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Abstract

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Comments

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Inertia and Change in the Early Years: Employment Relations in Young, High Technology Firms

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This paper considers processes of organizational imprinting in a sample of 100 young, high technology companies. It examines the effects of a pair of initial conditions: the founders' models of the employment relation and their business strategies. Our analyses indicate that these two features were well aligned when the firms were founded. However, the alignment has deteriorated over time, due to changes in the distribution of employment models. In particular, the 'star' model and 'commitment' model are less stable than the 'engineering' model and the 'factory' model. Despite their instability, these two blueprints for the employment relation have strong effects in shaping the early evolution of these firms. In particular, firms that embark with these models have significantly higher rates of replacing the founder chief executive with a non-founder as well as higher rates of completing an initial public stock offering. Some implications of these findings for future studies of imprinting and inertia in organizations are discussed.

1. *Imprinting, Inertia and Organizational Change*

How much do origins matter for organizations? This question has pivotal importance for understanding organizational change. Despite its theoretical importance, little effort has been directed at gaining evidence that speaks directly to it. This paper takes a first step in an effort to rectify this gap in our knowledge. It reports some early results from an effort to examine processes of imprinting in a sample of young, high technology companies.

Current theory and research on organizations and industries reflect two polar views on the importance of origins. One perspective holds that organizational structures reflect mainly *current* internal and external exigencies:

core technology (Thompson, 1967), the structure of transaction costs (Williamson, 1975, 1981), and cultural rules about organizing (Meyer and Rowan, 1977). This view builds on the (usually tacit) assumption that structural change by organizations is unproblematic and relatively free of friction. Lack of friction causes origins (and the past, more generally) to become irrelevant as time passes and internal and external challenges change. Consequently, looking to origins should not help explain structure, once the present set of constraints has been taken into account.

The other pole in the debate holds that origins matter a great deal: origin conditions become *imprinted* on organizations, and these imprints have enduring importance (Stinchcombe, 1965; Hannan and Freeman, 1977). Although organizations might subsequently change as the challenges and opportunities change, initial conditions limit the scope of subsequent changes. This view builds on the assumption of strong hysterisis or path dependence in organizational change.

Although the possible enduring effects of origins have important substantive implications, they have been the subject of surprisingly little empirical investigation. Researchers have sought to infer answers to questions about hysterisis in organizational structure by examining organizational mortality schedules under a variety of potentially relevant conditions. For instance, Carroll and Hannan (1989) report that environmental conditions at founding have lasting effects on organizations. Specifically, the density of organizations in a population at the time of an organization's founding, which is assumed to capture the intensity of competition, affects its lifetime mortality schedule.[1] Most recent research on the inertia hypothesis has concentrated on testing Hannan and Freeman's (1984) hypothesis that change in core structures increases the hazard of mortality by reducing the advantages of accrued experience.[2] However, few researchers have had access to detailed information on the early activities of a set of organizations and on subsequent developments. Hence, we lack a clear image of the processes involved.

Historical treatments of industries and organizations document extensive change over centuries and often over much briefer spans of time. Many of today's well-recognized industries and organizational populations did not exist a century ago; indeed, many did not exist even a quarter of a century ago. Even those industries and organizational populations whose origins date to earlier centuries have undergone extensive renovations, with many organ-

[1] This result has turned out to be extremely robust (Hannan and Carroll, 1992), suggesting that competitive conditions at the time of an organization's inception do have long lasting effects for diverse organizational populations.

[2] Well-designed research on this issue reveals that the effects of structural change vary with organizational age. The older an organization, the greater the resulting increase in the mortality rate (Amburgey *et al.*, 1993; Barnett and Carroll, 1995; Carroll and Teo, 1996).

izational actors coming and going and industry and population structures being altered greatly. The leading organizations and organizational forms in one era seldom manage to retain their lofty positions—or even to survive—when technological, social and economic structures change sharply. In each era, upstart organizations and organizational forms rise to prominence. In the very long run (i.e. a time-scale of centuries), it seems hard to dispute that industries and other organizational worlds change by a process of *selection* in the sense of differential replacement.

What about shorter time-scales—say, decades? Here the picture becomes unclear. Much organization theory in sociology and economics has held that organizational change over such periods reflects mainly *adaptive change* by existing organizations. In this view, organizations remake themselves when the times demand it. Nelson and Winter (1982) draw the resemblance between this view and the Lamarckian position in evolutionary biology.

Beginning in the late 1970s, organizational ecologists proposed a selectionist account of organizational change (Hannan and Freeman, 1977, 1989). In this perspective, individual organizations are seen as incorporating features of the prevailing social and economic environment at their time of founding. Initial structures (especially those that are most central—see below) are thought to be subject to strong inertial forces. Therefore, individual organizations have limited capacities to reshape themselves quickly when environmental changes pose challenges to their continued growth and survival. Limits on the speed of adaptation at the organizational level create the conditions for rival to emerge and flourish. Inertia at the organizational level allows evolution at the population level.[3]

Doubtless, both adaptive change at the organizational level and selection at the organizational population level characterize many situations of interest. There is much current interest in building models that combine these processes. However, such an integration might be premature because we lack a clear understanding of some key features of the underlying processes. There continues to be value in clarifying adaptation and selection stories. Doing so focuses attention on several issues.

First, there is the issue of change versus adaptation. Discussions of these issues often focus merely on the *frequency* of change. If observations on a set of organizations reveal that structures and procedures have been altered, then it is argued that the ecological perspective does not apply. But this

[3] March (1991) develops an alternative scenario in which organizational learning (a central component of any purposeful adaptation story) can produce the same result. When a set of organizations specialize their learning along certain paths (an 'exploitation' strategy), they become more and more narrowly specialized and less capable of learning about other regions of the strategy space. Such specialized adaptation opens the possibility that sets of organizations using a more generalized search strategy ('exploration') can gain a foothold and thrive.

kind of reasoning misses the central point about adaptation. The fact that organizations sometimes change their structures does not, by itself, vitiate a selection argument. Successful adaptation requires that organizations be able to (i) choose the 'right' structural change; and (ii) time its implementation correctly in response to the vagaries of their shifting environments. Hannan and Freeman (1984) argued that the worst case is to incur the costs of reorganization only to find, once the new structure has been put in place, that the environment has changed to a configuration that demands further reorganization.

Any useful treatment of organizational inertia must, therefore, go beyond debates about whether organizations change. Instead, research ought frame the issues in *relative* terms, comparing the characteristic speeds of organizational transformation and environmental change. The ecological perspective holds most strongly when environments can change more quickly than organizations can remake themselves. Unfortunately, little effort has been made to calibrate these speeds for any interesting cases. This is a major gap in our understanding.

The second challenge in sorting out adaptationist and selectionist accounts of organizational change concerns the multifaceted nature of organizations. What features of structure ought to be considered? Some aspects of even the stodgiest organizations change almost continuously. Consider the contemporary US research university. The detailed profile of the organization's research activity changes by the hour, as some experiments end, others begin, and so forth. The case of characters changes on a time-scale of months, as employees and students come and go. The organizational structure changes on a time-scale of years, as institutes and departments are created, merged, or closed. Key features of the employment relation for the professoriate, such as the institution of tenure for senior faculty, change on a time-scale of centuries. Whether such organizations are considered highly adaptive depends overwhelmingly on one's focus.

The common device for sorting out these myriad features of organizations relies on a *core-periphery* imagery. In this view, a feature forms part of the organizational 'core' if changing it requires adjustments in most other features of the enterprise. A feature lies at the periphery if it can be changed without imposing changes on other features. In this view, coreness means connectedness, elements in the core are linked in complicated webs of relations with each other and with peripheral elements.[4] Because dense webs

[4] It might be useful to pursue the parallels between treatments of inertia in organizational ecology with Kauffman's (1993) *NK* models. These models characterize the evolution of a system over a fitness landscape (a mapping of configurations to fitness). The evolving unit is specified as a linked set of components. *N* denotes the number of components and *K* denotes the per-component number of linkages. Kauffman's analyses and simulations reveal that the ratio of *K* to *N* determines the topography of the

of connections retard change, core features are more inert than peripheral ones (Hannan and Freeman, 1984).

Although there seems to be general agreement that some organizational features fall nearer the core than others, we see no consensus on exactly what constitutes the core. We suggest that research ought to measure connections directly and estimate the impacts of change in some features on the rate of change in others. In addition, attention to the sequence and timing of the adoption of structures and practices might help specify the composition of the core and how it varies across different types of organizations. There is a fundamental asymmetry based upon 'time's arrow'. Features adopted early in an organization's life can affect which structures and practices it adopts subsequently, but later events do not shape earlier ones. Consequently, the structures adopted in the process of initial organization-building are likely to have the broadest and longest-lived consequences—to be most core-like.

Imprinting refers to a process by which events occurring at certain key developmental stages have persisting, if not lifelong, consequences. The idea that organizations tend to imprint their founding conditions comes from Stinchcombe's (1965) elaboration of Max Weber's account of the logic of organization building. Stinchcombe argued that social and economic structures have their maximal impact on emerging organizations. Entrepreneurs must divert financial and human capital from other uses in order to build organizations. The process of mobilizing the two kinds of capital exposes their plans to intense scrutiny. Their proposals are tested against conventional wisdoms and taken-for-granted assumptions about organizations and employment. Because conventional wisdoms and taken-for-granted assumptions change over historical time (as new forms of organization flourish and others wane), the tests imposed on proto-organization also change. Consequently, the kinds of organizations that emerge in any era reflect the character of the founding period.

Imprinting requires two conditions. First, there must be an initial mapping of some external condition on the nascent organization (as suggested in the foregoing). Second, the imprinted characteristics must be fairly inert, otherwise, subsequent change will erode the association of founding conditions

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landscape. At low *K/N*, the landscape is smooth and has few peaks. Random search has a high probability of locating the configurations of maximal fitness. Average paths of search are long, because the smoothness of the landscape means that there are few chasms that end the lifetime and thus the search. Therefore, evolution resembles ordinary hill climbing search. Search appears to be adaptive. At high *K/N*, the landscape is rugged, with many local peaks separated by regions of very low fitness. Random search tends to get caught in the local peaks. Searches that entail long-distance moves end with high likelihood in the low fitness chasms. In this scenario, inertia is the rule for long-lived systems, because those whose random search moved them some significant distance in the metric of configurations will be unlikely to have survived. Therefore, there is a connection between density of connections among components (*K/N*) and inertia.

and organizational features. It is this second condition that makes notions of imprinting central to treatments of organizational change. Evidence of imprinting provides indirect evidence of strong-form (absolute) structural inertia.

In arguing for imprinting, Stinchcombe (1965, 1979) focused on the *employment relation*. Lacking comparative data on firms, he made the argument at the level of industries. He noted that industries formed in different centuries still reflect today some of the character of their formative periods. For instance, industries formed after the 'organizational revolution' during the closing years of the 19th century and the early years of the 20th century typically employ a higher fraction of administrative workers than those with earlier origins.[5]

If Stinchcombe is right, then certain features of the employment relation are likely to be imprinted. Moreover, the character of the employment relation gets set, at least implicitly, very early in the organization's existence: when the first employees arrive and later when jobs are formalized. Arrangements made at that time might have long-lasting consequences. As Baron and Kreps (in press) argue, emerging organizations might need to commit to a stable pattern of employment relations in order to build a reputation in the labor market that will facilitate the attraction and retention of valuable employees.

In the only research that we know that bears on these issues, Baron and colleagues investigated inertia in employment systems in agencies of the California state government. Baron and Newman (1990) analyzed the interactions of age of a job category and characteristics of its incumbents on its prescribed pay rate. They found that jobs with mainly female incumbents tended to have lower prescribed pay rates and that this effect increased significantly with the age of the job. Baron and Newman (1990, p. 172) interpret this effect as indicating that 'notions of imprinting and inertia thus might fruitfully be extended to the study of work roles: cohorts of jobs founded during the same period might be expected to evince common features, such as shared selection and promotion criteria and similar degrees of ascription'.

It also turned out that organizational age affected the rate at which gender composition of jobs changed in response to changing composition of the relevant work-force. Baron *et al.* (1991) report that the youngest and oldest state agencies integrated their work-forces more quickly than agencies of intermediate age. They interpret the effect for younger jobs as agreeing with

[5] Carroll and Mayer (1986) used Stinchcombe's historical typology of employment systems in industrial sectors in analyzing patterns of individual careers. They found that time of origin of industry affects mobility regimes centuries and decades after founding.

the idea that inertial pressures on youthful structures are weaker than on older ones. The effect for the oldest agencies is harder to understand. Baron and colleagues suggest that this effect reflects the survivor bias in their data the set of very old jobs is unusual in having survived for a long time and are therefore perhaps more responsive to environmental pressures). These studies make clear that age matters for the employment relationship and that the observed patterns are consistent with the hypothesis of age-dependent inertia in organizational structures and practices. However, the research design (with its survivor bias) precludes a sharp analysis of the processes by which jobs and organizations become fixed in certain configurations.

Lack of clarity about the underlying processes is a problem generally in current theories of organizational change. Consider, for instance, the timing of imprinting processes. If structures become fixed, when does this happen? Existing research focuses largely on the time of *founding*, following Stinchcombe's lead. Although imprinting plausibly reflects the conditions under which human and financial capital are mobilized, it is not obvious that lock-in occurs so early in organizational lifetimes. Close examination of the early days in organizational lifetimes suggests much learning by doing and seemingly random search for procedures and structures. Moreover, many founders eschew rules and formal structures initially and attempt to coordinate action by holding frequent meetings of the entire membership. Under such conditions, the organization might move flexibly among alternative ways of organizing. However, successful organizations inevitably outgrow this mode of coordination.[6] Perhaps lock-in processes operate strongly at the time that organizational and job structures are *first formalized*, when positions and roles get defined impersonally (without reference to the identities of incumbents) and patterns of ties among jobs are set in place. That is, an alternative view on imprinting holds that the 'clock' refers not to organizational age *per se* but instead to the intensity of formalization. A third possibility, which seems particularly germane to the case of firms begun by technologists, is that lock-in takes place after the *transition to professional management*. Discriminating among these (and perhaps other) scenarios would reveal much about the sources and likely consequences of imprinting.

We take advantage of a newly available set of data to begin to address these issues empirically. Our companion paper (Baron *et al.*, 1996) examines the origins of employment relations in a set of 100 young high technology firms in Silicon Valley. It seeks to describe how these firms varied in their initial blueprints for the employment relations, emphasizing consistency and

[6] In interviews, founders of the firms in our study, which is described below, often reported that a significant change in their organization's character can be traced to the period in which their work-force outgrew the company's largest meeting room.

complementarities among dimensions of human resource management and how founders' employment models shaped the early evolution of human resource policies and practices. This paper takes the second step, exploring the broader organizational implications of founders' initial blueprints. The analysis, which seeks to contribute to our understanding of how and why origins might matter, has two parts. The first addresses the extent and causes of changes in employment models over the early years. The second examines some implications of the initial blueprints for early development of these firms.

2. *Research Design*

This analysis, like that reported by Baron *et al.* (1996), uses data on the 100 firms studied in the first stage of the Stanford Project on Emerging Companies (SPEC). These firms constitute a stratified random sample of young high technology firms in Silicon Valley (defined as the part of the San Francisco peninsula from the San Francisco airport to San Jose). The sample comes from the population of firms that were reported as having been founded no earlier than 1984 and as having 10 or more employees in 1994.[7]

Our project team conducted interviews with founders, current chief executive officers (CEOs), and senior managers with responsibility for human resources. From founders we acquired information about the firm's early years. CEOs reported on current conditions and near-term prospects. Senior managers with oversight of human resources (HR) provided detailed information about changes in diverse features of the employment relation over the firm's history.

We intend to follow these firms over time. Current plans call for reinterviews in 1996 and 1999, which will enable us to relate early organizational histories to subsequent outcomes, including survival, performance, and changes in the work-force. We optimized this design for studying changes from 1994 forward. Therefore, the most dependable answers to questions about change for these firms lie several years in the future.

In the interim, we take advantage of the retrospective histories of the SPEC firms to address issues of stability and change among an unusual sample of firms. The retrospective data in hand, although not optimal, do paint a potentially interesting picture of patterns of change over the early years for 100 firms. Moreover, we have taken pains to obtain precise information on changes in the firm over its lifetime. This information allows us to examine the sequencing of changes and to estimate continuous-time stochastic models of change.

[7] In a few cases the sources turned out to be inaccurate. The oldest firm in our sample actually began business in 1982.

Nonetheless, we must emphasize that the cross-section of firms studied in mid-1994 comes from a 'survivor-biased' sample.[8] That his, we have sampled survivors from the birth cohorts of 1984, 1985, etc. This means that we cannot use these data to analyze the determinants of success (because we have 'sampled on this dependent variable'). Moreover, it means that effects of age on other outcomes do not have unambiguous interpretation as effects of aging. Instead, age tells both about aging and about the likelihood of having survived for a certain duration. These and other potential limitations of the research design, which are discussed in the companion paper (Baron *et al.*, 1996) should be kept in mind in considering the results we present.

The median firm in our sample was roughly 6.5 years when visited in the summer of 1994. Thus, our 100 firms provide roughly 650 firm-years in the presumably crucial formative life cycle stage. The range on age in the sample runs from 2 to 12 years (one firm turned out to be older than we thought).

This age distribution differs substantially from samples of organizations typically studied by economists and sociologists. Because the firms in SPEC are much younger than the population of comparably large firms, we expect change to be more fluid—virtually all of the well-designed research on the subject finds that rates of structural change decline with age (Barnett and Carroll, 1995). On the other hand, youth means that origins are recent. Hence, we would expect that origins would matter more in the SPEC sample than in the full population. More precisely, origins ought to be more highly correlated with current conditions for younger organizations, making it more difficult to distinguish the effects of the two sets of conditions.

The industrial environments facing these firms change rapidly. The firms in our sample are concentrated in several broad sectors of high technology: computer hardware and software, telecommunications and networking, and medical technologies and biotechnology. These high technology sectors experience rapid turnover in organizational composition. Rates of founding, acquisition, merger and bankruptcy are all high. The competitive landscape changes rapidly and nearly continuously—a firm's rivals today often differ markedly from those it faced only a year ago. Moreover, the velocity of change in product characteristics is also high. Thus, timeliness in developing and introducing new products makes an enormous difference for survival and profitability. Finally, environmental volatility is amplified by a lack of clarity of the boundaries between industries and their segments. That is, the boundaries demarcating high technology industries are faint and mutable

[8] It is perhaps worth noting that studies of organizations in economics and sociology routinely analyze such samples without acknowledging the threat to valid inference arising from the nature of the design.

over short time spans. Frequently, a firm's set of potential rivals cannot be bounded usefully by conventional definitions of industry.[9]

When environments are so volatile, even moderate brakes on the pace of structural change have important consequences. That is, the environments are moving so rapidly that only extremely rapid change can maintain close alignment of organizations and environments. The high level of environmental volatility also means that one can gain a great deal of information about issues of inertia and change from relatively brief spans of observation.

3. *Models of Employment and Business Strategies*

As noted above, theories of organizational change usually assume that those structural features and practices closest the organization's core face the strongest inertial force. This analysis builds on the premise that systems of employment relations and competitive strategy lie at the core. As we noted in the previous section, entrepreneurs enact an employment system, sometimes self-consciously and sometimes by default, in mobilizing financial resources to begin firms and in staffing their organizations, entrepreneurs commit to strategies, and these commitments impose binding constraints on subsequent actions. Business strategies, like employment systems, build commitments that are costly to change.

Models of the Employment Relation

As discussed in detail in the companion paper, we asked founders whether they initially planned to follow any model or blueprint in building their organizations and establishing a set of employment relations. As Burton (1995) and Baron *et al.* (1996) detail, we classified these responses according to what we regarded as the underlying images of the employment relation they reflected. We found that founders' conceptions varied along three dimensions. The first concerns the ***nature of the attachment between the employee and the firm***. Three images dominate here: (i) long-term commitment (the firm as 'family'), (ii) ties based on the nature of the work—the opportunity to work on interesting and challenging work ('cool technology'), and (iii) pecuniary compensation (the employment relationship is primarily a monetary one). The second dimension refers to images of ***coordination and control of work***. The dominant images of coordination include (i) managerial control with monitoring, (ii) peer and cultural control (where the employees have extensive control over the means by which work gets done but little control

[9] One founder of a firm in manufacturing networking products insisted that this industry lacks clear boundaries. When we asked him to name his most salient competitors, he replied 'Everyone'.

over strategic directions, projects to be pursued, etc.), and (iii) delegation to professionals of the right to influence strongly both the way in which work gets done and the larger strategic directions shaping the work. The third dimension pertains to the *firm's primary emphasis in recruiting and selecting employees*. The respondents tended to describe themselves as seeking primarily either: (i) bundles of demonstrable skills, (ii) stars and/or potential stars ('the best and the brightest'), or (iii) persons with strong fit to the organizational culture and a team orientation.

Of the 3^3 possible combinations of these categories, four predominate in the firms in which we conducted interviews. We refer to these four as the *models or blueprints of the employment relation*. They are:

- *Factory model:* pecuniary attachment, managerial control, hire for current skills;
- *Commitment model:* attachment based upon 'love', peer/cultural control, hire for cultural fit (all with a view to long-term employment);
- *Star model:* attachment to work, professional control, hire for potential;
- *Engineering model:* attachment to work (and to a project), peer control, hire for current skills (the taken-for-granted Silicon Valley model).

4. *Sources of Variation in Founders' Employment Models*

The mere existence of such diverse models among such a relatively restricted sample of organizations is itself interesting. Most sociological and economic theories of organizations suggest that organizations engaged in the same activities and utilizing the same productive resources should organize and manage their human resources similarly. Admittedly, the firms in our high technology sample are doing different things—searching for biotechnological breakthroughs, fabricating computer components, writing software, etc. but they are rather similar in their technologies, certainly relative to the economy as a whole. Moreover, we encounter startling diversity in founders' employment models even among start-up companies within the very same industry, competing directly against one another.

For example, several of the SPEC firms are working on developing computer operating systems. One of these firms exhibits a clear star model. They are extremely selective in their recruiting practices and require candidates to go through as many as 10 interviews. The culture was described as 'perfectionist', with every employee expected to make significant contributions. A competing firm, also in our sample, has a very different view of employees and the employment relationship. The CEO described his model as 'paternalistic'. He further described how he is opposed to the standard Silicon Valley

mentality of 'treating people as commodities' and went on to describe all of the ways that his firm cultivates and develops employees. Yet a third firm in our sample, engaged in the same business, espouses a standard engineering model and relies exclusively on the attractiveness of their technology to recruit, motivate and retain employees.

Moreover, note that our sample, by design, controls for a number of the main sources of variation in employment systems that would be attended to by various theories from economics and sociology. For instance, all the firms in our sample have their headquarters in Silicon Valley, representing a common set of labor markets and regulatory regime. They are all new, small companies engaged in technology-related activities. Most of the founders have worked previously in other ventures within the Valley and are therefore well aware of what the prototypical Silicon Valley start-up is 'supposed' to look like. Indeed, not infrequently we encountered the same established organization—such as Hewlett Packard, DEC, IBM, Apple and Oracle—serving as a model to be emulated for some founders in our sample and as a model to be avoided for others. Also of interest is the fact that occasionally founders cited models emanating from very different industries, such as the software company that cited Ben and Jerry's (ice cream) as its positive model.

What factors, then, account for the variations we observe in founders' employment models? We are currently exploring this issue in depth, including an examination of the role that the founders, their biographies, prior relationships (if any), and ties to external partners (such as venture capitalists, lawyers, consultants and the like) play in shaping the blueprint for human resources management (for preliminary results, see Burton, 1995).

Business Strategies

One obvious factor that is especially likely to shape the blueprint for the employment relation is founders' intended business strategies. Like initial employment systems, choice of initial business strategy entails commitments both inside and outside the organization. Because both employees and external partners make investment decisions based on announced strategic directions, change in strategy imposes costs on them and they can be expected to resist such changes. In other words, basic features of business strategies ought to be difficult to change.

Moreover, there are reasons for thinking that employment models and business strategies are highly interdependent. The claim that employment practices should be closely aligned with and supportive of business strategy is the mainstay of the field of strategic human resource management (e.g.

Sonnenfeld and Peiperl, 1988; Legnick-Hall and Legnick-Hall, 1988). Certainly, business strategy bears directly on transaction cost concerns that affect the optimal organization of work and employment. For instance, within our sample, some companies are 'born' with fully-formed products, whereas founders of other companies (e.g. biotechnology start-ups) have only the vaguest notion at the firm's inception of what the end product(s) of their research and development activities will be. In the latter case, this time lag between founding the company and having developed a commercializable product that can secure regulatory approval and be marketed, coupled with the highly proprietary nature of the technology involved, presumably gives the employer a strong incentive to bind the interest of key employees to the firm over the long term.

Above it was argued that tight connectedness among a set of organizational features makes them part of the organization's core, the part of the organization that is most resistent to change. If business strategy and employment systems turn out to be highly interdependent, then we ought to expect both to be affected by initial conditions, that is, to be imprinted. Thus, we examine the relationship between employment models and business strategies over the early years for the firms in the SPEC sample in some detail.

To investigate the relationship between founders' employment models and intended business strategy, we classified firms into a series of categories describing their *dominant* strategic focus. This classification was based on content analyses of the founder interviews, supplemented (in some cases) by secondary sources (e.g. newspaper articles and industry analysts' reports) and/or other materials provided by the firm (e.g. a business plan). Coders were asked to discern from available materials what the founder(s) envisioned as their source(s) of ability to succeed in the face of competition in the product market. As in the case of the employment models, we encountered many different responses (and combinations of responses) from founders, but descriptions of their presumed distinctive competence tended to cluster into several major categories.[10]

(i) *Technological Leadership:* These firms seek to gain first-mover advantages by winning a technology race. Often, this means gaining a crucial patent or set of patents. The emphasis here is on breakthrough technology. Illustrative quotations from interviews with founders of firms classified in this category include 'Founders of [firm] had found a technical solution that worked for a problem that the world didn't even realize they had'. 'The basic core competence of the firm was the patented technology for the first complete micro-valve that used a silicon chip for fluid pressure/flow regulation.' Of

[10] For more details, see Burton (1995).

the 100 firms in our sample, 44 were classified as being in this category, which is not surprising given the industries we studied.

(ii) *Enhancement of Existing Technology:* These firms seek to produce a product similar to other companies, but they employ some general modification to the technology to gain competitive advantage. Distinctive competencies can include system integration (e.g. of software and hardware), superior quality (in terms of dependability or availability of features desired by customers), and the like. Interview transcripts from firms classified into this category included the following examples: '[T]hey knew that there was a market for optical character recognition and they wanted to outperform their existing competitors on accuracy and speed. It was a 'me-too approach'.' '[Our] competitive advantage is [in] providing *both* hardware and software expertise . . . [Our] product is the most feature-rich in the industry.' Eighteen firms were classified as being in this category.[11]

(ii) *Superior Marketing and/or Customer Service:* Firms in this category seek competitive advantage through developing or exploiting superior relations with customers, achieved through custom design of products, branding, using non-standard methods of sales or distribution, or simply by developing superior capabilities in marketing, sales, and customer service. Here are a few illustrative excerpts from interview transcripts of firms classified in this category: 'We're pretty sharp at understanding our customers' requirements before they even knew they had them. We foresee requirements, invest in them, and then deliver a product that people want.' In another company, the strategy consisted of: 'creating a second label . . . creating a strong second source to Microsoft [by offering] superior sales and marketing.' In a third, the founders '[built their] own distribution system, which almost none of [their] competitors has'. In a number of companies, the strategy consisted of creating products that respond directly to customers' idiosyncratic needs, often working interactively with customers toward that end. Twelve firms were classified as having strategies driven by marketing, sales, and/or service.

(iv) *Technology-Marketing Hybrid* [(iii) combined with either (i) or (ii)]: Another 13 firms combined a marketing-service focus with an emphasis either on enhancing an existing technology or on technological leadership. Not surprisingly, most of these hybrids (11 or the 13 firms) involved a combination of a marketing or service orientation with efforts to enhance an existing technology (by catering to specific customer needs).

(v) *Cost-Minimization:* Firms in this category seek cost advantages through superior production techniques, economies of scale, and the like. '[Firm]

[11] Two firms in which the distinctive competencies included both technological leadership and technological enhancement were categorized as being in the technological leadership category.

began as an IBM PS/2 clone maker . . . [they] knew they could build systems more cheaply than IBM.' 'The founder was frustrated at his previous company with the cost of boards and knew they could be produced more cheaply.' Three firms were classified as having a pure cost strategy. Another four combined a focus on cost minimization with some other focus (generally marketing or service) and were included in this category as well.[12]

Alignment of Strategies and Employment Models at Founding

Table 1 cross-tabulates founders' strategies and employment models. The association between the two is quite striking ($X^2 = 32.9, df = 12, p < 0.01$). Not surprisingly, founders intending to pursue a strategy of cost-minimization also were likely to champion the factory model of employment: two-thirds of firms pursuing a cost strategy espoused this employment model, compared to 7.8% of the technology leaders, 12.5% of the technology enhancers, 8.3% of those pursuing a marketing-service strategy, and 7.7% of the technology-marketing hybrid firms.

As we would expect, the star model is espoused most frequently among founders embracing a strategy of technological leadership: 39.5% of that group were classified as belonging to the star category, followed by 33% for those pursuing a marketing or service orientation and 31.3% for those planning on enhancing an existing technology. None of the firms pursuing a 'hybrid' strategy or a cost-minimization strategy was classified as being in the star model category. The comments of one founder, drawing on the scholarly contrast between 'theory X' (industrial engineering, Taylorist) and 'theory Y' (self-actualization, employee development) approaches to manage-

TABLE 1. Relationship of Strategy and Employment Model at Founding

Founder's HR model	Founder's strategy					
	T	E	M	H	C	Total
Factory	3	2	1	1	4	11 (13%)
Commitment	6	5	6	6	2	25 (29%)
Star	15	5	4	0	0	24 (28%)
Engineering	14	4	1	6	0	25 (29%)
Total	38	16	12	13	6	85
	45%	19%	14%	15%	7%	100%

Pearsons $X^2 = 32.9, df = 12, p < 0.001$.

[12] We classified any strategy mentioning low costs as a distinctive competence into this category, even if the founder also enumerated some other competence(s), under the assumption that firms combining low costs with a marketing focus were more likely to resemble the pure cost minimizers than to resemble the marketing-driven firms that are serving idiosyncratic customer needs, engaging in concurrent engineering, and the like.

ment, provides a clear rationale for why the star model does not mesh well with a strategy centered around cost minimization:

> I set out to build a Y-type company, not an X-type. I wanted people who believed in the technology and were self-motivated. I realized after starting, however, that the reality of a bootstrap environment is that you can't afford the people who fit a Y environment. You have to settle for lower salaried people and drive them X-style. This 'settling for less' is also driven in part by greed. I simply don't want to give up the [stock] options it would take to get a high caliber person.

Technological leadership also appears to fit the engineering model of employment, which was espoused by 36.8% of founders intending to pursue that strategy. The engineering model is even more prevalent among firms that intended to combine technological and marketing-service competencies, espoused by 46.2% of founders whose firms are in the hybrid strategy category. The engineering model is also prevalent among the firms that planned to enhance an existing technology (25%). The popularity of this model within every category involving an emphasis on technology is hardly surprising, given that the engineering model of employment is the default or taken-for-granted conception within the Silicon Valley technical community.

Finally, it is interesting that the commitment model is most prevalent among firms pursuing a pure marketing-service strategy (50%), followed closely by those planning on combining technological and marketing competencies (46.2%). Presumably, companies that plan on sustaining their competitive advantage through long-term cooperative relations with customers and clients put a higher premium on long-term cooperative relations with their employees as well. These firms depend critically on the relationships that develop between their employees and the firm's long-term customers; those relationships represent valuable firm-specific investments, which are costly to replace and which the firm therefore seeks to protect by binding employees to the firm long-term. Those relationships also represent costly firm-specific investments to employees, creating an interest in long-term attachments on their part. Baron *et al.* (1996) report that firms built around the commitment model were also the fastest to adopt profit-sharing or gain-sharing, which ties employees' compensation to long-term overall company performance.

Just under a third (31.3%) of founders whose intended strategy was one of technological enhancement also championed the commitment model, compared to only 15.8% of those who intended to compete through technological leadership. Put differently, we find that founders planning on enhancing existing technologies are fairly evenly divided among the commitment, engineering and star models, with 12.5% even espousing a factory

TABLE 2. Stability and Change in Strategy

Strategy at Founding	Strategy in 1994					
	T	E	M	H	C	Total
Technology race (T)	41	0	0	3	0	44 (47%)
Enhancement (E)	1	13	0	4	0	18 (19%)
Marketing/sales (M)	0	0	10	2	0	12 (13%)
Hybrid (H)	0	0	0	11	2	13 (14%)
Cost (C)	0	0	2	0	5	7 (7%)
Total	42	13	13	20	7	94
	45%	14%	13%	21%	7%	100%

Pearson's $X^2 = 325.5$, $df = 16$, $p < 0.001$.

model of employment. In contrast, each of the other strategies tended to map into only one or two of the employment models, suggesting that founders intending to compete by 'building a better mousetrap' did not agree on any particular HR recipe for doing so successfully. Another way of making the same point is to note that the two most common employment models among 'technology enhancers' account for only 62.5% of the firms pursuing that strategy; in contrast, the two most prevalent employment models capture 76.3% of the 'technological leaders', 83.3% of firms with a pure marketing-service strategy, 92.3% of firms with 'hybrid' (technology-marketing) strategies, and 100% of firms pursuing a factory model.

Changes in Strategy, Models and Alignment

Business strategies, like employment systems, build commitments that are costly to change. Accordingly, it is interesting to examine stability in these organizations' strategies, employment models, and in the alignment between the two. First, how do the strategies employed in 1994 relate to those envisioned at founding? We relied on information obtained from interviews with CEOs (supplemented in some cases by company documents and archival sources) to characterize the current strategies of these companies in terms of the same categories used to code their founding strategies. Table 2 shows the joint distribution of initial and current (1994) strategies for the 94 firms for which we had the relevant information at both points in time. It reveals that articulated strategies have been remarkably stable: only 14 of the 94 enterprises (14.9%) have changed their strategies. Close examination of the Table reveals that 7 of the 14 changers supplemented their initial focus on technological leadership or enhancements in existing technology with a marketing or service focus, hardly a major strategic shift. Not surprisingly, a few firms also moved in the opposite direction, adding a focus

on technology to their initial emphasis on marketing or service. Thus, only 5 of the 94 firms (5.3%) actually abandoned their initial strategic emphasis altogether.

This degree of stability was somewhat surprising because we think of the early years as being very turbulent. As one founder told us, 'Young firms have messy lives'. Moreover, these firms face highly volatile and unpredictable environments; one expects to see firms learning about their competencies as a result of early experience and learning about the competitive landscape and reshaping their strategic directions accordingly. Indeed, the firms in this sample did change some of the detailed features of their strategies, such as which strategic partners to pursue and which of several prototype products to bring to market. But when strategies are viewed abstractly, it can be seen that radical changes in strategic direction are extremely unusual within the first few years of an organization's existence. In this sense, the way a firm positions itself at the outset matters greatly.

There is considerably greater evidence of change, however, in employment models between the time of found and 1994. We were able to code the three dimensions of employment relations (and thus the models) for both founders and 1994 CEOs for 70 firms in the sample, and Table 3 reports the joint distribution of the initial and current employment models. The fact that there is less stability in the employment models than in the business strategies is not surprising; entrepreneurs in high technology presumably know more about their products and markets *ex ante* than they know about an organization that they have not yet constructed and staffed.

Note that the four blueprints for the employment relation differ greatly in their persistence. The factory models stands at one extreme: no firm moves away from this blueprint. For the intermediate cases, about a third of the firms whose founders began with either a commitment model or an engineering model had a different blueprint espoused by the CEO in 1994. At the other extreme, the star model was replaced in about half of the cases.

TABLE 3. Stability and Change in Models of the Employment Relation

Founder's model	CEO's model in 1994				
	Cost	Com.	Star	Eng.	Total
Cost-minimization	10	0	0	0	10 (14%)
Commitment	0	15	1	6	22 (31%)
Star	4	2	8	3	17 (24%)
Engineering	3	1	1	16	21 (30%)
Total	17	18	10	25	70
	24%	26%	14%	36%	100%

Pearson's $X^2 = 84.9$, $df = 9$, $p < 0.001$.

TABLE 4. Relationship of Strategy and Employment Model in 1994

Employment model in 1994	Strategy in 1994					
	T	E	M	H	C	Total
Cost-minimization	8	2	1	3	3	17 (24%)
Commitment	5	1	7	4	1	18 (25%)
Star	6	1	2	1	0	10 (14%)
Engineering	11	5	2	7	2	27 (37%)
Total	30	9	12	15	6	72
	42%	12%	17%	21%	8%	100%

Pearson's $X^2 = 18.2, df = 15, p > 0.10$.

Again, we see that initial configuration has a potentially important long-run effect on organizations. If these patterns turn out to hold generally, then founders who begin with the factory model have placed their firms on a trajectory that appears very difficult to abandon. At the other extreme, the star and commitment models appear 'hard to reach' from other starting configurations; firms that do not begin with these blueprints seem unlikely to evolve subsequently to them.

Given that strategies were remarkably stable and that models of employment underwent substantial change, the overall quality (or consistency) of alignment has likely changed. According to Table 4, it has indeed. The association between the dominant business strategy and the employment model is much weaker in 1994 than at time of founding. Indeed, one cannot reject the null hypothesis of no relationship between current strategy and current model in Table 4 ($X^2 = 18.2$, $df = 12$). This result suggests less apparent consistency in the match between strategy and employment model when firms have been in operation for several years than at the time of founding. We cannot rule out the possibility that the seemingly good initial alignment actually reflects the operation of a prior selection process. Suppose that alignment at inception affects survival chances strongly. Then close alignment would be more common among a sample of survivors than in the initial population of firms in these cohorts. However, this consequence of selection does not appear to explain why alignment worsens over time for a given cohort of firms. Some potential causes and implications of this apparently weakening alignment between business strategy and employment relations are discussed below.

5. *Sources of Change in the Employment Model*

We have posited that changes in an organization's basic employment model are difficult and costly to effect. What factors explain the incidence of such

TABLE 5. Effect of Non-founder CEO on Stability and Change in Employment Models

A: Firms with a Founder as CEO in 1994

Founder's model	CEO's model in 1994				
	Cost	Com.	Star	Eng.	Total
Factory	9	0	0	0	9 (20%)
Commitment	0	12	0	1	13 (29%)
Star	1	0	6	0	7 (15%)
Engineering	3	1	0	12	16 (36%)
Total	13	13	6	13	45
	29%	29%	13%	29%	100%

B: Firms with a Non-Founder as CEO in 1994

Founder's model	CEO's model in 1994				
	Cost	Com.	Star	Eng.	Total
Factory	1	0	0	0	1 (4%)
Commitment	0	3	1	5	9 (36%)
Star	3	2	2	3	10 (40%)
Engineering	0	0	1	4	5 (20%)
Total	4	5	4	12	25
	16%	20%	16%	48%	100%

Pearson's $X^2 = 97.1$, $df = 9$, $p < 0.001$ in Panel A.
Pearson's $X^2 = 12.6$, $df = 9$, $p > 0.10$ in Panel B.

changes? It is reasonable to expect that major changes in senior management might prompt changes in blueprint for employment relations. In the case of young companies, a particularly dramatic change is the appointment of a CEO from outside the ranks of the founders. In the SPEC sample, 43% of the CEOs in 1994 were non-founders. We would expect to find more change in the employment model among firms with non-founder-CEOs for several reasons. Founder-CEOs might be expected to view their organizations as having evolved under a consistent blueprint or vision and, accordingly, tend to report that senior management's model has not changed. In contrast, CEOs who were not founders might want to stress their stamp on the organization and thus be inclined to report that the model had changed. Moreover, CEOs from outside the founding team might be brought in by investors precisely with the mandate to change some of the fundamentals of the organization and to rewrite some of the implicit contracts that might have existed previously between the firm and its employees. For these varied reasons, it is interesting to examine the joint distributions of initial and current models conditional on the status of the CEO (founder versus non-founder).

When the current CEO comes from the founding team, the CEO's model of the employment relation differs from that of the founder in only 20% of the cases. But when the CEO is a non-founder, the model differs about 60% of the time (Table 5). Should we conclude that change to a non-founder CEO is a critical event in shaping models of the employment relation in entrepreneurial firms? Perhaps. Yet, although change seems to occur more frequently for firms with non-founder CEOs, the *pattern of change* does not differ appreciably according to the status of the CEO in 1994. We see movement away from star and commitment models toward factory and engineering models in both panels of Table 5. It appears that change to non-founder CEO might speed the process of change, but it does not appear to dictate its direction.

The row marginals in Table 5 reveal an interesting fact: in 1994 the likelihood of the CEO coming from outside the founding team differs greatly by the initial employment model. In particular, more than half of the firms whose founders espoused star models had a non-founder CEO in 1994, and 41% of those that began with a commitment model had non-founder CEOs. In contrast, only 10% of those with a factory model and 24% of those with an engineering model changed. Change to a non-founder CEO does not appear to be an exogenous shock affecting a firm's employment system; rather it depends partly on the founder's initial blueprint.

Perhaps the employment models themselves generate consequences that lead directly to the appointment of a non-founder CEO. For instance, the high costs of implementing commitment and star models might create greater financial strains that undermine corporate performance or require external funding, which in turn might reduce CEO stability. On the other hand, these models might promote rapid growth or success (such as prospects for a successful IPO), making it attractive for firms to look beyond the set of founders for senior management appointments.

To investigate these possibilities further, we undertook analyses of stability and change in models of the employment relation that control for the effects of age, size, industry, founder versus non-founder CEO, and other relevant organizational conditions. In choosing the precise measure of change in the employment models, we faced the constraint that the number of possible transitions (12) is large relative to the number of firms with complete data on the relevant variables (70). Because the number of observed transitions of any type is small, analyzing the pairwise transitions does not provide much useful information. We therefore decided to aggregate over origins and destinations in measuring change; we distinguish firms that changed their employment model from those that did not. We allow the models to differ in the propensity to change by including dummy variables for founder's initial model as covariates.

TABLE 6. Effects on the Log-Odds of Changing the Employment Model (*t*-statistics in parentheses)

	(1)	(2)	(3)	(4)
Constant	−0.758	−1.77	−2.38	−3.25
	(−0.919)	(−1.72)	(−1.98)	(−2.25)
Age	−0.016	−0.165	−0.162	−0.198
	(−1.33)	(−1.14)	(−1.05)	(−1.14)
Size	0.0018	0.0021	0.0002	−0.0001
	(0.749)	(0.721)	(0.048)	(−0.018)
Telecom/networking	−0.280	−0.231	−0.223	0.061
	(−0.393)	(−0.277)	(−0.273)	(0.069)
Medical technology	−0.245	−1.43	−1.34	−0.716
	(−0.327)	(−1.28)	(−1.20)	(−0.606)
Founder employment model:				
Commitment	0.973	0.678	0.691	0.500
	(1.41)	(0.845)	(0.845)	(0.598)
Star	1.86	1.89	1.95	1.64
	(2.26)	(1.92)	(1.95)	(1.57)
Non-founder CEO		2.63	2.48	2.57
		(3.64)	(3.38)	(3.29)
Full-time HR			1.20	2.16
			(1.42)	(1.89)
Change in strategy				2.32
				(1.72)
Log-likelihood	−38.06	−29.86	−28.80	−27.11
Number of cases	70	70	70	70
Number of events	21	21	21	21

Table 6 reports the results of a set of four logit regressions. The dependent variable in each is the log-odds that the CEO's employment model in 1994 differs from the founder's model. Each specification controls for the effects of age in 1994, size in 1994, and industry (telecommunications and networking versus computers, semiconductor manufacturing, and others). As noted above, we also include founder's employment model on the right-hand side. Based on the results in the cross-tabulation of founder's model by CEO's model in Table 5, we estimate effects for the commitment and star models (contrasted with the other two models).

Not surprisingly given the retrospective design, age and size appear to be unrelated to change in the employment model. Similarly, industry does not predict change. Net of these other effects, however, the employment model does affect the odds of change significantly. The commitment and star models have substantially greater odds of being replaced. The estimated effect for the star model (1.86) implies that the odds of change are six times higher for

firms with this model (exp[1.86] = 6.42) than for those with factory and engineering models. Therefore, the differences among employment models that can be seen in the raw cross-tabulations do not appear to be an artifact caused by differences in age, size, or industry.

In the second step (column 2), we consider the effect of change to a non-founder CEO. Adding a dummy variable that equals 1 if the CEO in 1994 is a non-founder improves the fit of the model significantly (compare the likelihoods in columns 1 and 2). Firms with non-founder CEOs have much greater odds of changing the model of employment (net of the effects of age, size, industry and founder model). Adding the strong effect of non-founder CEO actually increases the strength of the effects of the star model. Initial conditions persist in the face of the very large shock of moving outside the founding team for a CEO.

The third and fourth columns in Table 6 report the results of adding additional effects to the model. The additional covariates are two dummy variables, one which distinguishes firms that had hired a full-time human resources manager between founding and 1994, and another which indicates firms that had changed their business strategy. Both variables have large positive effects; however, neither addition improves the fit significantly over the simpler specification in the second column. Nonetheless, we find it intriguing that appointment of a full-time HR manager has a positive and significant effect on the likelihood of changing models. This result conforms to the view that HR managers come to firms with fixed agendas that might not be responsive to the firm's business context. If so, then professional HR management might be partly responsible for undermining the alignment between employment models and business strategies observed (retrospectively) at founding. In the conclusion we return to the issue of why this alignment appears to diminish over time.

6. *Founders' Models and Subsequent Developments*

Our companion paper (Baron *et al.*, 1966) presented evidence that tentatively supports the view that a founder's employment model constrains subsequent evolution of human resource policies and practices. But what about broader effects of internal business strategies and employment models on organizational evolution? This section examines the effects of initial employment models and business strategies on two important changes in the evolution of young, entrepreneurial firms: the appointment of a CEO from outside the ranks of the founders and making the transition from private to public ownership (successfully completing an IPO).

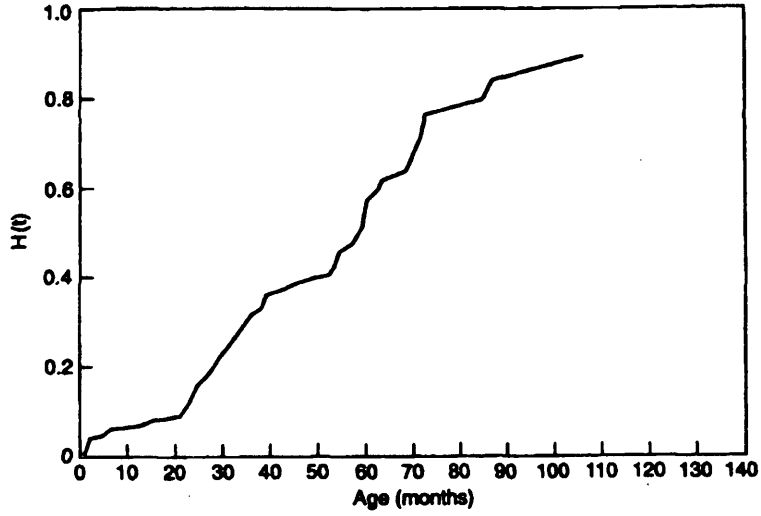

FIGURE 1. Cumulative hazard function: appointment of first non-founder CEO.

Change to a Non-founder CEO

We noted above that the appointment of a non-founder CEO is an occasion for major restructuring. We found that this event increases substantially the likelihood of change in senior management's espoused blueprint for the employment relation. Yet there was also evidence in Table 5 of an association between he founder's employment model and the likelihood that a non-founder serves as CEO in 1994. In this section, we investigate the possibility that the founder's model affects this transition directly. We do this in analyses that control for some of the other observable causal influences, including aging, growth, and industry.

We make use of the fact that we obtained the exact timing of the appointment of the first non-founder CEO. The methods of event-history analysis (Tuma and Hannan, 1984) are used to estimate effects of covariates on the rate of first transition (from founder to non-founder CEO). We specify the underlying process in terms of *organizational age* (t). That is, we regard each firm as becoming at risk of the appointment of a non-founder CEO at birth; and we analyze the (right-censored) distribution of age at the time of such appointment.

Let $Y_k(t)$ denote the state of one of the qualitative processes of interest, with state space: $Y(t) = 0, 1$. In the case at hand, let $Y(t) = 0$ indicate that only founders have served as CEO by age t and $Y(t) = 1$ indicate that a non-

founder serves as CEO at age t. Then, the hazard of shifting to a non-CEO founder is defined as:

$$r(t) = \lim_{\Delta t \downarrow 0} \frac{Pr\{Y(t + \Delta t) = 1 | Y(t) = 0\}}{\Delta t}, t > 0.$$

We summarize the (unconditional) age-variation in the rate with the (transition-specific) cumulative hazard function:

$$H(t) = \int_0^t r(u)\, du$$

Figure 1 plots the estimated cumulative hazard function for this event. The slope of the function tangent to this estimated function over any reasonably small interval approximates the underlying rate. It appears from this plot that the rate is low for young organizations and becomes higher, but variably so, at older ages.

In building models that incorporate heterogeneity among firms, we tried several specifications of age dependence, using both piecewise constant and parametric specifications. The best fits come from a Weibull model. The parameterization of the Weibull model that we estimate has the form.[13]

$$r(t) = ba^b t^{b-1}, \quad t > 0, \tag{1}$$

$$a = \exp(x'_i \alpha), \tag{2}$$

$$b = \exp(x'_i \beta), \tag{3}$$

where $r(t)$ denotes the rate of moving to non-founder CEO for firm i at age t, in months and x_i is a vector of covariates. (The log-linear relationships in (2) and (3) are useful because the transition rate must be non-negative.) In general, the covariates vary with age for each organization. Time variation in covariates are accommodated by the standard method of 'spell splitting', which breaks each firm's history into monthly subspells and updates the values of the covariates at the beginning of each subspell (Tuma and Hannan, 1984; Blossfeld and Rohwer, 1995). The number of spells in this analysis are the number of observed firm-months throughout the lifetime of each company.

Table 7 reports maximum likelihood estimates of the effects of various covariates on the rate of first transition to non-founder CEO.[14] As was the case for change in the model of employment, size and age have negligible effects. Both effects (the effect of size in the 'a-vector' and the constant representing the effect of pure aging in the 'b-vector') are statistically non-significant. The effects of the two industrial categories and ownership status (public versus private) are also non-significant.

[13] Henceforth, we suppress the subscripts indexing the origin and destination states. These should be clear in the context of each analysis.

[14] We used TDA (Rohwer, 1994) to estimate this and subsequent event-history models.

TABLE 7. Effects on Rates of Transition to a Non-founder CEO (*t*-statistics in parentheses)

A-vector	
Constant	−6.19
	(−8.56)
Size	0.010
	(0.569)
Telecom/Networking	0.406
	(1.24)
Medical Technology	−0.382
	(−1.07)
Founder employment model:	
Commitment	1.24
	(1.84)
Star	2.15
	(3.06)
Engineering	0.748
	(1.07)
Founder strategy:	
Technology race	0.504
	(1.70)
Marketing/Service	−0.981
	(−1.96)
Public company	0.016
	(0.039)
B-Vector	
Constant	0.176
	(1.27)
Log-liklihood	−265.30
Number of spells	7193
Number of events	39

See text for explanation of the 'a-vector' and 'b-vector'.

Table 7 documents that the founders' models of employment relations significantly affect rates of appointment of a non-founder CEO. The commitment, engineering, and star models of employment have higher transition rates than the (excluded) factory model. If the factory model stands at one extreme, the star model stands at the other. The estimates in Table 7 imply that the transition rate for firms with star model founders is approximately 8.5 (exp[2.15] = 8.58) higher than for firms with factory model founders (conditional on the covariates). This difference in rates for star and factory models is highly significant. The difference between he commitment and factory models is also large (the ratio of the rates is approximately 3) and this difference is significant at the 0.10 level.

Initial business strategies also have substantial and statistically significant effects on the rate. Firms whose initial strategy placed primary emphasis on

competing by superior marketing and service, where continuity presumably matters for maintaining partnerships with customers, were much less likely to see the appointment of a non-founder CEO. In contrast, firms engaged at the start in a technology race were more likely to experience this event.

These effects of employment model on founder-CEO persistence shed a different light on the instability of the star and commitment models. The high likelihood that these models will be changed appears to reflect at least partly the effect of these models on the persistence of a founder as CEO. In other words, the star and commitment models tend not to persist because founders with these models are likely to be replaced with non-founders. We suspect that the impermanence of founder leadership in firms begun with star and commitment models has something to do with implicit contracts. Neither the factory model nor the engineering model implies any implicit long-term contract between the firm and its employees. However, a star system typically involves implicit contracts that give very strong control over strategic directions in technology development to the technical stars. And a commitment system involves extensive implicit contracts with all classes of workers that they be treated as 'family'. We think that these contracts are typically thought to bind the founders. If the founders come to symbolize the cultures reflected in these implicit contracts, then it is difficult to change features of the employment relation as long as founders remain at the helm. Change might then require that an outside be brought in as chief executive.

Completion of an Initial Public Offering

Many founders report that their initial business plans called for their firms to become public companies at some point. Succeeding in going public is an important concern in many—if not most—young, high technology firms. Such firms frequently offer inexpensive 'founders' stock' and/or options to purchase the firm's stock on favorable terms at a future date to some—if not all—early hires. Both types of compensation are largely illiquid unless a firm becomes a public company. Not surprisingly, completion of an initial public offering (IPO) is widely regarded as an early sign of success in the Silicon Valley business community. Nearly a third of the firms in the SPEC sample had completed an initial public offering by mid-1994. In this section, we explore whether the rate of IPO depends upon the firm's initial conditions, specifically on the founder's strategy and model of the employment relation.

Because we know the exact timing of IPOs, we again use the method of event-history analysis. Figure 2 summarizes the age variation in the rate of

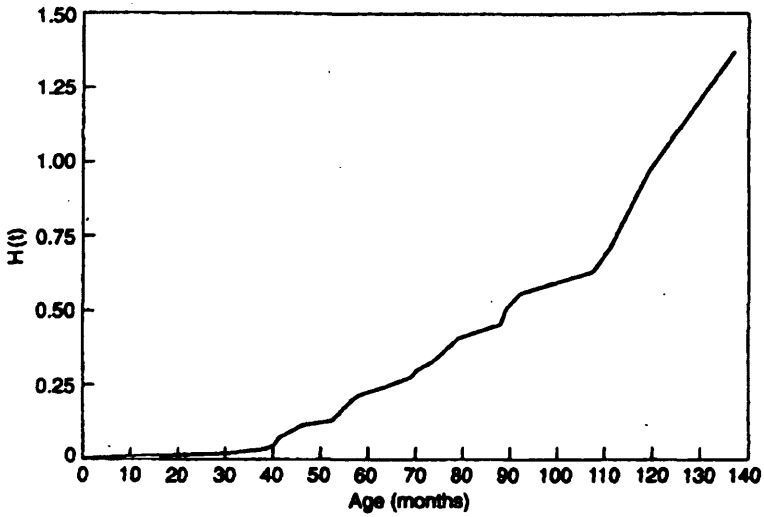

FIGURE 2. Cumulative hazard function: initial public offering.

IPO. The pattern differs considerably from that found for appointment of a non-founder CEO. Very few firms experienced an IPO within their first three years.

Again, we tried several specifications of age dependence in this analysis, using both piecewise constant and parametric specifications. In this case, the best fits come from a specification that breaks age into pieces and estimates a constant for each age segment. Let τ_p indicate the time (age) of the start of the pth segment, with $\tau_0 = 0$. The models we estimate have the form:

$$r(t) = \exp(x_t'\alpha)\exp(\phi_p), \qquad t\in(\tau_p,\tau_{p+1}),\ t>0.$$

We use three age segments: (0–35 months, 36–71 months, and 72 or more months). Again, we use the method of 'spell splitting' (by month of age) to update the values of time-varying covariates.

The empirical specifications used resemble those already discussed in the previous analyses. Table 8 reports the relevant results. As expected from examining Figure 2, the rate of going public is very low for the first three years. The rate is substantially higher over the rest of the age range, and the rates differ little for the second and third segments. These results suggest that these firms have little chance of undergoing an IPO for the first three years or so. The transition rate jumps and remains nearly constant over age from that point.

Again, we find that employment size does not affect the rate. However, industry does: firms in telecommunications, networking, medical technol-

ogy and biotechnology have substantially higher rates of going public than those in the excluded set (computer industry, semiconductor industry and other industries). The difference is statistically significant for the telecommunications/networking industry in both specifications in Table 8 and for medical technology/biotechnology in one of them.

The founder's model of employment has a surprisingly strong impact on the rate of IPO. The rates for the three included models are much higher than for the excluded factory model. The difference is large and statistically significant for the star and commitment models. Holding constant age, size, and industry, firms whose founders had star or commitment models go public at roughly 10 times the rate of firms whose founders had a factory model.

Further research is needed to clarify the mechanism(s) that produce a relationship between employment models and rates of IPO. Several possible mechanisms seem plausible. The relationship might stem from the logic of initial organization. For instance, our companion paper (Baron *et al.*, 1996) shows that firms founded on star models are more likely than others to grant stock options to employees, which creates a strong internal demand for an early IPO. Alternatively, employment models might directly affect chances of early success. That is, firms built on star and commitment models might develop differently in ways that make the firms especially attractive to outside investors, thereby enhancing opportunities for an IPO. An additional possibility is that the star and commitment models are costly models. Firm adoption of one of these models is actually a proxy for slack resources commanded by the founder which may be related to later ability to go public. We intend to pursue these different alternative explanations in future research.

Initial business strategy also affects the rate of going public. Exploration of various specifications revealed that two strategies—the technology race and marketing/service strategies—differ most strongly from the rest. We include dummy variables that distinguish these two strategies from he combined set of other strategies (technology enhancement, hybrid and cost). With this set of contrasts, firms that began by entering a technology race had significantly higher rates of going public and those with a marketing/service strategy had lower rates (but not significantly so).

The second column of Table 8 adds an effect of status of the CEO (nonfounder versus founder). The results show that the rate of IPO for firms whose current CEO is not a founder was nearly triple that of firms that stayed with founder top management. This difference in transition rates is highly significant. We also see that controlling for the status of the CEO weakens the effects of the star and commitment models. This is to be expected, given that we have already seen that CEO/founder status is power-

TABLE 8. Effects on Rates of Initial Public Offering (t-statistics in parentheses)

	(1)	(2)
Age segment (ϕ_j):		
0–35 months	−10.7	−10.4
	(−8.82)	(−8.58)
36–71 months	−8.31	−8.20
	(−8.22)	(−8.18)
72 months or more	−7.80	−7.72
	(−7.76)	(−7.75)
Size	0.010	0.010
	(4.35)	(4.47)
Telecom/Networking	1.05	0.902
	(2.19)	(1.81)
Medical technology	0.696	1.05
	(1.31)	(1.97)
Founder employment model:		
Commitment	2.35	1.68
	(2.56)	(1.77)
Star	2.52	1.69
	(2.73)	(1.74)
Engineering	1.04	0.545
	(1.18)	(0.610)
Founder strategy:		
Technology race	1.22	1.21
	(2.61)	(2.56)
Marketing/Service	−1.23	−0.702
	(−1.61)	(−0.911)
Non-founder CEO		1.09
		(2.65)
Log-likelihood	−210.52	−207.0
Number of spells	7193	7193
Number of events	31	31

fully affected by these models of employment. That is, controlling for status of the CEO is tantamount to controlling for one of the consequences of the initial models. This pair of results suggests a tendency for firms whose founders had star or commitment models to acquire non-founder CEOs in the process of becoming public companies. Very often this means bringing in seasoned managers to take the helm of firms that were founded and managed initially by engineers or scientists. It might also mean renegotiating implicit contracts about employment, as we discussed above.

7. *Conclusions*

Before assessing progress toward unraveling the causes of 'lock-in' in organizations, we repeat the cautions raised at the outset. Although the data

gathered in the first phase of SPEC provide unusual detail on the early histories of organizing and of crafting employment relations, they are less than ideal. The main limitation is that we are analyzing a sample of survivors, albeit survivors over a reasonably short time span. Moreover, we base our conclusions on a relatively small number of events. The panel study, once completed (in five years or so), will provide much more dependable information about the main questions addressed here.

Having stated these cautions, we think that this first glimpse at the histories of many young, high technology firms suggests that initial conditions matter a great deal, even within the turbulent early years. We find the pervasive impart of the founder's blueprint for the employment relation both surprising and impressive. We did not expect to find that the founder's employment model would affect rates of change in top management, success in going public, and establishment and elaboration of formal human resources management. This range of effects, along with their strength, makes us want to delve more deeply into these matters.

An especially intriguing finding reported in this paper is that the close alignment between business strategies and HR models at the time of founding had completely vanished by 1994, when these firms were studied. There are a number of explanations for this provocative result. One obvious possibility is that close alignment is easier to achieve in the early years because start-ups are more homogeneous than older, larger firms with respect to their tasks and labor forces, thereby enabling start-ups to construct a single employment system or governance regime that envelops most or all of the employees. To put it differently, with growth in the scale, complexity, and heterogeneity of their tasks and employees, transaction cost economizing in a firm's employment system may occur at ever-lower levels of aggregation, rather than at the level of the organization as a whole or major subunits with it.

If this is true, a worthwhile question for future research is whether specific business strategies and/or employment models are more or less flexible in coping with this transition. One might expect, for instance, that firms in which the employment relationship is initially conceptualized and structured in terms of the star or factory models might be able to cope with these pressures toward internal differentiation more easily than firms that adopt the commitment model at their inception. Similarly, one might imagine that firms pursuing a strategy of technology leadership view key technical personnel as their major competitive asset, adopting particular HR policies and practices designed to attract, nurture, and retain those individuals, but displaying less regard for individuals engaged in other domains of activity (e.g. manufacturing, marketing) by virtue of the firms anticipated technical

monopoly. In contrast, firms seeking to enhance an existing technology are likely to need to coordinate their technical core more closely with other functional areas of the firm, which may push them in the direction of adopting employment policies that are more consistent throughout the organization.

In addition, there may be particular types of firms and strategies for which the evolutionary trend is in the opposite direction—that is, toward more consistent treatment among different segments of the organization over time. For instance, companies founded around a strategy of technology leadership may find, once their initial success attracts the attention of competitors, that they need closer integration between technical personnel and those engaged in manufacturing and/or marketing their products, and that this is impeded by an organizational culture and HR system that has traditionally treated the latter as second-class citizens.

We are excited by the long-term prospects for examining these issues in more depth once we have gathered panel data on the SPEC firms. We conclude by outlining some of the next steps in this program of research. The second phase of the study, currently nearing completion, adds information on another 75 firms with the same profile. We have managed to find many younger firms in the second stage (as we have improved our ability to identify possible target firms). Using data from the second phase, we can validate our coding of employment models and business strategies and also check on the robustness of the patterns described in this (and the companion) paper. Then, combining the data from the two phases, we will gain enough statistical power to conduct more refined analyses of imprinting. For instance, we can compare patterns of relationships over the first few years of age for the older and younger firms in the sample. Such comparisons will allow us to assess the importance of survivor bias in affecting our results.

The most interesting possibilities lie in analyses of the planned panel data. Once we have made repeated observations on the firms in the sample, we will be in a position to test more interesting specifications of various imprinting stories. This is because we will be able to estimate the effect of origins on outcomes at time 2 (and subsequent times) controlling for the observed structures and practices in mid-1994. If imprinting has relevance to employment relations in these high technology firms, we ought not to be able to eliminate the effects of origins on outcomes by controlling in a very detailed manner for the history of the firm to the time of our first waves of observations. Such analyses promise to shed the clearest light yet on processes of organizational imprinting.

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