.0520)
Cumulative business-level generalism		−2.0540*		4.5890*		2.6070		−12.0800
		(.7153)		(.6149)		(1.3540)		(431.4000)
Cumulative corporate-level specialism		−2.0870		−14.7900		2.7460*		−1.2780*
		(1.1920)		(528.9000)		(.7415)		(.5398)
Cumulative corporate-level generalism		1.5270*		1.5990*		−.4897		2.1380*
		(.6162)		(.6468)		(.9202)		(.3793)
Constant	−7.5580*	−11.7700*	−7.2810*	−5.7140*	−10.6600*	−16.2800*	−12.3400*	−9.3060*
	(1.5650)	(2.2550)	(1.3860)	(1.5380)	(2.4180)	(2.7040)	(1.5260)	(1.8100)
Number of events	20	20	25	25	10	10	34	34
Chi-square	23.99*	70.61*	23.23*	123.16*	17.05*	51.16*	44.93*	91.65*
Degrees of freedom	3	7	3	7	3	7	3	7

[a] Figures in parentheses are standard errors.
* $p < .05$

Freeman's inertia model (model 1). The second column contains the test of the model that includes cumulative core feature changes to capture the idea of momentum in organizational change processes (model 2). Examination of the chi-square values supports rejection of all the null hypotheses. Models that include our independent variables provide significant improvements in explanatory power over the baseline models that include only the constant.

Hypothesis 1 predicts that the probability of change in strategic orientation will increase with the occurrence of environmental change. Instead, we found that industry deregulation was associated with a significant decrease in the probabilities of change for three of the four changes hypothesized in model 1. Airlines were less likely to change strategic orientation after the occurrence of deregulation. When we added the cumulative changes in model 2, the probabilities of change at the corporate level were the only ones significantly negatively affected by industry deregulation. This result is not consistent with the logic of inertia theory, according to which the probability of change in strategic orientation should increase with environmental change.

Hypothesis 2 predicts that the probability of change in strategic orientation will decrease with organizational age. In model 1, age has a negative effect on the probability of change at the business level. When we added cumulative changes in model 2, we found that old airlines are less likely than young ones to engage in a change that involves specializing at the business level and less likely to engage in a change that involves generalizing at the corporate level. This result offers support for the inertia theory prediction that the probability of change declines with organizational age.

Hypothesis 3 predicts that the probability of a change in strategic orientation will decrease with organizational size. In model 1, airline size is related positively to one probability of change, toward corporate-level generalism. However, when we added cumulative changes to model 2, organizational size is associated negatively with the probability of a change that involves business-level generalism. This result provides weak support for the inertia theory prediction that the probability of change declines with organizational size.

Hypothesis 4 predicts that the probability of a change in strategic orientation will increase with prior experience with a strategic change of the same type. Strong support for the idea of momentum in organizational change processes emerged. The probabilities of all four strategic changes occurring are positively associated with the occurrence of prior changes of the same type and, in general, negatively associated with prior changes of other types. This pattern suggests that a change does not "unfreeze" an organization but only unfreezes changes of the same type. One exception to this pattern is the effect of a change to corporate-level generalism, which makes other types of changes in strategic orientation more likely to occur, too.

Table 3 reports the determinants of the probability of organizational

TABLE 3
Effects of Organizational Characteristics, Organizational Changes, and Deregulation on Failure

	Failures	
Variables	**β**	**Standard Errors**
Cumulative business-level specialism	−.1659	.3122
Cumulative business-level generalism	.2617	.3626
Cumulative corporate-level specialism	.7172	.5577
Cumulative corporate-level generalism	−.5032	.4253
Cumulative peripheral feature changes[a]	−.3826	.3587
Industry deregulation	−.2670	.3399
Organizational age	−.0000	.0000
Organizational size	−.1731*	.0774
Organizational specialism	−.0021	.0083
Constant	−5.2900*	1.0550
Number of events	62	
Chi-square	42.65*	
Degrees of freedom	9	

[a] Horizontal and market-extension mergers were measured.
* $p < .05$

failure. Standardized coefficients are reported. Examination of the chi-square values supports rejection of all the null hypotheses. Models that include our independent variables provide significant improvements in explanatory power over the baseline model that includes only the constant.

Hypothesis 5 predicts that the probability of failure will increase with the cumulative occurrence of change in strategic orientation. None of the changes have significant effects on the probability of failure. This finding does not support the inertia theory prediction.

In addition to the independent variables, we included a number of control variables in the failure analysis. The first variable controls for the effects of cumulative peripheral feature changes on failure. According to inertia theory, this variable should not be associated with the probability of failure, and it is not in our model. The second control variable, industry deregulation, has no direct effect on the probability of failure. Figure 2 suggests, however, that deregulation may play an important role in foundings in this industry. Our third control variable, organizational age, also had no direct effect: there is no evidence that young airlines are more likely to fail than old airlines. This result must be interpreted with caution, however, because of missing information on foundings during the period 1914–25. Using our fourth control variable, organizational size, we found that large airlines are significantly less likely to fail than small ones. In an industry that has always been dominated by a "big four," the advantages of size are supported. Using the fifth control variable, organizational specialism, we found that specialists and generalists did not have differential survival chances in this population. Specialized airlines are just as likely to survive as generalized airlines. This result may reflect the CAB's protecting the industry incumbents by only allowing specialists into it after 1938.

DISCUSSION

No support emerged for the prediction that environmental change leads to an increase in the probability of change in strategic orientation. Instead, environmental change was associated with a significant decrease in the probability of corporate-level change. This finding is inconsistent with the findings Singh and colleagues (1988) reported but is consistent with the conclusion Baum (1990) reached. This finding may be explained by examining the new opportunities deregulation presented to the airlines. The growth possibilities in the industry caused a reduction in corporate diversification so that airlines could redeploy assets and resources to the business level of operations. The fact that we did not see increases in the probability of business-level change supports this argument if the strategic changes that occurred were unrelated to airline product-mix decisions such as changes in route structures, two-tier labor arrangements, and marketing agreements between carriers.

As for our second research question, we found support for the prediction that old organizations are less likely than young ones to experience change in their core features. With the exception of corporate-level specialism, all the relevant coefficients were negative, and the negative effect was significant for the probabilities of business-level specialism and corporate-level generalism. This finding is inconsistent with the findings of both Singh and colleagues (1988) and Baum (1990); therefore, it highlights the importance of testing the relationship between inertia and age in populations of varying ages.

There was no support for the inertia theory prediction that organizational size is associated with a decrease in the probability of change, unless we include prior experience with change in the model. Even then, we found support for only one of the four changes in strategic orientation: a large airline is less likely to change to business-level generalism than a small airline. Hannan and Freeman (1984: 158–162) discussed how complicated the relationship between organizational size and core feature change may be. Large organizations face not only low flexibility because of bureaucratization and formalization but also long durations of attempts to bring about change. Without data on organizational complexity and the duration of change attempts, it was impossible to assess that part of their argument. At best, we found a weak relationship between organizational size and the probability of change in this population. This finding should be interpreted with caution, however, because our measure of size is total airline assets rather than total organizational assets. Also, we lacked size data on 42 of the 178 airlines, and the size variable was left-censored.

We definitely saw momentum in organizational change processes. These organizations were significantly more likely to repeat changes that they had experienced in the past. We suggest that the concept of momentum is complementary to inertia theory and that a useful way to think about inertia is that it is high when organizations continue to extrapolate past trends in the face of environmental change. But before we can conclude that our findings are indicators of organizational "tracks" (Hinings & Greenwood, 1988) or archetypes (Miller & Friesen, 1984), we will need additional data on such internal organizational characteristics as culture, power, decision making, communication, leadership, and the like. This is an important issue that warrants further investigation.

This study expanded Hannan and Freeman's theory by demonstrating the utility of including cumulative prior organizational changes to capture momentum in organizational change processes. In our view, studies of organizational change require historical perspective. What can appear in isolation to be a discontinuous change in strategic orientation can actually be a manifestation of momentum.

As for our third research question, we did not find support for the prediction that changes in core features affect the probability of organizational failure. None of the core feature changes studied disrupted organizational operations to the extent that the changes jeopardized organizational survival. One reason for this result may be that we looked at the cumulative effect of change; as organizations gain experience with change, they may develop routines to handle it so that change itself becomes routinized. In future work, we want to examine the sequences of changes organizations make, taking into account organizational performance and slack resources.

The limitations of our study should be acknowledged, and addressed in future research. First, although we tracked four important changes in organizational strategy, we did not capture all the strategic changes that occurred in the focal population. Our conclusions about change and failure, therefore, should be viewed in light of this consideration. Examples of other changes that occurred in the airline industry after deregulation include the introduction of complicated fare structures, two-tier labor agreements, and "frequent flyer" programs as well as changes from linear routes to hub-and-spoke route systems. In addition, Hannan and Freeman (1984) discussed three other kinds of core features in addition to strategy—goals, forms of authority, and technology—and empirical work on change in those core features is needed.

Second, we examined the effect of a single discontinuous environmental change. An examination of relative inertia requires more fine-grained environmental data, such as annual data on changes in jet fuel prices and direct labor costs.

Despite these limitations, this study makes several contributions to knowledge of organizations. Our analyses suggest that structural inertia theory requires substantial modification. The airline industry's regulated environment changed dramatically, but most of the airlines did not respond with major adaptations. However, those airlines that did make major changes developed a momentum that continued over time. Inertia theory needs to broaden its conception of inertia by incorporating continuity with prior changes. Furthermore, our results cast additional doubt on the proposition that major organizational changes increase the probability of failure.

Our research also suggests that although managers have more discretion regarding change in their organizations than ecological theorists have typically proposed, managers remain constrained by organizational history. Old airlines are more resistant to change than young ones. More important, prior organizational actions have a powerful effect on both the probability and content of strategic change. At the level of both business units and an entire corporation, history constrains the choices available to managers. This constraint has an important implication for managers who desire organizational change: a true shift in orientation requires historical perspective, and a series of incremental changes may be more feasible and effective than a single major shift in a particular strategic direction.

Research in organizational ecology has focused primarily on foundings and failures and neglected organizational change. We hope that this study helps to put organizational change on an equal footing with population dynamics in ecological research. Such equality will strengthen ecological theory and other theories of organizational change as well.

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