Working Papers   ILR Collection

9-1998

Determinants of Managerial Intensity in the Early Years of Organizations

James N. Baron
Stanford University

Michael T. Hannan
Stanford University

M. Diane Burton
Cornell University, mdb238@cornell.edu

Determinants of Managerial Intensity in the Early Years of Organizations

Abstract

This paper examines how founding conditions shape subsequent organizational evolution— specifically, the proliferation of management and administrative jobs. Analyzing quantitative and qualitative information on a sample of young technology start-ups in California's Silicon Valley, we examine the enduring imprint of two aspects of firms' founding conditions: the employment blueprints espoused by founders in creating new enterprises; and the social capital that existed among key early members of the firm—their social composition and social relations. We find that the initial gender mix in start-ups and the blueprint espoused by the founder influence the extent of managerial intensity that develops over time. In particular, firms whose founders espoused a bureaucratic model from the outset subsequently grew more administratively intense than otherwise-similar companies, particularly companies whose founders had initially championed a "commitment" model. Also, firms with a higher representation of women within the first year subsequently were slower to bureaucratize than otherwise-similar firms with a predominance of males. Our analyses thus provide compelling evidence of path-dependence in the evolution of organizational structures and underscore the importance of the "logics of organizing" that founders bring to new enterprises. Implications of these results for organizational theory and research are discussed.

Keywords

Comments

Suggested Citation

Required Publishers Statement

Determinants of Managerial Intensity

in the Early Years of Organizations*

James N. Baron, Stanford University

Michael T. Hannan, Stanford University

M. Diane Burton, Harvard University

RESEARCH PAPER SERIES

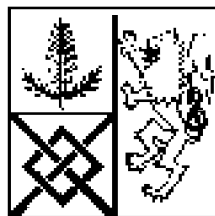# GRADUATE SCHOOL OF BUSINESS

STANFORD UNIVERSITY

Determinants of Managerial Intensity
in the Early Years of Organizations[*]

James N. Baron, Stanford University
Michael T. Hannan, Stanford University
M. Diane Burton, Harvard University

September 1998

ABSTRACT

This paper examines how founding conditions shape subsequent organizational evolution—specifically, the proliferation of management and administrative jobs. Analyzing quantitative and qualitative information on a sample of young technology start-ups in California's Silicon Valley, we examine the enduring imprint of two aspects of firms' founding conditions: the employment blueprints espoused by founders in creating new enterprises; and the social capital that existed among key early members of the firm—their social composition and social relations. We find that the initial gender mix in start-ups and the blueprint espoused by the founder influence the extent of managerial intensity that develops over time. In particular, firms whose founders espoused a bureaucratic model from the outset subsequently grew more administratively intense than otherwise-similar companies, particularly companies whose founders had initially championed a "commitment" model. Also, firms with a higher representation of women within the first year subsequently were slower to bureaucratize than otherwise-similar firms with a predominance of males. Our analyses thus provide compelling evidence of path-dependence in the evolution of organizational structures and underscore the importance of the "logics of organizing" that founders bring to new enterprises. Implications of these results for organizational theory and research are discussed.

Determinants of Managerial Intensity in the Early Years of Organizations

INTRODUCTION

Recent managerial downsizings and increased emphasis on "lean" operations and "empowerment" have rekindled interest in the factors that shape managerial and administrative overhead in organizations. The proliferation of specialized administrative roles and personnel has lately been decried by management commentators not only because of its financial cost, but also because it often excessively centralizes decision-making, thereby reducing the capacity of organizations to respond to shifts in their environments.

Yet despite intense recent interest in this issue among management practitioners, the study of managerial–administrative intensity in organizations has waned within the scholarly literature, after having been the focus of several streams of research in recent decades. Some students of organizations (e.g., Scott 1992, p. 40) have identified the existence of administrative specialists as the defining feature of bureaucracy. In the 1960s and 1970s, structuralists and contingency theorists adopted a technical approach to bureaucratization, relating the specialization of managerial and administrative functions to changes in organizational size and/or technology that alter requirements for information, coordination, and control (Blau 1970; Blau and Schoenherr 1971; Pugh et al. 1968). In the late 1970s and 1980s, this approach was largely supplanted by an institutional perspective, which views the proliferation of administrative structures as an organizational response to the need for legitimacy and accountability imposed by external constituencies, including the state, professional associations, and other organizations (Meyer and Rowan 1977; Meyer and Scott 1992; Edelman 1990; Dobbin et al. 1994).

In this paper, we argue for renewed attention to the determinants and consequences of managerial–administrative intensity in organizations, and also for an approach that incorporates what we have learned about organizational development in recent years—specifically, the path-dependent character of organizational evolution. Although the technical and institutional accounts of bureaucratization differ in their relative emphasis on internal versus external factors as driving the growth of administration, both approaches take an adaptationist stance; they link bureaucratization to changing requirements that organizations face as a function of growth, technology, or the environment. Without denying the importance of these determinants of organizational structure, we note that recent theory and research concerning path dependence suggest that the conditions of organizational founding might be no less decisive, exerting an indelible and enduring influence on how enterprises evolve (Boeker 1988, 1989; Barnett and Carroll 1995; Carroll and Harrison 1994; Tushman and Murrman 1998). Stated differently, differences in how administrative structures evolve might be, to some degree, "pre-programmed" during organizational infancy (Stinchcombe 1965).

We develop and illustrate this approach, drawing on a unique data base—the Stanford Project on Emerging Companies (SPEC)—which records the founding conditions and early evolution of a sample of high-technology organizations in California's Silicon Valley. Holding constant differences in size, growth, business strategy, industry, and other factors likely to influence bureaucratic overhead, we document how the proliferation of administrative and managerial positions over time in these companies reflects two founding conditions: the model or blueprint of the employment relation articulated by the firm's founder(s), and the gender composition of the labor force at an organization's inception. We begin by describing SPEC and briefly summarizing results of previous research based on that sample. After outlining the hypotheses, models, and

2

methods guiding our empirical analyses of administrative intensity, we report our empirical results. The concluding section discusses the implications of our results for organizations and organization theory.

THE STANFORD PROJECT ON EMERGING COMPANIES

SPEC is a panel study of young, high-technology firms in Silicon Valley, which examines the evolution of employment practices, organizational designs, and business strategies. By focusing on firms in a single region and sector of economic activity, we can control for labor market and environmental conditions, as well as some of the institutional influences asserted to shape organizational structures. This project seeks to understand how human resource systems are established. We assumed that organizations need to be of a minimum size before facing a need for any formal systems or practices; accordingly, we required that firms in our study have at least 10 employees when sampled.[1] Another project goal is to understand how

---

[1] In 1994, 250 companies were sent a letter soliciting their participation in the study. These firms were selected out of 676 technology firms having more than 10 employees, according to two commercial databases on Silicon Valley technology companies: *Rich's Everyday Sales Prospecting Guide* (1994); and the *Technology Resource Guide to Greater Silicon Valley* (1993/4), published by *CorpTech*. The 250 firms were selected according to a stratified sampling plan described in Baron, Burton, and Hannan (1996: Figure 1). Of the 250 firms to whom we originally wrote (some of which had gone out of business, moved out of the area, or been acquired by the time we contacted them), 109 eventually agreed to take part in the study. Utilizing the same sampling frame, we contacted an additional 94 companies in 1995 (out of 168 that were added to the 1995 edition of the *CorpTech* directory), 42 of which agreed to be studied. Finally, we supplemented the sample by contacting 32 very young firms not listed in *CorpTech*, which were identified by tracking the Silicon Valley business press; 22 of these firms participated in the study. We were

3

founding conditions and early decisions affect subsequent organizational evolution, which necessitates information about the earliest days of the organization. We assumed that individuals could only reliably recall fairly recent information; consequently, we limited the sample to firms no more than 10 years old when first visited in 1994–5 (though the typical firm was roughly six years old–see Table 1.)[2]

Data Collection

Survey, interview, and archival methods were used to gather information on each firm in the sample (see Burton 1995). Trained MBA and doctoral students conducted semi-structured interviews with the current chief executive officer (CEO). We also asked the CEO to identify: (a) the founder (or a representative of the founding team) who was best equipped to provide information regarding the firm's origins; and (b) the best informant for us to contact regarding human resources (HR) practices in the organization. We followed up with these informants about company history and HR, asking them to complete surveys and return them to us prior to being interviewed. The company history survey solicited details about the firm's founding and

---

concerned that relying exclusively on guidebooks such as *Rich's* and *CorpTech* to construct the sampling frame might under-represent new start-ups in our study, given that there sometimes appear to be considerable time lags before newly-created firms are listed in those guidebooks. For additional details regarding sampling and methods, see Burton, Hannan, and Baron (1998).

[2]About 10% of firms proved to be more than ten years old when we first visited them. In some cases, for example, our interviews revealed that the inception of the organization occurred somewhat earlier than the date of legal incorporation used in constructing our sampling plan. Even employing the most liberal definition of "founding," however, only three firms in the sample analyzed here had existed for 12 or more years when we first visited them.

subsequent milestones. The HR survey sought information about workforce demographics and a variety of employment policies and practices. Information from the surveys, when available, was used to guide interviews with informants in each company.

Founders' Organizational Models

Recent neo-institutional work on organizations has frequently invoked the notion of culturally-based logics, blueprints, scripts, or conceptions of control, which mold organizational structures, practices, and evolutionary trajectories (e.g., Fligstein 1987; 1990). Yet researchers have seldom tried to operationalize such blueprints directly, tending instead to infer their existence from other sources of information. Moreover, as noted above, institutional scholarship has tended to adopt an adaptationist stance toward organizational evolution, positing that organizational blueprints or conceptions of control change in accord with the prevailing economic, political and normative order. In contrast, we build on recent analyses of path-dependent organizational evolution, which provide support for Stinchcombe's (1965) classic statement of how founding conditions become imprinted on organizations and mold their subsequent development.

In examining whether the development of bureaucracy is path-dependent, we want to characterize the implicit organizational model or blueprint espoused by entrepreneurs so that we can assess whether that framework exhibits enduring effects on the enterprises they founded. Toward that end, each founder in the SPEC sample was asked whether or not he or she had "an organizational model or blueprint in mind when [you] founded the company." (The CEO was asked a parallel question about the period corresponding to the date of the interview.) Our analyses of transcripts of interviews with founders revealed three recurring dimensions along which their

5

images varied regarding how work and employment should be organized (for additional details, see Burton 1995; Burton, Hannan, and Baron 1998).

Attachment. Founders articulated three different bases of employee attachment, which we label *love, work,* and *money.* Some founders envisioned creating a strong family-like feeling and an intense emotional bond with the workforce that would inspire superior effort and increase retention of highly-sought employees, thereby avoiding the frequent mobility of key technical personnel that plagues Silicon Valley start-ups. What binds the employee to the firm in this model is, simply put, *love*—a sense of personal belonging and identification with the company. Many firms in the sample pursue cutting-edge technology, and the primary motivator for their employees is the desire to work at the technological frontier. Recognizing this, many founders anticipated providing opportunities for *interesting and challenging work* as the basis for attracting, motivating, and (perhaps) retaining employees.[3] Here, employees were not expected to be loyal to the firm, the boss, or even co-workers per se, but instead to the *project.* Finally, other founders stated that they regarded the employment relationship as a simple exchange of labor for *money.*

Basis of Coordination and Control. A second dimension concerned the principal means of controlling and coordinating work. The most common blueprint involved extensive reliance on *informal control through peers or the organizational culture.* Other founders intended to rely on *professional control,* even if they did not explicitly use this terminology. These founders' responses indicate that they took it for granted that workers were committed to excellence in their

---

[3]A few founders also spoke about providing unrivaled "opportunity" for prospective employees. Although opportunity is potentially a conceptually distinct basis of attachment, it was closely aligned with "challenging work" and there were very few such cases in our sample, so we treated these cases as instances of attachment based on "work."

work and could perform at high levels because they had been professionally socialized to do so. (Not surprisingly, this approach tends to be accompanied by an emphasis on recruitment of high-potential individuals from elite institutions.) Professional control emphasizes autonomy and independence, rather than inculturation. A third group of founders espoused a more traditional view of control as being embedded in *formal procedures and systems*. Finally, some founders stated that they intended to control and coordinate work personally, by *direct oversight*, reminiscent of the "simple control" paradigm that Edwards (1979) identified as characteristic of small capitalist firms in the late nineteenth and early twentieth century.

Selection. The third dimension concerns the primary basis for selecting employees. Some founders seemed to think of the firm as a bundle of tasks and sought employees to carry out particular tasks effectively. Time and money tended to be the paramount concerns here, so the focus was on selecting employees who could be brought on board and up to speed as quickly and cheaply as possible. In these cases, the founders envisioned selecting employees with the *skills and experience needed to accomplish some immediate task(s).* Other founders focused less on immediate and well-defined tasks than on a series of projects (often not yet even envisioned) through which employees would move over time. Accordingly, they focused on *long-term potential.* Finally, another group of founders focused primarily on *values or cultural fit.* Like the previous group, these founders were concerned about the long-term, rather than specific short-term personnel needs, but they put heavy emphasis on how a prospective hire would connect with others in the organization.

Relationships among the Three Dimensions. These blueprints can be classified into three types of attachment and selection and four types of control, yielding $3 \times 3 \times 4 = 36$ possible combinations. However, Burton, Hannan and Baron (1998) have shown that observations cluster

into a few cells, corresponding to what they term "pure type" employment models. These are

shown in Table 1.

(Insert Table 1 about here)

The *engineering model* involves attachment through challenging work, peer group control,

and selection based on specific task abilities. Consistent with the claim by some observers (e.g.,

Saxenian 1994) that this is the default blueprint for a high-tech Silicon Valley start-up, Burton et

al. (1998) reported that this was the modal employment model for the SPEC firms. The *star*

model refers to attachment based on challenging work, reliance on autonomy and professional

control, and selecting elite personnel based on long-term potential. The *commitment model* entails

reliance on emotional–familial attachments of employees to the organization, selection based on

cultural fit, and peer group control. The *bureaucracy model* involves attachment based on

providing challenging work and/or opportunities for development, selecting individuals based on

their qualifications for a particular role, and formalized control.[4] Finally, the *autocracy model*

_____

[4]Though we sometimes tend to view bureaucrats as alienated and pursuing purely instrumental motivations (see fn. 2,

Appendix) , in the classic Weberian conception of a bureaucracy, employees are strongly committed to their specific

work role or vocation and to following formal rules. Indeed, it is the specificity and intensity of that commitment that

creates some of the pathologies of bureaucracy, according to Weber, because it fosters an excessive division of labor

whereby bureaucrats can perceive themselves as bearing no responsibility for matters outside their "office." Also, it

is important to bear in mind the context here—small high-tech start-ups, dominated in their early stages by scientific

and technical personnel. Thus, the "bureaucracy" moniker here should really be thought of in *relative* terms,

indicating not that founders espousing a bureaucratic approach envisioned running their companies like a huge

government agency, but rather that they tended to place more early emphasis on formal controls, specialization of

functions, and the like than did other founders.

refers to employment premised on purely monetary motivations, control and coordination through close personal oversight, and selection of employees to perform pre-specified tasks.

Methodological Concerns. This effort to characterize the organizational blueprints of entrepreneurs raises a host of conceptual and methodological issues, which are discussed in detail by Burton, Hannan, and Baron (1998). Here we wish to touch briefly on several of those concerns. First, it is important to emphasize that the coding effort on which this taxonomy is based, and the conceptualization of "organizational blueprints" we have in mind, concerns the premises and rhetoric espoused by the key informant whom we interviewed (the founder, and, for assessing the current blueprint in each organization, the CEO). This blueprint may or may not bear a relationship to organizational reality, and in classifying firms in terms of the dimensions and subcategories described above, we were careful to rely not on what organizations were actually doing, but instead on what the informant recounted about his or her underlying organizational model or conception.

Second, given that our information on the founder's model comes from retrospective accounts, one must be concerned about the possibility of selective reconstruction. We address this issue in a number of ways in presenting our empirical results. Although we cannot definitively rule out the possibility of biases due to retrospection, we present some results that provide reassurance on that score. Furthermore, it was not uncommon for founders describing their initial premises or conceptions to view them unfavorably in retrospect—for instance, to acknowledge that their original model was naïve or ill-conceived. The ability and willingness of some founders to be self-critical in this way suggests that they were not simply reporting *ex post* a self-serving conception of the initial organizational model that was tailored to what had happened subsequently within their firm.

ORGANIZATIONAL FOUNDING CONDITIONS AND THE RISE OF BUREAUCRACY

We are interested in learning whether the evolution of bureaucracy is path dependent, reflecting the enduring imprint of formative influences at the inception of organizations. Our analyses focus specifically on the rise of managerial and administrative specialists as an indicator of bureaucratization

.

Founder's Model and Managerial Intensity

If founders' models of the employment relation affect the evolution of their organizations, we expect this imprinting to be reflected in the intensity of management and administration over time. Hannan and Freeman (1977; 1984) argued that images of how tasks and workers should be organized are among the most difficult aspects of organizations to change, at least in the short run. Once formulated and articulated, a founder's organizational blueprint likely "locks in" the adoption of particular structures, as well as certain premises that guide decision-making. Such structures and premises are difficult to dismantle or modify. The founder's employment model will also shape the kinds of people the enterprise attracts and retains, create expectations and interests among various actors in the organization, and help foster a reputation for the firm in the labor market. So we expect that founders' models have enduring effects on their enterprises, even after the departure of the initial founder(s). Consistent with that conjecture, our previous work found that founders' initial organizational blueprints shaped not only the evolution of human resource practices and the HR function, but also the likelihood of going public and the odds and timing of CEO succession (Baron, Burton, and Hannan 1996; Hannan, Burton, and Baron 1996). In the

same vein, we predict that founders' employment models shape the subsequent development of organizational structure, including the extent of managerial intensity.

At one extreme, we expect that firms whose founders espoused a bureaucratic model will subsequently rely more on managerial and administrative specialists to control and coordinate work. In particular, we predict that the size of the managerial–administrative contingent will grow more than in otherwise-comparable enterprises whose founders embraced other organizational models. Note that there is no automatic connection here. Indeed, founders enamored of formal systems, procedures, and rules might well be able to *economize* on administrative overhead by relying on information technology, budgeting, indoctrination in company rules and policies, and the like. Nonetheless, we expect that when founders initially championed formal means of coordination and control, employees are least likely to develop a capability to self-manage and there will be the strongest tendency to view managerial and administrative functions as the purview of specialists, a tendency that of course is self-reinforcing given the incentives that bureaucrats typically have to expand their ranks.

At the other extreme, we predict that commitment-model firms will proliferate the least bureaucratic overhead. Advocates of "high commitment work systems" argue that organizations can economize on formal control by providing long-term employment prospects, relying on peer pressure, encouraging employees to internalize the organization's goals and values, and investing in workers' development (Walton 1985).[5] Consequently, we hypothesize that start-ups built on the commitment model will add fewest managerial and administrative personnel, all else being equal.

_____

[5]To be sure, more managerial and administrative effort might be required initially to establish such HR-intensive systems, and firms founded along commitment lines might provide more support functions internally to their employees. However, recall that the outcome of interest is the proliferation of managerial and administrative roles,

We predict that star-model firms will also develop less managerial overhead than firms built on a bureaucratic model. "Stars" are hired in part because they require less formal oversight, and indeed they tend to be highly suspicious of and resistant to formal control. On the other hand, several attributes of firms built around a star model might temper this effect, producing more rapid bureaucratization than in commitment-model firms. Organizations predicated on a star model typically focus on a small cadre of key employees (usually scientific or technical personnel, but sometimes sales or marketing talent). Star-model firms might find that mechanisms used to gain the commitment of star employees (stock options, reliance on recruitment from elite institutions, etc.) fail to elicit consummate cooperation from the entire labor force, many of whom will have entered the firm in the later stages and in "non-star" roles. Moreover, given the strong disdain of technical stars for administration, firms might need to add more specialists to carry out oversight activities that can be handled more readily through self-management in establishments built along commitment lines. Hence, we expect more bureaucratization in star-model firms than in otherwise-comparable commitment-model firms, but less than in engineering-model, autocracy-model, and bureaucracy-model firms.

We predict that the autocracy and engineering models fall between the polar extremes of the commitment and bureaucratic model. The autocracy model entails an antipathy toward overhead of all forms, because autocratic founders want to minimize costs and also tend to resist delegating control. However, firms founded along these lines might bureaucratize more than commitment-model firms as they grow and mature, given their low initial investments in either inculturation or

---

and we predict less need to proliferate such roles among commitment–model firms as they grow and age, relative to otherwise-similar firms founded along other lines.

formal organizational controls. Thus, despite the desire of autocrat entrepreneurs to economize on costs, we expect that the autocracy blueprint will eventually be associated with at least moderate levels of managerial and administrative overhead as enterprises age and grow.

We do not make a strong prediction for the engineering model. As the default employment blueprint for Silicon Valley start-ups, this model might attract and accommodate successive generations of new (and diverse) employees and promote clear expectations regarding their roles without extensive administrative overhead. Yet several characteristics of engineering cultures—the lack of organizational loyalty, aversion to managerial and administrative tasks, and affinity for order and structure (Shenhav 1994)—might foster greater bureaucratization as enterprises embodying the engineering model grow and mature.

Initial Gender Composition and Managerial Intensity

Organizational theories typically relate the evolution of an organization's roles and structures to its scale, tasks, and external environment. An interesting sociological issue is whether the initial attributes or composition of the labor force also shape the evolution of organizational structures. Like architects, founders of organizations may design enduring structures that depend on the social characteristics of—and relations among—the first individuals intended to occupy the structure. If so, initial composition of the labor force in an enterprise may be one of the more crucial "founding conditions" that mold organizational evolution.

However, we are unaware of any prior quantitative work on this topic. As an initial exploratory analysis of this issue, we focus on the organization's gender composition in its infancy. We do so for two reasons: (i) the longitudinal data on workforce demography available for the SPEC firms are limited; and (ii) more theory and past research regarding organizational gender composition exists than for other dimensions of workforce demography (e.g., ethnicity).

13

Given extensive gender segregation in the labor market, the initial sex composition of a company likely reflects to a large extent its occupational mix, with women concentrated in clerical positions and men predominant within scientific and engineering roles. However, past research documents that employers have some latitude in staffing occupational roles (Bielby and Baron 1986; Reskin and Roos 1990). Economic and sociological perspectives offer competing predictions about the effect of initial gender composition on subsequent organizational structure, including administrative intensity. According to human capital economics (e.g., Becker 1957; Polachek 1979), employers anticipate greater stability among male employees and consequently reserve jobs for men when they anticipate that turnover will be costly and disruptive—for instance, because of high training costs or team production. Under these conditions, employers seek to bind employees to the firm through employment security and/or efficiency wages. This argument would seem to imply a *positive* relationship between female hiring and administrative intensity because: (a) the relative absence of employment security and premium wages in female-dominated settings presumably requires more managerial control over the work force and more administrative resources devoted to replacing and training incoming employees; and (b) when team production makes turnover costly (and males are therefore preferred by employers), peer control should largely supplant formal administrative controls.[6]

Sociological and cultural approaches seem to inspire the opposite prediction— namely, less bureaucratization in settings characterized by more female employment. Past research has shown that employers tend to use more detailed and differentiated (both horizontally and vertically) job

---

[6]However, if employers offer more extensive employment benefits to male employees in order to bind them to the firm, more overhead might be required to administer those benefits.

titles for men in a given work role and to concentrate women in fewer, larger job titles (Baron, Davis-Blake, and Bielby 1986; Strang and Baron 1990). If employers are more likely to construct opportunity chains for men than for women and if one *raison d'être* for elaborating administrative positions is to provide middle management career opportunities for employees, then this could explain a stronger tendency to add administrative overhead in organizations with an initially larger fraction of men in the labor force. In addition, some feminists have contended that bureaucratic logic is primarily a male contrivance and that the control and coordination of female employees might require less formal managerial and administrative overhead as firms age and grow (Martin, Knopoff, and Beckman, 1998).

Given these competing predictions, we do not offer a specific hypothesis but instead seek to adjudicate empirically between the two perspectives. In addition to examining the effects of initial gender mix, our empirical analyses also examine whether *changes* in gender composition influence the size of the managerial and administrative component.

Control Variables

Various other characteristics need to be held constant when examining whether a firm's initial employment blueprint and/or gender mix subsequently influence managerial intensity. For instance, both the employment model and initial gender mix might reflect the firm's *industry*. In addition, the firms under study vary, even within industries, in the *main dimension along which founders planned to seek competitive advantage*—through breakaway technological innovation, enhancement to existing technology, superior marketing, or low cost—which, in turn, has implications for the scope of the firm and the administrative functions likely to be required. We obviously also need to control for the level of *non-administrative employment* (and for possible nonlinearities in the relationship between administrative and non-administrative employment), as

15

well as for *firm age* (at the time of measurement of administrative intensity). We also control for whether the firm underwent an *initial public offering*, a crucial event in the lives of start-up companies that can influence the number of administrators and managers. In supplementary analyses we also controlled for the extent of *employment formalization* (the number of specific HR policies aimed at formalizing and systematizing employment relations—see below); *growth in the firm's HR function*; whether the firm *received venture capital financing*; the firm's initial *occupational composition* (e.g., the predominance of scientists and engineers versus clerical workers); CEO succession (whether the founder had been replaced by another CEO); and differences across firms in *reliance on external sourcing* (e.g., use of independent contractors). In addition, we also controlled in supplementary analyses for each firm's *level of managerial intensity in its first year of operations*, to model *change* in managerial intensity between the first year of operations and the 1994-5 time frame during which firms were studied. These controls capture possible sources of unobserved heterogeneity among the SPEC companies and ensure that any observed enduring effects of initial gender composition or founder's employment model on present-day managerial intensity are not spurious.

MODELS AND METHODS

The outcome of interest is the prevalence of managers and administrators. Previous research has documented returns to scale in managerial and administrative personnel—that is, the proportion of the organization's employees in such jobs declines with the size of its workforce. We represent this idea by regressing the natural log of the number of administrators and managers on the logged

16

number of other (non-administrative, non-managerial) employees, controlling for other covariates.[7]

We are interested in the effect of conditions during the first year of founding (which we refer to as time 1) on managerial intensity in the year in which the firms were first interviewed, either 1994 or 1995 (which we refer to as time t). We use as the baseline a power-law relationship between the number of administrative and managerial employees and the size of the remaining workforce, and we allow the substantive variables of interest (employment models and gender composition) to moderate this relationship:

$$A_t = N_t^{\alpha} \exp\{\beta_1 C_1 + \beta_2 S_1 + \beta_3 E_1 + \beta_4 A_1 + \beta_5 H_1 + \gamma Fem_1 + \varepsilon_t \} \qquad (1).$$

Here, A_t is the number of full-time managers and administrators at time t; N_t measures non-administrative, non-managerial FTEs at time t; C_1, S_1, E_1, and A_1 are dummies denoting (respectively) the commitment, star, engineering, and autocracy models of employment at founding (time 1); H_1 is a dummy for "hybrid" firms that embody attributes of multiple models and therefore do not fit into one of the five basic employment model categories (see Appendix for more details on how the categories are defined); Fem_1 denotes the proportion female in the firm's full-time workforce at the end of the first year; and ε_t is an error term. The effects of employment models are expressed relative to the omitted category: the bureaucratic model.

---

[7]A survey sent to the person in each firm responsible for human resources asked the number of full-time equivalent employees or "FTEs" (total and female) in eight broad occupational categories: senior management; other administrative and managerial; engineering and scientific; sales and marketing; clerical; skilled labor; semi-skilled and unskilled labor; and other. Respondents provided this information for one year after founding and the period when the company was first visited by the research team (June 1, 1994 or June 1, 1995). We measure managerial–administrative intensity as the (logged) FTEs in senior management and "other administrative and managerial" positions at a given point in time.

If $\alpha=1$, then the number of administrators increases linearly with the number of non-administrators. If $\alpha<1$, then there are economies of scale in administration and management. We chose this functional form to constrain the predicted dependent variable to be non-negative. Using weighted least squares,[8] we estimate this model in log-linear form:

$$\ln A_t = \alpha \ln N_t + \beta_1 C_1 + \beta_2 S_1 + \beta_3 E_1 + \beta_4 A_1 + \beta_5 H_1 + \gamma Fem_1 + \varepsilon_t \qquad (2).$$

Inspection of the relationship between the number of managerial–administrative FTEs and the number of other full-time employees indicated some non-linearity even in the log-log relationship. We wanted to ensure that any substantive results were not merely artifacts of having misspecified the function relating administrative to non-administrative employment. Accordingly, we also constructed a term to capture quadratic effects: $Q_t = (N_t - 100)^2$. Thus, Q_t is the squared deviation between the number of non-administrators in the firm and 100 (which is close to the average size for the sample as a whole). Expressing this effect as a deviation from 100 produces a meaningful reference point for the effect of α: it is roughly the size effect for the average firm in the sample. We include the natural log of Q_t as an additional regressor, along with the variables shown in (2). In addition, the models include measures to control for firm age, industry business strategy, and public-private status.

Missing Data

Of 173 firms that agreed to take part in the study, 102 furnished completed HR surveys. As summarized in the Appendix, statistical analyses predicting whether firms returned the survey

---

[8]To correct for heteroskedasticity, we weight by an empirically-derived function of the log of 1994 full-time employment.

18

revealed little evidence of systematic differences between firms that did versus did not complete the survey. Nor did the pattern of results reported in this paper change when we controlled for non-response (by including the predicted probability of having completed the HR survey, based on a probit analysis, as an independent variable in models of managerial intensity).

Of the 102 firms that completed a survey, one firm did not provide sufficient data on employment by occupation to compute the dependent variable. We also did not have adequate information on seven firms to characterize the founder's blueprint (e.g., we were unable to interview a founder, or the interview was abbreviated and did not provide adequate information to code his/her assumptions reliably). This reduces the number of available cases to 94.

Of those 94 companies, 18 did not furnish information on their occupational or gender distribution at the end of the first year of operations. One reason for this is that many of the people who completed the HR surveys were not employed in the firm during its first year and did not have easy access to the information on gender and occupational mix at that time. This means that these 18 firms are missing information on two important independent variables describing the company's first year of operations: occupational gender mix and managerial intensity. The Appendix summarizes statistical analyses predicting which firms were unable to provide occupational and gender data for their first year of operations. The pattern of missing data is not random; in particular, the effects of founders' employment models on present-day managerial intensity are weakened considerably when firms that were unable to provide time 1 occupational data are included in the analysis. The Appendix suggests an explanation for this pattern and some implications for our analyses and conclusions. The Appendix also summarizes analyses using various imputation techniques to assign predicted values on first year gender composition to these 18 firms, to boost the sample size from 76 back up to the full 94 companies.

19

Given that we only have complete data on the dependent and key independent variables for 76 companies, the Appendix also reports results from bootstrapping analyses that help gauge whether our estimates of coefficients and standard errors are distorted by sampling variability.[9] Those analyses produce results that are extremely similar to those obtained in the actual sample of 76 SPEC companies, bolstering our confidence in the accuracy of the statistical estimates reported below.

RESULTS

Descriptive Statistics

Table 2 reports descriptive statistics for key variables in our analysis, based on the 76 firms having complete data. The average firm was roughly 6 years old when first interviewed and had 27 senior managers and administrators overseeing 111 other employees.[10]

(Insert Table 2 about here)

Some additional descriptive information highlights the considerable variation among these companies, even in their first year of operations. At the end of the first year, the firms ranged in size between 1 and 440 full-time employees, with a mean of 29.1; by the time they were first interviewed in 1994–5, they ranged between 6 and 1,895 employees, with an average of 135.8. At the end of the first year, the administrative–managerial contingent averaged about 40% of the

_____

[9]In conducting those analyses, SPEC firms are randomly sampled (with replacement) to create a pseudo-sample with N=76, which is used to re-estimate the specification on which our main substantive conclusions are based (model 2 of Table 3). One thousand such pseudo-samples were drawn, and the mean and standard error for each "bootstrapped" regression coefficient reflect the distribution of outcomes realized in those 1000 replications.

[10]All counts of employees are given in terms of full-time equivalents (FTEs).

workforce in these companies, ranging from 9% to 100%; by 1994–5, the average had declined to 24%, with a range from 6 to 89%. Women averaged 22% of the full-time workforce at the end of the first year of operations (ranging from 0% to 64%); the mean increased to 31% by 1994–5, with a range of 0% to 77%.

Effect of Founders' Models

The effects of the founder's employment model generally support our hypotheses. (The Appendix explains how we chose to represent employment models for this analysis.) Each of the other models of the employment relation entails less managerial intensity than the bureaucracy model, the reference category. As predicted, the contrast is greatest vis-à-vis the commitment model: the estimated effect of the commitment model in the log-linear specification (-0.989 in model 2 of Table 3) implies that commitment-model firms had only 37% as many administrators ($e^{-0.989} = 0.372$) at the same (non-administrative) workforce size as did otherwise-similar firms founded along bureaucratic lines. This is a striking difference. For instance, consider two firms each with 50 non-administrative employees in 1994-5 and differing only in having been built around a bureaucratic versus commitment model. Our estimates imply that the former had 25.5 full-time managers and administrators, compared to 9.2 in the latter; at 500 non-administrative employees, the contrast is 184.2 versus 66.2 managers and administrators, respectively; at 1500, the difference is 485.4 versus 174.5 full-time managers and administrators.

The star model is the next least bureaucratic, as predicted, with firms whose founders espoused the star model having about 45% as many full-time administrators and managers at the same (non-administrative, non-managerial) workforce size as otherwise-similar firms that began with a bureaucracy model (i.e., $e^{-0.807} = 2.241$). The remaining three categories (autocracy,

engineering, and other) are also less administratively intense than firms founded with a bureaucracy model, though the contrast between autocracies and bureaucracies is not statistically significant at the .10 level.[11]

The effect of founders' blueprints on the subsequent proliferation of administrators and managers suggests a process of path-dependent development. Before adopting that interpretation, however, we conducted several supplementary analyses (results available upon request). First, we estimated models that added a control for administrative intensity and/or for non-administrative/non-managerial employment *during the company's first year of operations*. These specifications control for any unobserved differences among firms (e.g. scale or scope) that might have required more bureaucracy from the outset. When added to the specification in model 2 of Table 3, the effect of managerial–administrative intensity at time 1 (logged FTEs) is not significant (b=–0.034; t=–0.504) and its inclusion does not change the results appreciably. Nor does controlling for (logged) time 1 non-administrative employment (b=–0.020; t=–0.676).

Second, we replaced the variables depicting the founders' models with corresponding variables for the blueprints espoused by the CEO when interviewed in 1994–5. Given that we interviewed founders in 1994–5, one might worry that they crafted their retrospective accounts to reflect what has transpired since the founding of the firm. For instance, they might claim to have embraced a bureaucratic model after having seen the firm become top-heavy with managers and administrators (see Golden 1997). And when asked in 1994-5 to characterize their implicit

_____

[11]If the commitment model is made the omitted category in Model 2 of Table 3, the contrasts with autocracy, bureaucracy, and hybrid are each significant at the .05 level (two-tailed); the contrast with engineering is significant at the .10 level; and the contrast with the star model is not significant.

assumptions regarding employment relations, the then-current CEOs may have simply been rationalizing what *is* in their respective organizations, rather than espousing their views of what *should be*. If such biases are at work, they should be most evident in the responses of the then-CEO, particularly in situations where a founder was still CEO. (A founder was still CEO in 64% of the 76 companies analyzed in Table 3.)

Model 3 in Table 3 reports results from a regression that replaces variables denoting founders' employment models with measures characterizing CEOs' espoused models in 1994-5. None of the contrasts vis-à-vis bureaucracy is significant in Model 3, and a joint test on all five variables depicting CEOs' models indicates that they are not statistically significant as a group (F=0.833; p=.531)[12]. (In a model that specifies effects of *both* founders' and CEOs' models, none of the latter effects is significant and the effects of founders' models are not diminished; results available on request). Furthermore, supplementary analyses that control for whether the founder was still CEO do not reveal a significant main effect nor any interaction effect with founder's model; in other words, the "imprinting effect" of the founder's model on present-day administrative intensity is not appreciably different in firms where the current CEO is not a founder versus firms where the same person (the founder-CEO) characterized the founding conditions and present-day circumstances.

In our view, these results provide quite strong evidence in support of path dependence and against the notion of biased response by our respondents. It is the *founder's* organizational blueprint, not the reported convictions of the then-current CEO, that relate most strongly to current

---

[12]If the commitment model is specified as the omitted category, the contrast with engineering and the hybrid category approach statistical significance (b=.338, t=1.749 for engineering; b=.272, t=1.683 for hybrid).

administrative intensity. The path-dependent effect of the founder's model is just as strong in firms where the founder is no longer CEO (and thus was not our source of information about the firm's present-day circumstances). Moreover, recall that our measure of administrative intensity is an objective one derived from occupational data provided from the HR Survey (typically filled out by someone other than the founder or CEO). This reduces the likelihood of any spurious association between our dependent variable and the interview responses of founders and CEOs used to characterize their employment blueprints.

Effect of Initial Gender Composition

Gender composition at the end of the first year of operations has a significant negative effect on administrative intensity at time t, in support of the sociological account. In model 2 of Table 3, this effect is significant beyond the .01 level on a two-tailed test ($b=-0.957$; $t=-2.806$; $p=.007$). Thus, firms that began with higher fractions of female employees proliferated fewer managerial and administrative positions for a (non-administrative) workforce of a given size. Given the small sample and exploratory nature of this analysis, we do not wish to over-interpret this result. Nonetheless, this effect is quite large in substantive terms and is robust across many different specifications. Take as the baseline of comparison a firm with only male employees in its first year. Relative to the all-male baseline, a firm that was 25% female at the end of the first year (which is close to the sample mean) is predicted to have had only 79% as many administrators by 1994–5. To pick a different comparison, a difference of one standard deviation (0.1563) in a

24

firm's initial proportion female translates into a difference of 16% in the number of full-time

managers and administrators in 1994-5, all else being equal.[13]

Not surprisingly, differences among firms in gender composition are fairly stable over time;

for firms analyzed in Table 3, the bivariate correlation between percent female in the first year and

in 1994–5 is 0.52. As we found in comparing the effects of founders' versus CEOs' models of the

employment relation, early gender mix seems to matter more than contemporaneous gender

composition in determining the growth of administrative overhead. Analyzing the same firms as in

model 2 of Table 3, we replaced first-year gender composition with a measure of percent female in

1994-5. In that analysis, the latter effect is sizable ($b=-1.010$) but only approaches statistical

significance ($t=-1.772$, $p=.081$, two-tailed). When we include measures of gender mix at both

points in time, the measure *of first-year gender composition* has a stronger impact on

administrative intensity (though, not surprisingly, the time 1 effect is diminished slightly when both

measures are included in a single model).[14] This is an additional piece of evidence in support of the

claim that the evolution of administrative structures is path dependent.

We also estimated models incorporating controls for (logged) managerial–administrative

employment at time 1 (to focus solely on *growth* in bureaucratization over time) and models that

_____

[13]The estimated effect of proportion female in column 2 of Table 3 is −0.957. Thus, the estimated effect at 25%

female is exp(−0.957 x .25)=0.787. Similarly, the standard deviation of time 1 proportion female is 0.1563, for a

predicted effect of exp(−0.957 x −0.1563)=1.161.

[14]The effect for gender composition at time 1 declines from −0.957 (in column 2 of Table 3) to −0.776 (t=−1.897);

the effect for gender composition in 1994–5 is −0.427 (t=−0.667).

controlled for (logged) non-administrative employment at time 1. Those variables did not have

significant net effects on administrative intensity in 1994-5, and the large negative effect of initial

gender composition on bureaucratization persists despite these controls.

Finally, we conducted analyses that disaggregated the gender composition at time 1 by

occupation. The results indicate that it is the early presence of women *among the firm's core

workforce* that slows down the rate of bureaucratization: the proportion of scientist and engineering

jobs held by women in the first year has a significant negative effect on administrative intensity

($b=-0.652$; $t=-2.336$) whereas women's share of other jobs in the firm has only a trivial effect

($b=-0.171$; $t=-0.622$). The finding that women's early representation in the key scientific and

engineering occupations shaped subsequent bureaucratization within these technology-based

companies provides additional evidence that the gender composition effect is not spurious but

instead captures differences in the need for formal administration and management attributable to

the social demography of an organization's core workforce early in its history. We return to this

issue in the conclusion.

Effects of Control Variables

With a constant of -0.031, $\hat{\alpha} = 0.803$, and a quadratic effect of 0.029, and setting all other

covariates to zero, our specification in model 2 of Table 3 implies a ratio of full-time

managers/administrators to other employees of 1.34 for a firm with only one full-time non-

administrator (the smallest value observed in our sample), 0.85 for a firm with 10 non-

administrators, and around 0.42 at 100 non-administrators. However, according to our

specification, the ratio increases slightly beyond that size: to around 0.48 between 120 and 200,

then declining to 0.43 at 500, 0.39 at 1000, and .37 at 1582 (the size of the firm in our sample

having the largest number of non-administrators). Thus, our results suggest strong economies of scale in administration as young companies grow to the size of the average firm in our sample (roughly 115 non-administrators). However, managerial and administrative jobs appear to grow at a slightly faster rate than the rest of the workforce as firms add approximately their second hundred non-administrative employees. Beyond more than several hundred non-administrators, only slight economies of scale are associated with subsequent growth in managerial and administrative roles; our estimates imply that the ratio of overhead to non-overhead positions remains at about 2:3 throughout the rest of the size range, differing only modestly between firms having 500 versus 1500 non-administrative employees.

Our particular non-linear specification of the relationship between administrative and non-administrative employment was based on examination of the data (chosen to ensure that the other effects in our model are not spurious), rather than being derived from any particular theory or formal model. Consequently, we do not want to over-interpret this non-linear pattern, and we are also mindful that cross-sectional relationships involving size differences among organizations do not necessarily reflect the dynamics of growth. Yet it is interesting to note that among the SPEC firms with complete data that had added a full-time HR specialist, the average employment size was around 100 employees at the time the HR function was added. This result suggests that this is the scale at which organizational infrastructure begins being added. Moreover, the upturn in the rate of bureaucratization observed in this sample after firms reach about 100 employees is broadly consistent with other research examining the dynamics of bureaucratization (e.g., Haire 1959). If these results faithfully capture the dynamics of bureaucratization within this sample, they suggest that the principal bursts of overhead creation in technology start-ups occur at founding and as organizations grow between roughly 100 and 200 employees.

27

We find that becoming a publicly traded company significantly increases the number of managerial and administrative positions. Neo-institutionalists might construe this as evidence of the need or desire for public companies to establish legitimacy by adopting formal structures, and elsewhere we have reported some evidence on formalization among the SPEC firms that is broadly consistent with such accounts (see Baron, Burton, and Hannan, forthcoming). However, any public company must discharge numerous responsibilities—including financial reporting, compliance with various regulatory agencies, and managing investor relations—that likely increase the need for administration and management. Consequently, we do not find this particular result very startling. In supplementary analyses, we examined the effects of CEO succession, employment growth, and receiving venture capital, but none of these had a significant effect on administrative intensity net of the other variables in model 2.

Finally, we found only modest effects of industry and strategy. Not surprisingly, companies intending to rely on marketing and customer service as key competitive competencies added more administrative overhead over time than companies of a similar size pursuing other strategies. Relative to the omitted industry category (medical devices and biotechnology, which face considerable legal and regulatory demands), other firms were slower to add overhead, particularly companies in semiconductors or technology-based manufacturing.

Other Supplementary Analyses

We were concerned that the founder's blueprint or the firm's early gender mix might reflect other differences across organizations that affect the demand for managers and administrators. For instance, one might suspect that differences in firms' occupational composition could account for variation in both employment model and in gender mix. Similarly, firms might vary in their propensity to carry out particular functions by relying on external providers rather than using

employees. To explore these possibilities, we estimated numerous other specifications on the sample of 76 firms (available upon request), which controlled for: occupational composition at time 1 and in 1994-5 (i.e., the percentage of workers in science and engineering jobs versus clerical jobs versus other non-administrative jobs); the extent to which independent contractors were used in different occupations and differences in the propensity to outsource various administrative functions; formalization of the employment system (the number of formal HR practices adopted) within the first year and over time; the size, growth, and structure of the human resources function; CEO succession; and the presence of women within senior management in the firm's first year. We found few consistent effects of any of these factors on administrative intensity. Moreover, the effects of initial gender composition and founders' models were unchanged in models including these various additional controls.

DISCUSSION

Recent organizational scholarship by neo-institutionalists emphasizes how top managers' conceptions of control shape the evolution of the enterprises they command (e.g., Fligstein 1987). We have empirically characterized the organizational models or blueprints that founders had in mind in building new organizations. Drawing on our previous work, we argued that those blueprints can be categorized into a small number of distinctive types, which vary in their assumptions about the nature of organizational attachment, the strategy for selecting employees, and the principal basis of coordination and control.

That we identified five distinct blueprints within this sample is itself noteworthy, given the relatively homogeneous set of companies we analyzed: high-technology enterprises founded during one historical period; all located in the same area; founded by people who tend to know one another

and to draw on the same pools of employees, advisors, and potential financiers. Even among firms competing directly in the same narrow market segment, we sometimes observed markedly different organizational models being espoused by their respective founders. The different models for organizing that we identified drew on widely-shared conceptions about organizations that were available to the founders and prospective employees of these companies. For instance, the revered status of Hewlett-Packard in Silicon Valley folklore, coupled with all the writings on Japanese management in the 1980s, ensured that founders and employees had a clear conception of what the pure commitment model entails. Similarly, the star model is isomorphic with the familiar organizational model of basic science (including universities).

At one level, the existence of these diverse models seems at odds with institutional accounts that tend to assume a dominant logic of organizing within particular organizational fields. Yet some institutionalists (e.g., Scott 1995) argue that institutional forces can also define the contours of *differentiation* within a population. This suggests an important agenda for future neo-institutional research: to consider how much and what types of differentiation in organizational models can exist within a given field without doing violence to the assumptions underlying institutional theory. To have predictive value, institutional theory ultimately must be able to specify *ex ante* where a given realm of organizational activity falls between the poles of "all organizations are the same" and "all organizations are different." Norms and institutions can promote isomorphism within a population, but they can also structure and sustain differentiation among organizations. When and how do we observe institutional forces doing the latter versus the former? For instance, as dependent care and elder care providers enter the market economy in large numbers, how broad a range of models will be viable, along what dimension(s) will they be organized, and what will be the regulatory, normative, and cognitive factors that encourage or

discourage isomorphism within that organizational sphere? Are the answers different for dependent care centers than for, say, Internet service providers? If so, how and why?

We hasten to emphasize that in operationalizing the models or blueprints espoused by founders, we do not at all mean to reduce the process of organization-building to the personality, temperament, or idiosyncrasies of the founder(s). In other research, we have documented that founders' organizational blueprints are associated with a number of factors, including the intended business strategy and the early influence of important external constituents such as venture capitalists (see Burton et al., 1998; Baron et al., forthcoming). To put it differently, founders may embed their distinctive visions and values on the enterprises they create, or they may simply be the conduits through which economic, social, or cultural forces systematically shape organizational blueprints. Our results here demonstrate that those blueprints are consequential for the pace of bureaucratization, but they do not resolve the thorny issue of the distinctive contribution made by founders and other actors in the building and changing organizations. As DiMaggio (1988) has noted, clarifying the role of "agency" remains a top priority for theory and research in the neo-institutionalist tradition.

We acknowledge that our study has various limitations, including a relatively small and homogeneous sample (of firms that survived long enough to permit study by our team); retrospective accounts of organization-building (obtained in most cases from a small number of the key actors involved); a method of classifying organizational models based largely on the assumptions and rationales provided by informants; limited data on the sources of the founders' models and on how faithfully they were implemented; and so on. On the other hand, we think our study is distinctive and noteworthy for taking seriously the institutionalists' concept of "models of organizing," seeking to operationalize the construct and empirically assess how founders'

31

blueprints affect organizational evolution. For the most part, the extant institutional literature has tended either to: (a) posit a single dominant logic of organizing within a given field; (b) infer organizational models from organizational outcomes; or (c) assume that models emanate from various sources of influence (e.g., educational institutions, occupational socialization, government regulation, professional groups) and measure an organization's "proximity" to those sources (e.g., the occupational background of its top executives, extent of government regulation). We have little doubt that future research can improve on our efforts to identify the organizational models embraced by key actors as they seek to create new enterprises (or transform old ones), tracing the origins of those models and examining their effects on organizational evolution. Moreover, it remains to be seen whether the dimensions and typology we used to differentiate among the employment models in our sample will prove useful in studies of other populations of organizations. Until the new institutionalism tackles these issues, however, it will remain susceptible to criticism on the grounds that its central constructs—conceptions of organizing and the legitimacy those conceptions supposedly confer—do not get represented well in empirical research (for an exception, see Deephouse 1996).

Our analyses revealed fairly compelling evidence of path dependence in bureaucratization. Founders' initial models of the employment relation shaped the administrative and managerial intensity of their firms in the ensuing years. We found dramatic differences in the extent to which organizations of the same size elaborated administrative and managerial jobs, with the most extreme contrast being between firms whose founders had championed a commitment model versus a classic bureaucratic model. Thus, our findings are consistent with the assertion that early investments in inculturation and systems of cultural control enable organization builders to economize on the need for formal management and administration. Indeed, founders' initial

organizational blueprints did a much better job in predicting managerial intensity in 1994–5 than did the organizational blueprints espoused by CEOs in 1994–5.

One might ask whether a six-year time interval (which was typical of the firms we studied) is long enough to provide a strong test of path-dependence. Yet, for many of the companies in our sample, six years is a long time indeed, subsuming several generations of products, stages of financing, and executive turnover events. (One SPEC firm, just over eight years old when visited in 1995, was already on its seventh president and sixth chief executive![15]) As Hannan and Freeman (1984) argued, one must assess the pace of organizational change relative to the environmental pressures and turbulence an enterprise faces. By that criterion, an enduring imprint of founding conditions five to ten years into the life of technology start-ups seems to us compelling evidence of path dependence.

Our analyses also highlight the challenges that organizational researchers face in trying to characterize the conditions that prevailed during key periods in an organization's history, particularly for long lived enterprises and those that no longer exist. For instance, when firms that did not furnish labor force statistics from their first year of operations were included in our analyses, the effects of founder's initial models on subsequent bureaucratization were weakened considerably (see Appendix). Supplementary analyses suggested that this is because those companies had weaker organizational memories than enterprises that were able to provide historical employment data. The fact that our estimates of the effect of founders' blueprints depended somewhat on whether or not firms provided historical employment data suggests that

---

[15] The founding CEO was temporarily brought back as CEO after having previously stepped down, so the six regimes actually reflect five different leaders.

caution is warranted in drawing inferences about path dependence from our findings, at least until they can be replicated in other settings. But we think there is a broader, and more important, implication as well. Pragmatic considerations frequently dictate that organizational researchers must rely on retrospective data collection to gather longitudinal information, as we have done (though we designed our study to minimize the likelihood of such difficulties by restricting attention to firms still in their early years). Our results regarding non-random missing data should serve as a useful reminder that the mere (in)ability of informants to furnish data on the enterprise's past may influence the likelihood of unearthing evidence of path-dependent development. Researchers must consider carefully how the formats by which data on the past are collected might influence the findings and conclusions. For instance, simplifying and standardizing the formats in which organizational informants report on the past might boost the response rate and facilitate comparisons across enterprises, but it might also reduce the likelihood of discovering path-dependent developmental trajectories by artificially homogenizing the form in which organizations report on their histories.

If future studies confirm the strong enduring effects of early blueprints on organizational evolution that were evident in our analyses, this would suggest some fruitful avenues for subsequent research. First, a thorough understanding of founding conditions and initial blueprints might prove critical for predicting important changes (or the lack of changes) at later points in time. Consider the recent waves of corporate downsizings, focused at least partly on managers and administrators. Both scholarly and journalistic discussions have argued that downsizings frequently prove ineffectual in the long run because they reflect a "binge and purge" process, with organizations soon adding back the overhead that they cut during the last round of layoffs. Though few companies in our sample have undergone significant downsizings, an understanding of the

founders' organizational blueprints might help to predict: (a) the probability of making significant managerial–administrative cuts; and (b) the likely permanence of those cuts. For instance, in organizations whose founders embraced a bureaucratic model from the start, the centrality of managerial and administrative functions likely gets accepted more widely and deeply than in organizations that early on embraced a commitment or star model.

Future work might also examine the processes that institutionalize the blueprints of founders and other early organizational architects, thereby producing the path-dependent effects that we have documented. Among the 76 companies that were the main focus of analysis in this paper, roughly 36% had replaced their original founder–CEO with a non-founder CEO by 1994–5. Moreover, based on our coding protocol, the organizational model had changed in 51% of companies (and in 65% of firms with a non-founder CEO, versus 43% of those where a founder was still CEO). Given these changes in leadership and organizational models, along with the many other dramatic changes that start-ups in our sample have experienced (rapid growth, mergers, going public, etc.), the enduring effects of founding conditions are all the more striking. Future theoretical and empirical work identifying the internal and external factors that strengthen or weaken the imprinting of founding conditions would be very useful.

We conjectured that organization-building might be affected by the social composition of an organization's workforce—specifically, its early gender mix. We found a robust, negative effect of initial proportion female on later administrative intensity. As was the case for the effects of employment models, initial conditions (gender mix in the first year) mattered more than

contemporaneous conditions (gender mix in 1994–5) in predicting subsequent bureaucratization.[16] To explore the process by which early gender mix influences subsequent bureaucratization, we focused in depth on firms that had an unusually large representation of women within the first year and that were less administratively intense than otherwise-comparable companies, drawing on transcripts of our interviews with key informants.[17]

These analyses suggest that the early presence of women seems to be an indirect result of *network-based recruitment strategies*. In some cases the founders were well established in an industry and drew upon their professional contacts. For example, two early-stage biotechnology firms were founded by scientific teams from established firms. These founders were able to recruit associates from their prior employer to the new venture as well as other colleagues from the industry. In other cases, founders relied on people known from their ethnic or religious community. One founder, an Asian entrepreneur in contract manufacturing, described his dilemma: "We know [that] our size, our name, our business won't attract any top-notch people. So you have to use your relationships. People who know you can be successful. They believe you more than they believe in the business." As a result of this personal recruiting strategy, his

---

[16]One might suspect that the founder's employment model is a strong determinant of the firm's gender composition and extent of gender segregation. However, employment models and gender composition at time 1 are not significantly correlated, and regression models predicting initial gender composition from founders' HR models (controlling for other time 1 covariates) reveal no significant effects.

[17]We identified these firms by estimating the regression in model 2 of Table 3 but omitting time 1 gender mix, calculating residuals from that equation, and identifying cases with large negative residuals that were also well above the median on time 1 proportion female.

employees (including a number of women) were primarily Asian and either directly or indirectly part of his social network. Similarly, another entrepreneur described his workforce:

> It actually happened that most of the people we employ are Mexican Americans. We have some Filipinos and some Portuguese. Not because we made any effort in that area, but what happened was when we started there were four people. Two were Mexican Americans, one was Portuguese and one was Filipino. When we started to grow it was slow. We needed one or two people. Our best bet was someone our employees knew. They always knew somebody.

This suggests a different interpretation for our result that technology start-ups with a higher fraction of women in the early years develop less bureaucracy over time. This finding might simply reflect the fact that firms in which women were present from the start were the ones most likely to be built by relying on personal networks, creating a larger stock of "social capital" on which founders could draw as an alternative to formalized structures of coordination and control. (Recall that according to supplementary analyses, the gender composition effect was restricted to women's prevalence within the core scientific and engineering occupations in these companies, which is where network-based recruitment is most likely to take place in the start-up phase.) The social similarities and strong interpersonal connections established through network-based hiring facilitate reliance on peer monitoring and self-management, as alternatives to formal means of coordination and control, which might become institutionalized as firms grow and age.

Additional research on this topic would be invaluable. If our finding proves to generalize and our interpretation is borne out by future research, this would raise interesting questions about gender and employment in fluid labor markets like Silicon Valley. In particular, the notion that women penetrate technology-based start-ups through network-based hiring potentially runs counter

to two widely accepted views. The first is that bureaucratic employment systems favor less advantaged groups because they enforce universalistic criteria in recruitment and selection. The second is the notion that social networks are so homophilous with respect to gender (McPherson and Smith-Lovin 1987) that network-based recruitment would lower gender diversity of employment. If women secured senior management or key scientific and technical roles in our sample of start-ups primarily through network ties, this raises the question of how they were able to form those ties in the first place. Are there particular organizational settings (e.g., in well-established companies, in business and engineering schools) that are conducive to the formation of ties that cross lines of sex, race–ethnicity, and other social categories, which can be leveraged to gain positions in new enterprises? Research along these lines could enhance not only our understanding of social networks and labor market outcomes, but also the factors that influence who is represented among founders and key employees of new enterprises, which our analyses suggest is crucial in shaping how those organizations evolve over time.

REFERENCES

Barnett, William P., and Glenn R. Carroll. 1995. "Modeling Internal Organizational Change."
Annual Review of Sociology 21:217-36.

Baron, James N., M. Diane Burton and Michael T. Hannan. 1996. "The Road Taken: The Origins
and Evolution of Employment Systems in Emerging High-Technology Companies." *Industrial
and Corporate Change* 5:239–76.

————. Forthcoming. "Engineering Bureaucracy: The Genesis of Formal Policies, Positions, and
Structures in High Technology Firms." *Journal of Law, Economics, and Organization*.

Baron, James N., Alison Davis-Blake and William T. Bielby. 1986. "The Structure of
Opportunity: How Promotion Ladders Vary Within and Among Organizations." *Administrative
Science Quarterly* 31:248–73.

Becker, Gary. 1957. *The Economics of Discrimination*. Chicago: University of Chicago Press.

Bielby, William T. and James N. Baron. 1986. "Men and Women at Work: Sex Segregation and
Statistical Discrimination." *American Journal of Sociology* 91:759–99.

Blau, Peter M. 1970. "A Formal Theory of Differentiation in Organizations." *American
Sociological Review* 35:201–18.

Blau, Peter M. and Richard A. Schoenherr. 1971. *The Structures of Organizations*. New York:
Basic Books.

Boeker, Warren. 1988. "Organizational Origins: Entrepreneurial and Environmental Imprinting
at the Time of Founding." Pp. 33-51 in Glenn R. Carroll (ed.) *Ecological Models of
Organizations*. Cambridge, MA: Ballinger.

————. 1989. "Strategic Change: The Effects of Founding and History." *Academy of
Management Journal* 32:489-515.

Burton, M. Diane. 1995. *The Evolution of Employment Systems in High Technology Firms.* Unpublished Ph.D. dissertation, Stanford University.

Burton, M. Diane, Michael T. Hannan, and James N. Baron. 1998. "Employment Models in Entrepreneurial Companies." Unpublished manuscript, Harvard Business School.

Carroll, Glenn R., and J. Richard Harrison. 1994. "On the Historical Efficiency of Competition between Organizational Populations," *American Journal of Sociology* 100 (November): 720-49.

Deephouse, David L. 1996. "Does Isomorphism Legitimate?" *Academy of Management Journal* 39:1024-1039

Dimaggio, Paul J. 1988. "Interest and Agency in Institutional Theory." Pp. 3-21 in *Institutional Patterns and Organizations: Culture and Environment*, edited by Lynne G. Zucker. Cambridge, MA: Ballinger.

Dobbin, Frank, John R. Sutton, John W. Meyer and W. Richard Scott. 1994. "Equal Opportunity Law and the Construction of Internal Labor Markets." Pp. 272–300 in *Institutional Environments and Organizations: Structural Complexity and Individualism*, edited by W. Richard Scott, John W. Meyer and Associates. Thousand Oaks, CA: Sage.

Edelman, Lauren B. 1990. "Legal Environments and Organizational Governance: The Expansion of Due Process in the American Workplace." *American Journal of Sociology* 96:1401–40.

Edwards, Richard C. 1979. *Contested Terrain: The Transformation of the Workplace in the Twentieth Century.* New York: Basic.

Fligstein, Neil. 1987. "The Intraorganizational Power Struggle: The Rise of Finance Presidents in Large Corporations." *American Sociological Review* 52:44-58.

———. 1990. *The Transformation of Corporate Control.* Cambridge: Harvard University

Press.

Golden, Brian R. 1997. "Further Remarks on Retrospective Accounts in Organizational and

Strategic Management Research." *Academy of Management Journal* 40:1243-52.

Haire, Mason. 1959. "Biological Models and Empirical Histories of the Growth of

Organizations." Pp. 272-306 in *Modern Organization Theory*, edited by Mason Haire. New

York: Wiley.

Hannan, Michael T., M. Diane Burton, and James N. Baron. 1996. "Inertia and Change in the

Early Years: Employment Relations in Young, High-Technology Firms." *Industrial and

Corporate Change* 5:503–36.

Hannan, Michael T. and John Freeman. 1977. "The Population Ecology of Organizations."

American Journal of Sociology 82:929–64.

———. 1984. "Structural Inertia and Organizational Change." *American Sociological Review*

49:149–64.

Martin, Joanne, Kathy Knopoff, and Christine Beckman. 1998. "Seeking an Alternative to

Bureaucratic Impersonality and Emotional Labor: Bounded Emotionality at The Body Shop."

Administrative Science Quarterly 43: 429-69.

McPherson, J. Miller and Lynn Smith-Lovin. 1987. "Homophily in Voluntary Associations:

Status Distance and the Composition of Face-to-Face Groups." *American Sociological Review*

52:370–79.

Meyer, John W. and Brian Rowan. 1977. "Institutionalized Organizations: Formal Structure as

Myth and Ceremony," *American Journal of Sociology* 83:340–63.

Meyer, John W. and W. Richard Scott. 1992. *Organizational Environments: Ritual and Rationality.* Updated ed. Beverly Hills CA: Sage.

Polachek, Solomon. 1979. "Occupational Segregation Among Women: Theory, Evidence, and Prognosis". Pp. 137-57 in *Women in the Labor Market,* edited by Cynthia B. Lloyd, Emily S. Andrews, and Curtis C. Gilroy. New York: Columbia University Press.

Pugh, D. S., D. R. Hickson, C. R. Hinings, and C. Turner. 1968. "Dimensions of Organizational Structure." *Administrative Science Quarterly* 13:65–91.

Reskin, Barbara F. and Patricia A. Roos. 1990. *Job Queues, Gender Queues: Explaining Women's Inroads into Male Occupations.* Philadelphia: Temple University Press

Saxenian, AnnaLee. 1994. *Regional Advantage: Culture and Competition in Silicon Valley and Route 128.* Cambridge, MA: Harvard University Press.

Scott, W. Richard. 1995. *Institutions and Organizations.* Thousand Oaks, CA: Sage.

——— 1992. *Organizations: Rational, Natural, and Open Systems.* Third edition. Englewood Cliffs, NJ: Prentice-Hall.

Shenhav, Yehouda. 1995. "From Chaos to Systems: The Engineering Foundations of Organization Theory, 1879-1932." *Administrative Science Quarterly* 40: 557-85.

Stinchcombe, Arthur L. 1965. "Social Structure and Organizations." Pp. 142-93 in *Handbook of Organizations,* edited by James G. March. Chicago: Rand-McNally.

Strang, David and James N. Baron. 1990. "Categorical Imperatives: The Structure of Job Titles in California State Agencies." *American Sociological Review* 55:479–95.

Tushman, Michael L. and Johann Peter Murmann. 1998. "Dominant Designs, Technology Cycles, and Organizational Outcomes." Pp. 231-66 in *Research in Organizational Behavior, Volume 20,* edited by Barry M. Staw and L. L. Cummings. Greenwich, CN: JAI Press.

Walton, Richard E. 1985. "From Control to Commitment in the Workplace." *Harvard Business*

Review 63:76-84.

APPENDIX

Alternative Specifications of Employment Models

Table A-1 reports estimates of models using several different ways to characterize the effects of founders' employment models, based on the 76 firms for which we have information on all variables.[1] Model 1 reports coefficients from a model with dummy variables corresponding to the five "pure type" models. The omitted category is bureaucracies, and firms that did not fit into one of the pure types are classified into a residual category (labeled "Hybrid Employment Model" in the table.) About 6% of firms were very close to one (and only one) pure type; we refer to these as "quasi-pure types." Model 2 in Table A-1 groups these quasi-pure types with the corresponding "pure type" cases. This increases moderately the number of cases in the commitment category, because a number of companies deviated from the pure commitment model in only one respect (e.g., attachment based on work as opposed to love). There were also several quasi-autocracies; recalling that pure autocracies were the rarest type, adding in the quasi-autocracies provides a slightly larger category for analysis. (There were no quasi-bureaucracies, so the reference category is still pure bureaucracies in model 2 of Table A-1.)[2]

---

[1]As noted in Table 3, all analyses were conducted using weighted least squares to correct for heteroskedasticity. Not surprisingly, in a sample like ours containing organizations of widely varying sizes, the residuals in an unweighted model predicting the number of managers and administrators were not homoskedastic. Rather, the error variance diminished with firm size. Accordingly, we used an empirically-derived scheme that weights observations as a function of the log of 1994 full-time employment. All descriptive statistics presented in tables and in the text are based on unweighted data, however.

[2]In supplementary analyses (available on request), we defined "bureaucracy" to include firms in which money, rather than work, was intended to be the basis of attachment. This slightly increases the number of firms contained in the

(Insert Table A-1 about here)

Given that only 6% of firms in our analysis are "quasi-pure" types, the results in models 1 and 2 differ only in two minor respects. First, the contrast between commitment and bureaucracy is slightly stronger when quasi-commitment firms are grouped with pure commitment firms (cf. columns 1 and 2).[3] (Perhaps the pure commitment model ultimately generates slightly more administrative overhead than the quasi-commitment model because the pure form of the model requires more extensive "care and feeding" of the labor force, even if employees require less direct managerial oversight.) Second, pure autocracies remained somewhat less bureaucratic over time than did quasi-autocracies; consequently, the contrast between autocracies and bureaucracies is more stark when based only on the pure-type cases (cf. models 1 and 2).

Given these results, we also examined a model that characterizes firms in terms of the three underlying *dimensions of* attachment, selection, and coordination–control, rather than in terms of pure types. Model 3 reports the results, based on a specification that includes dummy variables for the subcategories within each dimension—love and money for attachment, talent and fit for selection, and direct, normative, and professional for control—with the omitted category representing the combination of work, skills, and formal control that constitutes bureaucracy. The

---

(omitted) bureaucracy category; although the coefficients associated with the contrasts among founders' models are generally unchanged, the standard errors are reduced, producing somewhat larger t-statistics.

[3]This is because: (a) quasi-commitment firms, which tend to be less administratively intense, are grouped into the "Hybrid Employment Model" category in model 1, muting the contrasts among categories; and (b) the number of firms in the commitment category increases from 7.5% to 13% of the sample in model 2, providing more statistical power.

coefficients reported in the table are obtained by summing the dummy coefficients that correspond to each pure type (for instance, for the autocracy model, money, skills, and direct control).

The broad pattern of effects in model 3 is consistent with our expectations, and, as in models 1 and 2, the commitment model is revealed to be the least administratively intense. Not surprisingly, the coordination–control dimension has the strongest relationship to managerial intensity of the three dimensions: normative, professional, and direct control all entail somewhat lower levels of managerial intensity than does reliance on formal control. However, of the seven effects required to characterize firms along the three dimensions, only the contrast between direct and formalized control was statistically significant below the .05 level, with firms embracing direct control being less administratively intense ($b=-0.498$; $p=.033$). As one would expect, firms emphasizing cultural fit in selection were also somewhat less administratively intense than firms intending to select based on specific competencies ($b=-0.251$, $p=.089$). But taken as a group, the seven dummy variables representing firms' locations along the three dimensions do not contribute much in seeking to explain variation in managerial and administrative intensity ($F=1.545$; $p=.17$). In short, in accounting for differences in administrative intensity, the employment model types are more parsimonious and more powerful than the dimensions on which they are based. This result provides fairly compelling evidence that it is the specific pattern of *interactions among dimensions*, as reflected in the discrete types or models rather than an organization's position on any individual dimension, that is related to bureaucratization.

Analyses of Missing Data

Survey nonresponse. One source of missing data in our study is that only 102 (59%) of the 173 companies that participated in some manner in our project returned the HR survey that provided the information on staffing patterns we used to measure managerial intensity, as well as

gender and occupational composition and labor force size. We estimated various logistic and

probit regressions attempting to predict which firms did not provide the survey, in order to

determine whether non-response was systematic. Among the independent variables we examined

were founder's employment model, age, having gone public, having received venture capital,

whether a founder was still CEO, firm size (based on secondary information sources), whether the

firm had any full-time HR employee(s) as of 1994-5, industry, and strategy. Firms that had

received venture capital and/or hired at least one full-time HR employee by 1994-5 were slightly

more likely to have returned the HR survey. In contrast, larger firms and those pursuing a cost

strategy were slightly less likely to comply with our request for this information. However, only

the venture capital effect was significant at the .05 level, and the overall explanatory power of all

these prediction models was very weak. Furthermore, in no case did including predicted

probabilities from such selection equations as regressors in our substantive models alter the results.

In short, there is no evidence of bias associated with the pattern of missing data resulting from

some firms not filling out our HR survey.

Missing data on first year staffing. We have information on managerial–administrative

employment for 94 firms but we know the first year gender composition of only 76 of these firms.

Given our interest in analyzing effects of both employment models and gender composition, we

have concentrated on the 76 firms for which we have full information. Here we examine

consequences of this decision. Model 1 in Table A-2 reports estimates from a model lacking the

percent female variable, applied to all 94 firms. Model 2 includes a "missing data correction"; this

is the predicted probability for each firm from a probit regression predicting whether a given firm

was missing data on first year gender mix as a function of the other independent variables

incorporated in our analyses. That predicted probability is included on the right hand side in the

model reported in column 2. The overall explanatory power of the probit regression was weak and far from approaching statistical significance.

(Insert Table A-2 about here)

Even after this correction for missing data, the contrasts between bureaucracies and the other model types appear more muted in analyses based on the full set of 94 companies than in models estimated only on the 76 firms with complete data.[4] We suspect that *differential organizational memory* might account for the stronger effect of founders' models on managerial intensity among firms that provided staffing data for both time points (their first year of operations and 1994-5). Bear in mind that the 18 firms lacking staffing data for the first year of operations were willing and able to furnish that data for 1994-5. Hence, we suspected that the missing data for these firms might reflect something about them that made it difficult or costly to locate information on their past—that is, a limited organizational memory. Consistent with that conjecture, we found in supplementary analyses (available on request) that the strongest predictor of whether a firm was missing staffing data for the first year of operations was the firm's average turnover rate in the four years preceding our visit to the company. (Consistent with this conjecture, several other variables likely to capture continuity of organizational memory, such as a founder still being CEO or having established an HR department early in the firm's history, also moderately increased the odds of having provided early staffing data; however, these effects were not statistically significant.) Hence, it is not altogether surprising that founders' initial employment models display weaker effects on present-day managerial intensity when we include firms that were unable to

---

[4]The effect of going public is no longer significant in model 2. That variable is the only significant predictor of missing data on first year staffing, and consequently including the missing data correction in model 2 inflates the standard error associated with the effect of going public.

provide data on their early staffing levels, because those firms appear to have weaker

organizational memories. Put differently, the (in)ability of an organization to provide consistent

historical data provides important information about the strength of its organizational memory,

which in turn may influence the strength of the evidence uncovered regarding "path dependence."

Imputing missing data. We also explored methods for imputing missing data to increase our

effective sample size. Illustrative analyses are summarized in Table A-3. For the 102 firms that

had completed our HR survey and furnished information on 1994-5 staffing (required to measure

the dependent variable), model 1 in Table A-3 reports estimates from the same specification

reported in model 2 of Table 3, but based on substituting the observed sample mean on any

variable for which a firm was missing data. Model 2 reports estimates for the same model, but

based on the pairwise-present matrix of correlations. Model 3 reports estimates after using

regression techniques to impute missing data for the 18 firms that were missing data on gender

composition in year 1.[5] The results in Table A-3 are generally similar to those in Table 3. The

negative effect of proportion female and the negative effect of the commitment model relative to

bureaucracy) are evident irrespective of the methods used for imputing missing data, and the

effects of the control variables are also broadly consistent. The main difference is that the

---

[5]The imputation was done by applying a probit transformation to the measure of proportion female in year one, and

regressing that transformed variable on the other independent variables listed in Appendix Table A-3. Predicted

values from this regression were then transformed back into the original (proportion) metric and used as missing data

estimates. (Models that included additional right-hand-side variables in the prediction equation, including percent

female in 1994-5, yielded results that were no different than those reported in Table A-3. Also, adding a control in

model 3 of Table A-3 for whether missing data on gender composition was imputed for a given firm does not alter the

results.)

contrasts among models are less pronounced and less significant when missing data are imputed.

(The *t* statistics in parentheses in Table A-3 pertain to the contrast vis-à-vis "commitment," if that

category is omitted instead of "bureaucracy.") These weaker effects are consistent with our

contention above that the 18 firms that were unable to provide staffing data from their first year of

operations had weaker organizational memories. Consequently, including those cases in our

analyses and imputing missing data for them attenuates the effects of founders' models on present-

day administrative intensity that are evident in analyses based on firms with complete data.

Incidentally, it should be borne in mind that even though the effects of founder's models are smaller

and less significant in Table A-3, they are still far from trivial in substantive terms. For instance,

an effect of -0.30 for a particular model vis-à-vis bureaucracy implies that roughly six years (on

average) after their inception, firms founded according to that model are predicted to have only

74% as many full-time managerial–administrative specialists as otherwise-identical firms founded

along bureaucratic lines.

(Insert Appendix Table A-3 about here).

Bootstrapping

Given that we have complete data only for 76 companies, we used bootstrapping

techniques to gauge whether our results might be sensitive to sampling variability. For the 76

firms having complete data, model 4 in Table A-3 reports bootstrapped estimates of WLS

regression coefficients and *t* statistics for the same specification reported in model 2 of Table 3.

The coefficients and *t* statistics reported for model 4 are based on the mean for each coefficient and

its corresponding standard error obtained by running 1,000 replications in which 76 firms were

randomly sampled (with replacement) and the WLS model reported in model 2 of Table 3 was estimated using the "bstrap" routine in STATA 5.0.[6]

These bootstrapped results are very similar to the estimates reported in Table 3. (The only discernible difference is that the t statistics associated with the contrasts among models tend to be a bit smaller, particularly for the contrasts vis-à-vis the "commitment category," which are shown in parentheses.) On balance, the pattern of results obtained through bootstrapping is unchanged from the results reported in Table 3. This is particularly reassuring: despite the relatively small number of companies for which we have complete data, sampling variability does not appear to affect appreciably our estimates of the effects of founder's employment model and gender composition nor their statistical significance.

----

[6]In doing the bootstrapping, the same weighting specification used in model 2 of Table 3 was employed in every replication, rather than permitting the weighting scheme to vary across replications.

Table 1. Five Pure-Type Employment Models, Based on Three Dimensions.

| DIMENSIONS | | | EMPLOYMENT |
Attachment	Selection	Coordination/Control	MODEL
Work	Potential	Professional	STAR
Work	Skills	Peer/cultural	ENGINEERING
Love	Fit	Peer/cultural	COMMITMENT
Work	Skills	Formal	BUREAUCRACY
Money	Skills	Direct	AUTOCRACY

Table 2. Descriptive Statistics (N=76, unweighted).

Variable	Mean	Median	Standard Deviation
Firm age at first interview (1994-5)	6.17	5.88	2.98
Full-time employees in 1994-5	135.82	59.50	241.74
Full-time non-administrative employees in 1994-5	115.80	49.50	215.50
Log non-administrative employees in 1994-5	3.91	3.86	1.26
Full-time managers and administrators in 1994-5	27.83	13.00	44.74
Full-time employees at end of first year	29.09	14.00	65.77
Proportion female employees at end of first year	0.22	0.20	0.16

Dummy Variables	% of Sample
Founder's Employment Model (pure or quasi-pure type)[a]	
Commitment	13.16
Star	9.21
Engineering	32.89
Autocracy	5.26
Bureaucracy	5.26
Hybrid	34.21
CEO's Employment Model (pure or quasi-pure type)[a]	
Commitment	13.16
Star	5.26
Engineering	25.00
Autocracy	3.95
Bureaucracy	19.74
Hybrid	32.89
Founder's Intended Business Strategy	
Innovation Focus	55.26
Enhancement Focus	15.79
Marketing Focus	14.47
Cost Focus	3.95
Hybrid Marketing-Technology Focus	10.53
Industry	
Manufacturing	5.26
Medical-related	13.16
Semiconductor	10.53
Research	2.63
Computer (hardware or software)	48.68
Telecommunications/networking	19.74
Firm became public company by 1994-5	31.58
Firm received venture capital by 1994-5[^]	70.83
Founder was still CEO in 1994-5[§]	63.51

[a]Quasi-pure types differ on one dimension from one (and only one) of the pure types shown in Table 1.

[^]Number of valid cases=72.

[§]Number of valid cases=74.

Table 3. Weighted Least Squares Analysis of Managerial Intensity (log number of senior managers and administrators); N=76 firms.[a]

Variable	(1) Founder's model, without year 1 gender mix			(2) Founder's model, with year 1 gender mix			(3) CEO's Model, with year 1 gender mix	
	b	t		b	t		b	t
Employment Model (pure or quasi-pure type)[b]								
Founder's Model								
Commitment	-0.911	-3.090		-0.989	-3.568			
Star	-0.807	-2.791	(0.438)	-0.807	-2.996	(0.826)		
Engineering	-0.566	-2.258	(1.877)	-0.684	-2.872	(1.782)		
Autocracy	-0.424	-1.247	(1.813)	-0.427	-1.366	(2.311)		
Hybrid	-0.566	-2.184	(1.914)	-0.646	-2.634	(2.068)		
CEO's Model								
Commitment							-0.193	-1.009
Star							-0.029	-0.118
Engineering							0.145	0.839
Autocracy							-0.164	-0.381
Hybrid							0.079	0.540
Other Variables								
Proportion Female in Year One				-0.957	-2.806		-0.829	-2.193
Age in 1994-5	0.017	0.781		0.018	0.912		0.019	0.953
Size (ln number of non-managerial full-time employees in 1994-5)	0.748	13.35		0.803	14.359		0.806	12.879
Quadratic Size Term[c]	0.017	0.645		0.029	1.175		0.031	1.201
Firm Became Public by 1994-5	0.460	4.026		0.363	3.274		0.309	2.499
Research, Computer, or Telecommunications Industry	-0.052	-0.377		-0.142	-1.088		-0.114	-0.789
Semiconductor or Manufacturing Industry	-0.300	-2.006		-0.246	-1.765		-0.333	-2.165
Marketing-oriented Strategy	0.182	1.470		0.270	2.304		0.222	1.774
Constant	0.005	0.015		0.031	0.099		-0.706	-2.359
Log Likelihood	-43.765			-39.908			-45.774	
Adjusted R^2	0.864			0.887			0.854	
F (df)	40.616 (12)			46.074 (13)			34.863 (13)	

[a]Observations weighted as a function of 1994-5 (log) full-time employment to correct for heteroskedasticity. t statistics shown next to coefficients.

[b]Omitted employment model is "Bureaucracy." t statistics shown in parentheses for models 1 and 2 are for contrast with "Commitment" model instead of "Bureaucracy."

[c]Quadratic term equals: $\ln (size_{1994-5} -100)^2$.

Table A-1. Alternative Specifications of Effects of Employment Models on Managerial Intensity (N=76)[a]

Variable	(1) Pure Types		(2) Pure and Quasi-Pure Types		(3) Dimensions[d]	
	b	t	b	t	b	t
Commitment Employment Model[b]	-0.693	-2.149	-0.989	-3.568	*-0.661*	
Star Employment Model	-0.744	-2.381	-0.807	-2.996	*-0.571*	
Engineering Employment Model	-0.627	-2.466	-0.684	-2.872	*-0.353*	
Autocracy Employment Model	-0.718	-1.769	-0.427	-1.366	*-0.404*	
Hybrid Employment Model	-0.696	-2.670	-0.646	-2.634	---	
Proportion Female in Year One	-0.883	-2.240	-0.957	-2.806	-1.101	-2.644
Age in 1994-5	0.023	1.128	0.018	0.912	0.028	1.269
Size (ln number of non-managerial full-time employees in 1994-5)	0.795	13.210	0.803	14.359	0.787	13.114
Quadratic Size Term[c]	0.039	1.428	0.029	1.175	0.051	2.025
Firm Became Public by 1994-5	0.347	2.740	0.363	3.274	0.360	2.853
Research, Computer, or Telecommunications Industry	-0.125	-0.855	-0.142	-1.088	-0.153	-0.985
Semiconductor or Manufacturing Industry	-0.344	-2.351	-0.246	-1.765	-0.357	-2.441
Marketing-oriented Strategy	0.204	1.615	0.270	2.304	0.202	1.513
Constant	-0.073	-0.207	0.031	0.099	-0.323	-1.034
Log Likelihood	-43.781		-39.908		-42.193	
Adjusted R^2	0.862		0.887		0.864	
F (df)	36.997 (13)		46.074 (13)		32.762 (15)	

[a]t statistics shown in parentheses. Observations weighted as a function of log 1994 full-time employment to correct for heteroskedasticity.
[b]Omitted employment model is "Bureaucracy."
[c]Quadratic term equals: ln $(\text{size}_{1994\text{-}5}-100)^2$.
[d]Actual regression included dummy variables for dimensions of employment relationship: Attachment (Money and Love, with Work omitted), Selection (Talent and Fit, with Skills omitted), Control (Direct, Peer/Cultural, and Professional, with Bureaucratic omitted). Coefficients shown for each model (in italics under model 3) are derived by summing the effects for the dimensions corresponding to each pure-type model.

Table A-2. Modeling Missing Data (N=94 firms).

Variable	Model 1, Uncorrected		Model 2, Corrected	
	b	t	b^a	t
Commitment Employment Model	-0.513	-1.761	-0.513	-1.748
Autocracy Employment Model	-0.442	-1.330	-0.430	-1.237
Star Employment Model	-0.344	-1.134	-0.373	-0.970
Engineering Employment Model	-0.218	-0.865	-0.217	-0.852
Hybrid Employment Model	-0.303	-1.179	-0.318	-1.113
Missing Data Correction[a]			-0.152	-0.124
Age in 1994-5	0.039	1.735	0.039	1.727
Size (ln number of non-managerial full-time employees in 1994-5)	0.667	11.448	0.671	10.142
Quadratic Size Term[c]	0.030	1.047	0.029	0.990
Firm Became Public by 1994-5	0.420	3.385	0.454	1.492
Research, Computer, or Telecommunications Industry	-0.037	-0.252	-0.057	-0.261
Semiconductor or Manufacturing Industry	-0.312	-1.833	-0.339	-1.229
Marketing-oriented Strategy	0.111	0.789	0.101	0.612
Constant	-0.145	-0.392	-0.113	-0.249
Log Likelihood	-67.037		-67.112	
Adjusted R-Square	0.763		0.760	
F (df)	25.955 (12)		23.668 (13)	

[a]Predicted value from a logistic regression modeling whether or not the firm is missing data on gender composition in year one as a function of the independent variables reported in this table. Similar results are obtained if other variables (e.g., average annual turnover rate in 1991-94) are included in the equation predicting missing data.

Table A-3. Supplementary Analyses of Managerial Intensity.[a]

Variable	(1) MEAN SUBSTITUTION		(2) PAIRWISE-PRESENT		(3) IMPUTING % FEMALE[e]		(4) BOOTSTRAPING (Model 2, Table 3: 1000 replications)[f]	
	b	*t*	*b*	*t*	*b*	*t*	*b*	*t*
Founder's Employment Model (pure or quasi-pure)								
Commitment	-0.584	-2.071	-0.693	-2.149	-0.492	-1.821	-0.950	-2.724 (2.807)
Star	-0.259	-0.895 (1.361)	-0.300	-0.907 (1.388)	-0.240	-0.861 (1.078)	-0.730	-2.153 (0.705)
Engineering	-0.179	-0.714 (2.194)	-0.274	-0.955 (1.928)	-0.218	-0.909 (1.520)	-0.631	-2.081 (1.502)
Autocracy	-0.328	-1.032 (0.950)	-0.327	-0.901 (1.150)	-0.224	-0.735 (1.034)	-0.448	-1.215 (1.562)
Hybrid	-0.359	-1.423 (1.255)	-0.394	-1.363 (1.414)	-0.289	-1.191 (1.180)	-0.584	-1.934 (1.738)
Other Variables								
Proportion Female in Year One	-0.822	-1.966	-0.900	-1.901	-0.865	-1.982	-0.895	-2.308
Age in 1994-5	0.050	2.368	0.051	1.999	0.038	1.752	0.023	1.151
Size (ln number of non-managerial full-time employees in 1994-5)	0.775	12.074	0.785	10.269	0.752	11.603	0.782	12.853
Quadratic Size Term[c]	0.059	2.282	0.062	2.019	0.037	1.378	0.029	0.958
Firm Became Public by 1994-5	0.279	2.413	0.269	1.947	0.283	2.343	0.362	2.852
Research, Computer, or Telecommunications Industry	-0.128	-0.909	-0.154	-0.904	-0.143	-1.006	-0.113	-0.652
Semiconductor or Manufacturing	-0.317	-1.940	-0.276	-1.430	-0.304	-1.907	-0.218	-1.165
Marketing-oriented Strategy	0.284	2.144	0.321	2.083	0.201	1.451	0.259	1.896
Constant	-0.580	-1.770	-0.569	-1.506	-0.246	-0.721	-.011	-0.028
N	102		≥77[d]		94		76	
Adjusted R²	0.833		0.829		0.795		0.886	
F (df)	39.731 (13)		29.320 (13)		28.759 (13)		45.831 (13)	

[a]Observations weighted as a function of log 1994 full-time employment to correct for heteroskedasticity. *t* statistics shown next to coefficients.

[b]Omitted employment model is "Bureaucracy." *t* statistics shown in parentheses are for contrast against "Commitment,", instead of "Bureaucracy."

[c]Quadratic term equals: ln $(size_{1994-5} - 100)^2$.

[d]Minimum N in matrix of pairwise-present correlations is 77; median is N=95.

[e]Missing data were imputed for 18 cases by regressing percent female in year 1 (probit-transformed) on the other independent variables listed above, and then converting predicted values back into original (percentage) metric. Including a dummy variable denoting cases that were imputed does not appreciably change the coefficients reported here.

[f]Results reported for model 4 based on mean values for coefficients and standard errors obtained from 1000 replications, drawing samples of N=76. Adjusted R² and F for model 4 calculated by applying means for bootstrapped coefficients to (weighted) data and comparing observed and predicted values.