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STARTUP FIRMS' GROWTH, MANAGEMENT CONTROL SYSTEMS ADOPTION AND PERFORMANCE

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Abstract

Startup firms face a significant managerial challenge when they grow beyond the boundaries of informal interactions. This transition point has often been identified with a significant crisis in the growth path of these firms. An important aspect of this transition is the adoption of management control systems that leverage top management attention and provide the infrastructure to scale up the business model. Using a multi-method, multi-case field research design in a sample of 78 startup firms, we examine the relevance of the adoption of financial systems vis-à-vis other management control systems. We find that financial planning—including cash budget, operating budget and sales projections—are the earliest set of systems adopted. We also look at the association between the adoption of management control systems and startup firm growth. We model this association using a simultaneous equation specification to capture the theoretical arguments that posit the endogeneity of these variables. We find a positive and significant association in both equations among these variables. We further examine whether the often argued CEO replacement at this transition point is associated with the level of adoption of management control systems. We find that CEOs that have adopted fewer systems have shorter tenures. Taking advantage of the intimate knowledge that venture capital investors have about the management processes (and management systems in particular) of the firms they invest in, we examine the association between company valuation and the adoption of management control systems. We find evidence consistent with this association. Finally, we examine the association between the adoption of financial planning systems and the adoption of strategic and human resource planning systems.

Keywords: management control systems, formal systems, professionalization, CEO tenure, startups

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1. Introduction

An important stage in the growth of startup firms is the transition from an informal management style to the need for professional management tools (Baron, Burton, & Hannan, 1999; Hellmann & Puri, 2002). This transition point traditionally has been associated with the first growth crisis (Greiner, 1972, 1998). Failure to properly manage this crisis has been associated with constrained growth and even firm liquidation. The entrepreneurship literature has also documented a common association between this transition point and the replacement of the original CEO (Willard & Krueger, 1992). The proposed explanation for this empirical regularity is that the psychological characteristics of entrepreneurs are such that while they enjoy the fluidity of new ventures, they dislike the formality required for growth. This transition point is most visible in the population of small growing firms.[1]

Management control systems—defined as "formal, information-based routines and procedures managers use to maintain or alter patterns in organizational activities" (Simons, 1995) (page 5)—are important tools for professionalizing a company. They help managers leverage their attention, liberating it from decisions that can be delegated and controlled by exception and supplying information when the informal network is overloaded. Management control systems are interpreted as a subset of organizational routines (Nelson & Winter, 1982; Zollo & Winter, 2002) characterized by being recurrent, formalized, and information-based.

The study of management control systems has focused on cross-sectional variation in large established firms (Cardinal, 2001; Chenhall, 2003); it is only recently that empirical evidence on their emergence in startup firms has started to accumulate (Dávila, 2005; Sandino, 2005). These studies have examined factors associated with cross-sectional variation in the time-to-adoption of particular management control systems and how this timing varies with the strategy of startups. However, they only look at a subset of these systems. More importantly, they do not address a fundamental question implicit in models

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[1] The phenomenon, which is driven by small organizations outgrowing informal management processes, may also be observed within departments of medium and large firms.

of startup firm growth: the relevance of management control systems to the ability to deal successfully with this first growth crisis and, consequently, to organization performance.

We examine the evolution of 78 startup companies from their founding. We analyze how these firms build up their management control systems in eight different areas: financial planning, human resource planning, strategic planning, financial evaluation, human resource evaluation, product development, sales, and partnerships; and how this process is integrated within the broader process of growth. We address three research questions. The first one compares the rate of adoption of financial planning and evaluation systems against other types of management control systems. The second question examines the relationship between the adoption of various management control systems and three different variables associated with growth—number of employees, CEO rotation, and company valuation. The third one looks at how the adoption of financial planning systems is related to the timing of adoption of strategic and human resource planning systems.

We collect field research data using a multi-method, multi-case research design. The proprietary nature of the data and the detail needed to address the research questions demanded the design of tailored data collection instruments. For each company in our sample, we triangulate information from public sources, three questionnaires to three different managers, and three semi-structured interviews with those managers.

This paper contributes to the literature in two distinct ways. First, we provide empirical evidence on the simultaneous association between the evolution of management control systems and firm size measured by number of employees. This finding is consistent with firm growth requiring the management infrastructure that these systems provide as well as these systems being a consequence of growth. We further probe a common argument put forward to explain the founder's replacement as CEO; in particular, we document an association between the level of management control system adoption and the likelihood of CEO turnover. CEOs that adopt fewer systems are replaced sooner; this is consistent with certain founders having difficulties in moving from an entrepreneurial to a managerial role—as measured by the level of adoption of a set of managerial tools—and being replaced. We also document an association between the level of management control system adoption and company valuation. This result takes advantage of venture capitalists' broad understanding of management practices, which allows them to price their quality. Our second contribution documents how the adoption decisions for different types of management control systems complement or supplement each other. In particular, we examine this relationship for the three types of planning systems: human resource planning, strategic planning, and financial planning. We find that the adoption of human resource planning and the adoption of strategic planning complement each other—a firm's having adopted one of them is associated with faster time to adoption of the other. In contrast, the fact of having adopted financial planning is associated with longer time to adoption of human resource planning and strategic planning.

2. Management control systems and startup growth

Two lines of research are relevant to the relationship between management control systems and startup growth. One of them examines a sub-set of management control systems in startup firms. The second one looks at the determinants of growth in this type of firms.

Management control systems have been said to facilitate growth. They are adopted to overcome the limitations of informal management styles that require constant personal interaction. The need for these systems has been argued from agency and information

processing perspectives, which are the main roles of management accounting systems (and, more broadly, management control systems) (Baiman, 1982; Narayanan and Dávila, 1998). As firms grow, direct observation of the agents' effort—the main control approach in the absence of systems—becomes too costly, and motivation and monitoring have to be achieved through the design of appropriate management control systems such as compensation systems, standard operating procedures, or performance measurement systems. Firm growth also affects a firm's ability to move information to the right decision makers. Without formal systems, the number of interactions required to move information around the firm increases exponentially with the number of employees. The cost of communication becomes excessive if management control systems are not implemented.

Baron, Burton and Hannan (1996, 1999) examine the adoption of human resource management systems in startup firms. Their objective is to understand the impact of the founder's mental model of human resource relationships on the speed of adoption of these systems. They do not attempt to associate them with company size, although this latter variable is included as an independent control. Size is significant in explaining speed of adoption in 17 out of 25 HR policies, and in explaining the number of systems adopted at the end of the first year. Hellman and Puri (2002) find that venture-backed firms are faster at adopting HR policies and stock-option compensation plans.

Moores and Yuen (2001) map the type of management accounting systems in place throughout the lifecycle of firms. In particular, they identify the transition from birth to growth as the point at which these systems are formalized. Sandino (2005) studies the adoption of management accounting systems in a sample of 97 young U.S. retailers. She finds that all these firms adopt a basic set of managerial accounting systems, including budgets, pricing systems and inventory control. But they differ in the adoption of more advanced systems: firms following a cost strategy add managerial tools focused on enhancing efficiencies, while firms following a differentiation strategy adopt tools to gather customer information. In a companion paper, Dávila and Foster (2005) examine the adoption of management accounting systems and of budgets in particular. They find that size, the presence of venture funding, CEO experience and how the CEO interprets management accounting systems are associated with faster adoption of operating budgets. They further find an association between the adoption of operating budgets and firm growth.

Another research thrust has devoted its efforts to understanding what differentiates high-growth startups. Most of this research is based on empirical observation and has evolved around three main themes: management characteristics, competitive strategy, and competitive environment. For instance, Roure and Keeley (1990) identify the completeness of the founding team, technical superiority, product development time, and buyer concentration as associated with value creation in venture-backed startups. Feeser and Willard (1990) identify success with top management's "sensitivity to opportunity." Similarly, Siegel, Siegel and Macmillan (1993) identify management's industry experience and their ability to stay focused as separating high and low growth young firms. Evidence on the potential role of management control systems is sparse but in the expected direction. Reid and Smith (2000) use a sample of 150 small and medium Scottish firms to examine variables associated with performance (measured as a combination of employee growth, profitability and productivity). Their ordered logit specification (they group the firms into three performance groups) includes 20 variables capturing different aspects of the management team and organization. They find that management characteristics are non-significant or have a negative impact on performance except for "pursuit of high return on investment"; however, "forward planning" and "organization and systems" have a positive effect. Barringer, Jones, and Neubaum (2005) content-analyze the narrative case studies for 50 high-growth and 50 slow-growth firms. Based on an extensive literature review, they base their analysis on four broad topics: founder characteristics, firm attributes (such as

vision, planning, commitment to growth, etc.), business practices (such as product superiority, innovation, etc.), and HR practices. They conclude that high-growth firms have founders with more experience, better education, and higher motivation; have stronger commitment to growth and alliances; have deeper customer understanding; and emphasize training, employee development and financial incentives.

A third research stream relevant to this paper is summarized in the following quote: "[founders] are probably unsuited to be managers" (Greiner, 1998) (page 61). The assumption is that the founder "needs and values creative expression and is easily bored by familiar territory" (Rubenson and Gupta, 1996) (page 25). However, evidence consistent with this assumption is only starting to emerge. Willard and Krueger (1992) do not find support for founders underperforming compared to non-founding CEOs. Fiet et al. (1997) relate the likelihood of top management dismissal with sales underperformance, smaller boards, and the presence of venture capitalists on the board. Hellman and Puri (2002) find that venture capitalists are faster at replacing the CEO with an outsider. Wasserman (2003) also finds that founder turnover is associated with venture capital and with completing product development. This evidence reveals a pattern of founder turnover, but it does not address the assumption that most entrepreneurs do not transition to the managerial role that CEOs of larger firms have to fulfill.

The two main roles of management control systems—reducing agency and information processing costs—suggest that these systems play a relevant role in facilitating growth. While theoretical arguments are compelling for this relationship, the empirical evidence is sparse; mostly because empirical studies that have examined startup firms' growth have looked at variables such as founder characteristics, strategy or competitive environment. In contrast, the potential effect of firm size on management control systems has been documented for a subset of these systems (HR and accounting). Finally, the personal characteristics that lead to unusual CEO turnover in high-growth startups suggests that the founders' inability to structure the organization will be reflected in lower levels of management control system adoption.

3. Research design

3.1. Sample description

We used the following criteria to select our sample: 1) between 50 and 150 employees at sampling date, 2) less than 10 years old, 3) independent, and 4) in a limited geographical area. Prior to launching the study, we met five chief financial officers with start-up firm experience (all of them with multiple start-ups). This position is typically responsible for the development of financial and strategic management systems and provides a company-wide perspective. We described the objectives of the study to identify which types of startups would be most suitable to address our research question. These managers indicated that smaller companies rely on informal mechanisms, and that management control systems only become relevant when companies reach a size of 40 to 50 employees. This pilot feedback led to a minimum size of 50 employees. Our sample includes companies with more than 150 employees. Some firms with fewer than 150 employees at the time of sampling had more in prior periods or at the time of data collection. We also set an age limit of 10 years; the objective of this criterion was to sample companies that have grown fast. Also, this age limit identified companies more likely to have top managers who are familiar with the history of the firm and with the adoption of management control systems in particular. We also restricted our sample to independent companies—to avoid including companies which had these systems imposed on them by

headquarters—and companies within a limited geographical area.[2] We did not require companies to be either public or private, foreign owned, or venture funded; however, most of the companies in our sample were private, domestically owned, and venture funded.

Our sample includes high technology and non-tech companies. We sourced our sample from the *CorpTech Internet directory of technology companies*. We accessed the database in January and June 2002 from the following industries (using *CorpTech* industry classification): biotech (BIO), computer hardware (COM), manufacturing (MAN), medical equipment (MED), pharmaceuticals (PHA), photonics (PHO), computer software (SOF), subassemblies (SUB), test & measuring equipment (TAM), and telecommunications (TEL) and non-tech industries (NON).[3] Within the high technology sector, we purposefully over-sampled biotechnology companies to collect a large enough sample of companies in an increasingly important sector. To collect a large enough sample of biotechnology firms, we extended this sub-sample using three additional databases particular to the industry: *Rich's high-tech business guide to Silicon Valley and Northern California* (2000/2002), *BioScan* (Oct. 2001), and the *U.S. Business Browser* (2001). We also expanded the geographical criterion. We extended our search for venture-backed non-technology companies through *PWC MoneyTree*, accessed in January 2003.

We sent a letter to the CEO of every company in the sampled population, describing the purpose of the research, the research process, and the benefits of participating. The letter was followed up with a phone call; a company was dropped from the sample if it had not accepted or declined participation after five phone calls. Table 1 documents the sample selection process. The acceptance rate was 19% of the population of eligible firms.[4] We compared participating and non-participating companies in terms of size and age, both of these variables being available from the databases. We found no significant differences between these two populations.[5] The final sample includes 78 start-up companies. Table 2 provides descriptive statistics on the sample. The sample includes a high percentage of information technology (48/78=62%) and venture-backed firms (60/78=77%), reflecting the need for significant funding to grow at the fast pace required by the sample selection criteria. Panel C in Table 3 gives additional summary statistics for the variables in the research. The CEOs have mean work experience of 18 years, with the 25th percentile at 12 years. Most firms have not yet reached profitability, again reflecting the bias towards technology firms in early stages of their life cycle. The mean number of financing rounds is 3.43.

3.2. Research design

We adopted a multi-method, multi-case field research design. Because data on the evolution of management processes is not available from public sources, we developed tailored research instruments to gather the data. We used a multi-method design, combining archival data from public sources, three questionnaires and semi-structured interviews.

For each company, we collected available information from public sources—such as company web pages and press releases from Lexis-Nexis. This information was important to familiarize the research team with each company before the actual data

[2] The main reason for the geographic criterion was research funding (more than fifty percent of the companies were visited on-site).
[3] We excluded from these lists any companies that were also listed as "Energy," "Environment," "Chemical," "Defense," or "Transportation".
[4] This response rate assumes that all companies that did not respond were eligible.
[5] We compared means and medians of sales, employees, and age of our sample and the sample of companies that did not participate but were eligible.

collection. Then we sent three questionnaires to each firm, addressed to the CEO, CFO/ financial manager and the business development/ marketing manager. The questionnaire captured quantifiable information about the company, including its financial and funding history, as well as the dates on which particular management control systems were formalized. The information was triangulated in various ways. Financial and funding information was compared with information independently collected by Venture One and Venture Economics.[6] The dates of adoption of a sub-sample of management control systems were asked for in two different questionnaires. In both of these triangulation efforts, the kappa statistic of inter-rater agreement was highly significant. Finally, we collected additional data through semi-structured interviews with each of the three managers. Each interview relied on a detailed protocol with the questions to be addressed. The protocol insured that the main topics were systematically covered during the conversation. The semi-structured nature of the interview gave flexibility to query the interviewer when clarification of particular practices was required (Marshall & Rossman, 1995). We conducted the interviews in person or by phone and at least two researchers were present in every interview. Interviews lasted about an hour and were taped and then transcribed. The interview was also instrumental in clarifying and triangulating the answers to the questionnaire (Jick, 1979). Rich description of each company's history gave the context to understand why systems were adopted. During the interviews, we did not ask respondents directly about "intangible" variables such as company culture, which may vary depending on the respondent's background or may entice respondents to bias their answer to "acceptable practices." Rather, we infer these variables from the actors' description of their experience (Seidman, 1998). Finally, we chose a multi-case field design to gather a large enough sample to go beyond company-specific experiences and examine the generalizability of the findings through statistical validation.

Interviews and questionnaires have certain limitations. There is no guarantee that the data fully reflects reality. Respondents may be subject to recall bias or to their image of the history of the company. We mitigate this limitation by asking several respondents about various dimensions of the variables of interest, and by inquiring mainly about their experiences while minimizing their personal assessments. We also compare their responses with public sources of data when available.

3.3. Research variables: Management control system intensity

Our main variable of interest is management control systems adoption. We asked respondents about the date of adoption of eight categories of systems: 1) human resource planning, 2) strategic planning, 3) financial planning, 4) human resource evaluation, 5) financial evaluation, 6) product development management, 7) sales management, and 8) partnership management. These categories map the most relevant organizational functions. Table 3 lists the systems included in each category. It is not intended to be an exhaustive list but captures the main systems in each category. To further examine the adequacy of these eight groups we ran an exploratory factor analysis with varimax rotation on the time-to-adoption of the 46 systems; the various systems loaded into factors that closely mapped onto the categories defined.

Using the adoption date, we classified each company-year since funding as having or not having a particular system.[7] Founding date was obtained from the CFO questionnaire and checked against the date reported in Venture One. In all cases but one, the dates were comparable. In that one case, we cross-checked the information with the CFO and used his

[6] Both firms are public data sources that collect funding information for startup companies. In some cases, they also report financial statement information.

[7] In a very few cases, companies dropped a system after it had been adopted.

reported date. For each of the eight categories and for each company-year, we estimated the category intensity or level of system adoption as the percentage of systems adopted. Finally, we constructed the overall system intensity variable as the sum of the eight standardized intensities.[8]

Table 4 provides descriptive statistics on the eight categories of systems. Panel A presents the time-to-adopting half of the median number of systems within each category and the percentage of companies that reached this benchmark. As expected, planning systems are adopted faster,[9] while the adoption of sales and partnership systems is slower. For each firm, we also ranked the eight categories from fastest to be adopted (1) to slowest (8). Panel B reports the average ranking for each category. We examined these same descriptive statistics using time-to-adoption of the second most popular system within each category. The pattern was similar to the one reported in Table 4.

Figure 1, Panel A plots intensity for each of the eight categories since the companies' founding. Financial planning system intensity is highest throughout the initial stages of a company's life. Sales and partnership management intensities are lowest during that initial period. Figure 1, Panel B plots intensity over four company size portfolios. The patterns are similar, with financial planning at the top and sales and partnership systems at the bottom. Figure 2 describes variability in management control system intensity across the sample. Panel A plots the 25th, 50th, and 75th percentiles of our measure of system intensity over the first seven years of a company; Panel B does the same for the four size portfolios. The pattern is similar to Figure 1, with intensity growing over time and with size, and with significant variability in intensity across firms in the sample.

3.4. Additional research variables

To examine the relevance of management control systems to the early stages of high-growth firms, we collected information on number of employees over time, company valuation, and CEO rotation. We asked CFOs in each company to detail the number of employees at the end of each year since founding. We also asked them to provide a financial history of the company, giving the dates of funds inflows—in most cases, venture capital investments—the amounts invested, and company valuation. This information was contrasted with Venture One and Venture Economics data. In most cases, both sources provided the same information; when in conflict, we reconfirmed the data with the CFO. To control for the valuation environment, we adjusted company valuation by the NASDAQ index. We collected the CEO history from the CEO questionnaire, where we asked for the dates on which a new person was appointed CEO and this person's years of experience. We checked this information during the CEO and business development manager interviews.

Finally, from the CFO we gathered the firm's revenue and profit history since founding.

[8] We standardized each type of system to equally-weight the eight different types of systems in our overall measure of system intensity.

[9] This finding is consistent with traditional control systems theory, where planning comes first, followed by evaluation and corrective actions (Ashby, 1960; Anthony, 1965).

4. Empirical results

4.1. Management control systems and company growth

Management control systems have been said to facilitate growth. For instance, Greiner (1972, 1998) identifies the first crisis in the evolution of a firm as a "crisis of leadership", where a new leader downplays creativity to provide direction to the company. Management control systems are adopted to overcome the limitations of informal management styles that require constant personal interaction. They provide the management infrastructure to scale up the business model. Or as a manager in our sample put it, "We had management by personality and it became evident that that wouldn't scale. We figured our personalities can go through one floor and two walls. After that, management by personality doesn't work anymore."

Figure 3 provides initial evidence on the predicted relationship between company size and management control system intensity. It plots the average firm size over time for three portfolios. Portfolio (1) is formed with the companies in the lowest third in terms of system intensity in year two. Portfolio (2) is formed with the next third of companies. And portfolio (3) is formed with the third of companies with highest intensity in year two. The plot suggests an association between intensity in year two and company size over time. Means and median tests between the various portfolios are significant from year two onwards. Similar results are obtained if the portfolios are formed in year one or three.

However, management control systems themselves are endogenous to company size. Small companies do not need these systems, and empirical evidence has found strong evidence for company size being associated with the adoption of these management systems (Baron, Burton, & Hannan, 1996; Dávila, 2005).

We model the endogeneity of our two research variables using a simultaneous equation model. The first equation uses number of employees as a proxy for company size. The second equation uses management control system intensity as a measure of rate of adoption. To ensure identification of the system of equations, both equations require additional variables. In addition to management control system intensity, we include in the first equation two additional variables—revenues and cumulative funding—which arguably affect company growth. In equilibrium, companies will hire the number of employees required to satisfy demand for their products. We use revenues to proxy demand in the company's product market. In addition to external demand, growth may come from the need to develop technology, products, and markets. We proxy this internal demand for growth with the cumulative funding that a company has received.

In addition to number of employees, our second equation includes the following variables. Venture capitalists have been said to professionalize their firms faster (Hellmann et al., 2002). We include a dummy variable that takes the value of 1 for company-years in which the company has venture capital investors. CEOs with more experience are more likely to have been exposed to management control systems and, therefore, to be knowledgeable about their benefits and costs. If, on average, the adoption of these systems trails company needs, then we would expect CEO experience to accelerate their adoption. This variable is a time-varying variable that changes each time the CEO is replaced and as time progresses. We also include a dummy variable that takes the value of 1 if the original CEO has been replaced. Entrepreneurs often have a hard time transitioning into a manager's mindset (Willard et al., 1992). Management control systems are tools that managers rely on but entrepreneurs perceive as killing the entrepreneurial spirit. Therefore, we expect this variable to have a positive effect. We also include a dummy variable that takes a value of 1 if the company is beyond the pre-revenue stage. We expect pre-revenue stage companies to

require fewer systems. Table 5 provides relevant quotes from the research interviews that illustrate the potential relevance of these variables to explain management control system intensity. Finally, we control for companies in information technology, which is the largest group in our sample.

Table 6 reports Pearson and Spearman correlations. Variables are positively and significantly correlated. In particular, management control system intensity and number of employees are highly associated. The pattern of both types of correlations is similar, indicating that Pearson correlations are not driven by extreme observations.

We examined the model for the possibility of auto-correlated error terms. We found this to be a problem in equation two, and model the error term using a first order auto-correlation model. In addition to the information technology industry, we further control company attributes using a random-effects model. We run a Hausman test comparing the more efficient random-effects model with a fixed-effect model and did not reject the equality of coefficients.

Our final specification is:

$$Employees = \alpha_0 + \alpha_1\ intensity + \alpha_2\ revenues + \alpha_3\ ln\ (cumulative\ funding) + \varepsilon$$

$$Intensity = \beta_0 + \beta_1\ employees + \beta_2\ VC\text{-}backed + \beta_3\ CEO\ exp. + \beta_4\ founder\ replaced + \beta_5\ post\text{-}revenue + \beta_6\ IT\ industry + \varepsilon(AR1)$$

Table 7 provides the results using an iterative estimation approach. The coefficient on management control system intensity (α_1) is positively associated with employee growth. This is consistent with the predicted relevance of these systems to the growth of startup firms. Revenues (α_2) and cumulative funding (α_3) are also positive and significant. These findings are consistent with external demand and the availability of resources to meet internal needs for employees being associated with company growth.

In the second equation, the number of employees (β_1) is significantly associated with management system intensity. This finding is consistent with predictions and with previous empirical evidence that identified size as a relevant variable to explain management system adoption. The coefficient on the presence of venture capital (β_2) is positive and significant, consistent with this type of capital bringing "professional" systems to companies. The founder's replacement as CEO (β_4) is marginally associated with system intensity. Also, companies beyond the pre-revenue stage (β_5) are positively associated with the intensity of management control systems.

In summary, the findings are consistent with company growth and management control systems being interrelated. These systems are needed to provide the management infrastructure to support growth beyond the informal stage; simultaneously, they are needed only if the company is growing.

4.2. CEO rotation and management control systems

The replacement of entrepreneurs in the CEO position has been frequently associated with these people being unable to transition into a manager's mindset (Willard et al., 1992). A powerful indicator of this transition is the adoption of management control systems. Figure 4 provides descriptive evidence relevant to this question. For each one of the first three years of the life of a firm, we independently classified firms into three groups according to system intensity in each of the three years. That is, we classified firms in their

first year of existence according to intensity, then again in their second year, and again in their third year. For each group in each year we estimated the proportion of founders that were replaced during the years for which we have data. Figure 4 suggests an association between management control system intensity and the founder's replacement as CEO.

Table 8 examines this same question in a multivariate setting. We examine two different models. The dependent variable in the first model is the time from founding to the replacement of the founder as CEO. The dependent variable in the second one is the time to replacement of a CEO from his or her hiring date, regardless of whether the CEO was a member of the founding team. The second model takes advantage of the additional information in the database about CEO tenure beyond the founding CEO. We use a hazard model to reflect the survival series structure of the dependent variable (Allison, 1995). The hazard function characterizes survival models and can be thought of as the conditional probability of a particular event happening (CEO replacement) in an interval (t, $t+\Delta$), given that it has not happened at time t.[10] The hazard function is modeled as:

$$h(t, X(t)) = h(t, 0) \exp[(\beta' X(t)]$$

Where h(t, X(t)) is the hazard rate at time t and X(t) are the explanatory variables that can vary over time. To impose the least structure in our statistical specification we use a Cox proportional hazard model with right censoring and time-varying covariates. In contrast to parametric models, the Cox is a semi-parametric model and does not require estimates of the baseline hazard function (h(t, 0)), which is assumed to be common across companies. Covariates affect the proportion of a company's hazard function relative to any other company's hazard.

If intensity is associated with an entrepreneur (or CEO in the expanded model) being able to transition into a managerial role, then we expect intensity to be associated with longer tenure. In addition, we control for number of employees, industry, CEO experience, and whether the firm is venture-backed.

Table 8 reports the hazard ratios. A coefficient of one indicates that the variable has no influence on the time to the event, while a coefficient of less (more) than one indicates that the variable is associated with a longer (shorter) time to the event.

Intensity is significant and associated with longer tenure in both models in Table 8. The coefficient for information technology is larger than one and significant, indicating that tenure in this industry is shorter. Size of the firm is significant and greater than one in the second model but not in the first. This result is consistent with shorter tenures in larger firms. CEO experience is also larger than one and significant in model one (but non-significant in model two). This result indicates that founders with more experience are replaced sooner. It appears that founders with less experience (younger) can better transition from their original background into general management. Alternatively, these younger founders may be more reluctant to leave the CEO position than more experienced managers. While our data does not include further information on CEOs that are not in office other than their years of experience, our interview data includes detailed background information on the current CEO. To shed some initial light on this result, we examined the impact of current CEO characteristics on CEO transition. In particular, we found that in companies in which the current CEO has extensive company background or has been CEO previously, the founder had shorter tenure. How we interpret this evidence depends on the correlation we expect to find between the current CEO's background and the founder's background. If we

[10] The formal definition is $h(t) = \lim_{\Delta \to 0} Pr[(t \le T < t + \Delta | T \ge t) / \Delta]$. Thus, the explanation is only approximate because the definition divides the conditional probability by Δ.

expect the new CEO to have a different background, we can infer that the founder had no prior general management experience and less exposure to management control systems. Finally, Table 8 reports no evidence that CEOs in venture-backed capital firms have shorter tenures.

4.3. Company valuation and management control system intensity

Previous evidence supports the relevance of management control systems to the growth of the firm and CEO tenure. A further test of their relevance is to examine whether they appear to be valued. In contrast to public companies, private companies are not valued continuously, but only at funding events—typically when the company obtains new venture capital investment to fund its growth. This fact limits the number of observations available. However, venture capitalists investing in a firm have much more access to company information than public markets have. Venture capitalists are in close contact with the top management team and value the market opportunities open to the firm as much as how the company is managed. Thus, they are more likely to have information about and value management control systems.

The observed relationship between company size and management control systems and the evidence from Table 7 suggest that such systems are needed for managing larger firms. Thus, system intensity is not valuable at any size but only as companies grow. We model this interdependence using an interaction variable of number of employees with system intensity.

The specification is:

$$Valuation = \alpha_0 + \alpha_1\, employees + \alpha_2\, intensity + \alpha_3\, employees * intensity + \Sigma\, \alpha_i\, other\ covariates + \varepsilon$$

Table 9 presents the results using a rank regression. Prior studies examining the valuation of pre-IPO companies have adopted this specification (Armstrong, Dávila, & Foster, 2005). This type of regression has been shown to perform well when the dependent variable is a non-linear, monotonic function of the independent variables. Company valuation of pre-IPO firms is likely to have this functional relationship. Indeed, Sahlman (1993) argues that venture capital investments have three option components—the option to abandon, the option to revalue, and the option to increase investment—which are likely to introduce nonlinearities. Moreover, rank regression is preferred to alternative robust regression techniques such as winsorizing extreme observations because it gives equal weight to extreme observations (Iman & Conover, 1979) and treats them as valid data points, rather than as "outliers." We examine this model in the sub-sample of venture-backed firms (for which we have valuation information) prior to IPO.

The interaction term in Table 9 is positive and significant, indicating that higher company valuation is associated with firms that adopt management control systems as they grow. In addition, number of employees is also significant, consistent with larger firms having higher valuation. The coefficient for income is negative. This is consistent with firms in this sub-sample being in an early stage of their life cycle, with high R&D investments, low revenues, and periodic funding rounds. Consistent with this observation, Armstrong et al. (2005), in a sample of venture-backed pre-IPO firms, find R&D investments are between 35% and 70% of income and have a positive valuation. The coefficient on revenue is negative, in contrast with prior evidence (Armstrong et al., 2005). However, our model controls for number of employees; therefore, revenue has a negative association after

controlling for employees. This observation is consistent with companies with higher revenues having lower growth prospects, conditional on their being the same size. That is, companies with lower revenues have more employees devoted to pre-revenue activities such as R&D that receive higher multiples than revenues (Armstrong et al., 2005).

4.4. Management control system complementarities

In this sub-section we address the question of what variables are associated with time-to-adoption of management control systems. Prior literature has identified organizational size, founder replacement as CEO, and the presence of venture capital in the equity of the firm as associated with the adoption of human resource management systems (Dávila, 2005). We extend this line of inquiry to management control systems beyond human resource systems to the three types of planning systems identified in our database—human resources, strategic, and financial. Panel A, Table 4 identifies them as being the earliest ones adopted. Furthermore, these three types of systems capture the most interesting aspects of system complementarities; human resources and financial evaluation systems are closely associated with firms having adopted the corresponding planning systems; product development, sales, and partnership systems depend on the particular needs of the function and are unlikely to be associated with the adoption of other types of systems. We focus on these three types of systems to further examine whether having adopted a particular type of system is associated with faster (or slower) adoption of alternative systems. A positive (negative) association—that is, faster (slower) adoption—is consistent with these types of systems being complements (supplements).

There is little in terms of theory to guide our priors; therefore, the results should be interpreted as exploratory. If the demand for one type of system (human resource planning, for instance) influences the demand for another (strategic planning), then we expect the presence of the former to accelerate adoption of the latter. The systems behave as complements. Conversely, if the adoption of one type of system provides enough structure to facilitate company growth without the need to adopt other types, then the presence of the one will delay adoption of the others. These systems behave as supplements.

The dependent variables are the time-to-adoption of half of the median number of systems adopted within each type of system. We chose half of the median number of systems as a reasonable benchmark to have enough variance in the dependent variable and to capture the relevance of each type of systems to the management of the firm.[11] The explanatory variables are the same ones as were used in the system intensity equation in Table 7. These variables are included following the same arguments as in Table 7. In addition, we code whether a company has adopted a particular type of system using a time-varying dummy variable. This variable takes the value of 0 for years in which the company has not adopted half of the median systems within the type, and the value of 1 if it has reached the benchmark. This variable captures the potential role of alternative systems as complements or supplements.

The three models are:

Time-to-adoption of HR planning systems = f(control variables, presence/absence of strategic planning systems, presence/absence of financial planning systems)

[11] We run the tests using the time-to-adoption of the second most popular system within each type. We chose the second most popular rather than the most popular to avoid picking up idiosyncrasies of individual systems. The inferences do not change.

Time-to-adoption of strategic planning systems = f(control variables, presence/ /absence of HR planning systems, presence/absence of financial planning systems)

Time-to-adoption of financial planning systems=f(control variables, presence/absence of strategic planning systems, presence/absence of HR planning systems)

Table 10 reports the results. For each of the three planning systems, we run two separate models. The first includes the variables from Table 7, which were said to affect system adoption. The second one includes whether a company has adopted the other two types of systems as additional explanatory variables.

Given the survival nature of the data, we again use a Cox specification model and report hazard ratios. To model the endogeneity of the adoption of the three types of management systems, we run a first stage logit regression for each type of system, where the independent variable is the dummy variable for whether a particular type of system has been adopted and the independent variables are the exogenous variables from Table 7. For financial systems we also include whether the company has hired a financial manager, which during the interviews appeared to be an important determinant of these systems. For HR and strategic systems we include whether the company has international operations, which arguably increases the need for planning. We use the residuals from this first stage model—that is, the variance unexplained by the exogenous variables—as independent variables in the second stage.

The results from the model without the alternative systems' explanatory variables are broadly consistent with prior results. The presence of venture capital is associated with faster adoption; size is also associated with faster adoption, except for financial systems; CEO experience is associated with faster adoption of financial systems but slower adoption of HR systems. While experienced CEOs appear to quickly embrace financial systems, they take longer to do the same with HR.

When including the presence/absence of alternative planning systems, we find that the adoption of financial systems is associated with slower adoption of HR and strategic systems. We also find that HR and strategic planning systems behave as complements, the adoption of one being associated with faster adoption of the other.

5. Conclusions

An informal approach to managing organizations becomes harder when they grow beyond a certain size. At that point, the adoption of management control systems becomes important to provide the management infrastructure required to scale up the organization. Modeling this transition point as a system of simultaneous equations, we find that management control systems adoption is positively associated with firm size and, simultaneously, firm size is associated with the presence of such systems. This evidence indicates that growth and the adoption of management systems reinforce each other as firms transition through their first "growth crisis." We also find evidence regarding the empirical regularity found in startup firms, where founders are replaced as CEOs more often than expected. We find that CEOs with lower adoption of management control systems are more likely to be replaced. Furthermore, venture capital investors appear to price the adoption of management control systems in larger startup firms. Overall, the evidence supports the relevance of these systems to the growth of startup firms beyond their initial stage. Finally, we find that HR systems are adopted more slowly in startups that already have financial planning systems.

The evidence adds to our understanding of an important phase in the life of firms—their transition from informal to professional management. The research was designed to minimize the threats to validity of field research by using multiple informants, multiple sources of data and data triangulation. However, the data is still subject to biases associated with recreating the history of the firm. In addition, the research design is limited to the existence of omitted variables. In particular, we do not have detailed information on CEOs that have been replaced and thus we cannot characterize them beyond their years of experience. These managers' functional background and prior experience in startup and mature firms may be relevant variables to explain why they appear to adopt management systems at a slower pace.

The evidence in this paper can be extended in several dimensions. We treat systems in a dichotomous way—either the company has adopted or has not adopted them. While this characterization is appropriate, it fails to capture the potential variance in the quality of systems. During the data collection period it was not unusual to find anecdotal evidence where a company had over-invested in software for financial systems that put too much burden on the firm once its growth prospects did not materialize. It was also common to have descriptions of these systems evolving from fairly straightforward systems to more sophisticated ones. We also look at an overall measure of system adoption, but do not model each particular type of system. It is likely that each type of system, from HR to partnerships systems, has its own pattern of adoption. For instance, it was common during the interviews to have descriptions of adoption associated with the hiring of a particular manager—the idea of "importing" knowledge. Finally, we do not model the interaction between strategy, growth and management control systems; while strategy may have only a minor role in the overall pattern of adoption, it may play a significant role in the sequence in which different types of systems are adopted.

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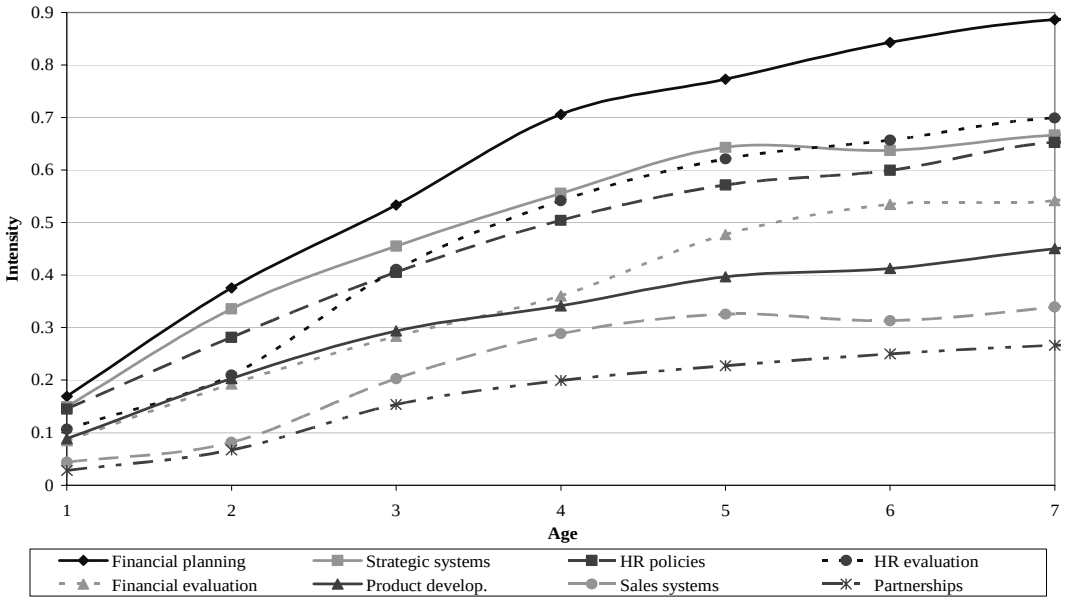
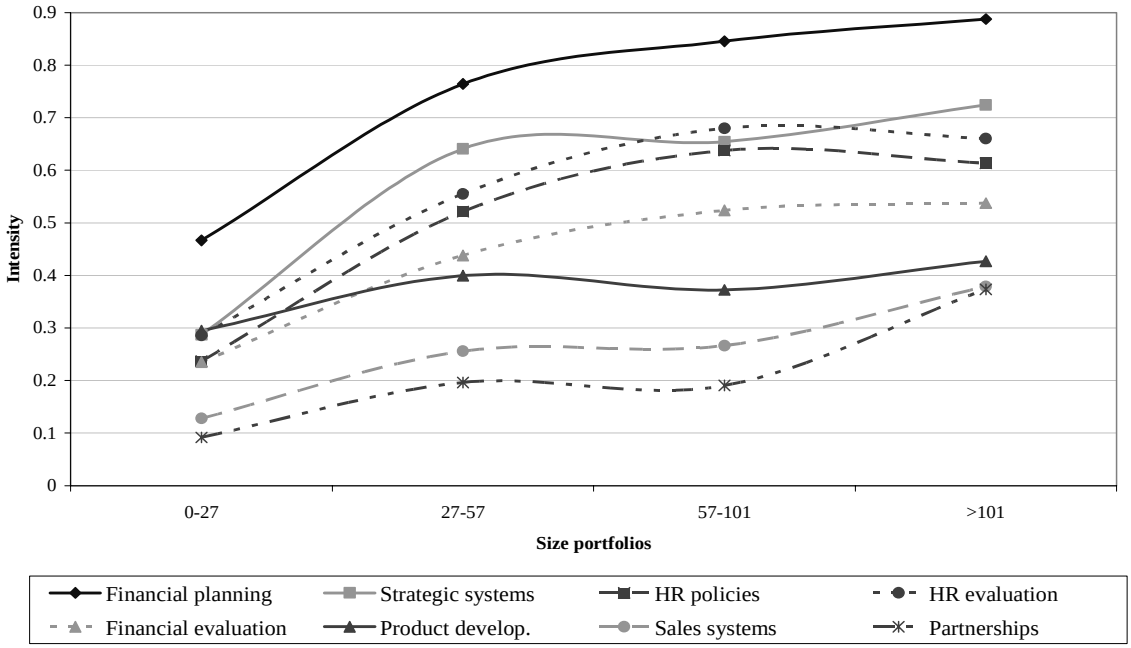
Figure 1
Adoption of management control systems

Panel A: Management control system intensity over time



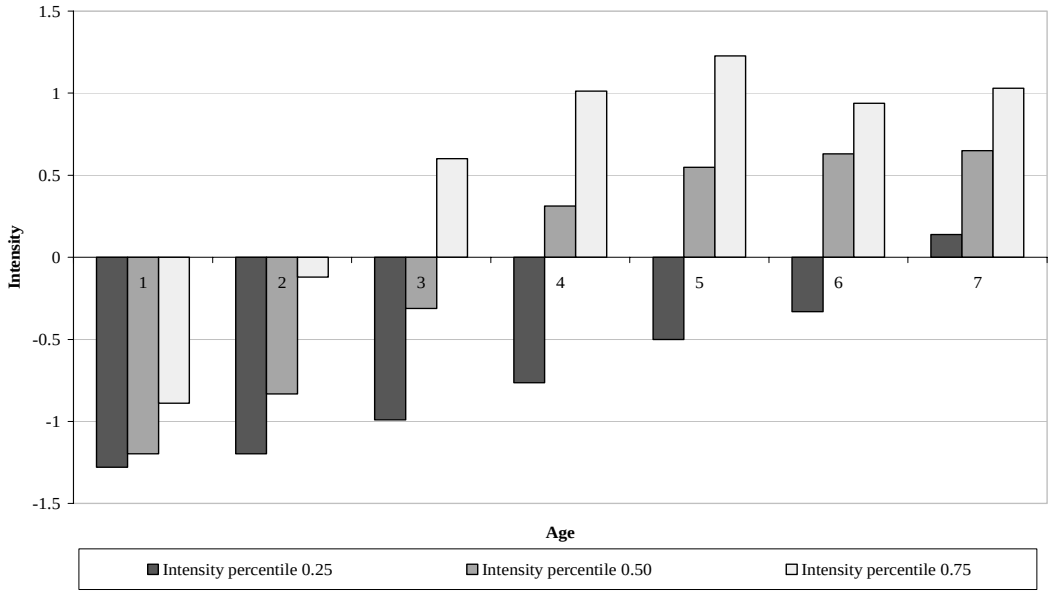
Panel B: Management control system intensity by size



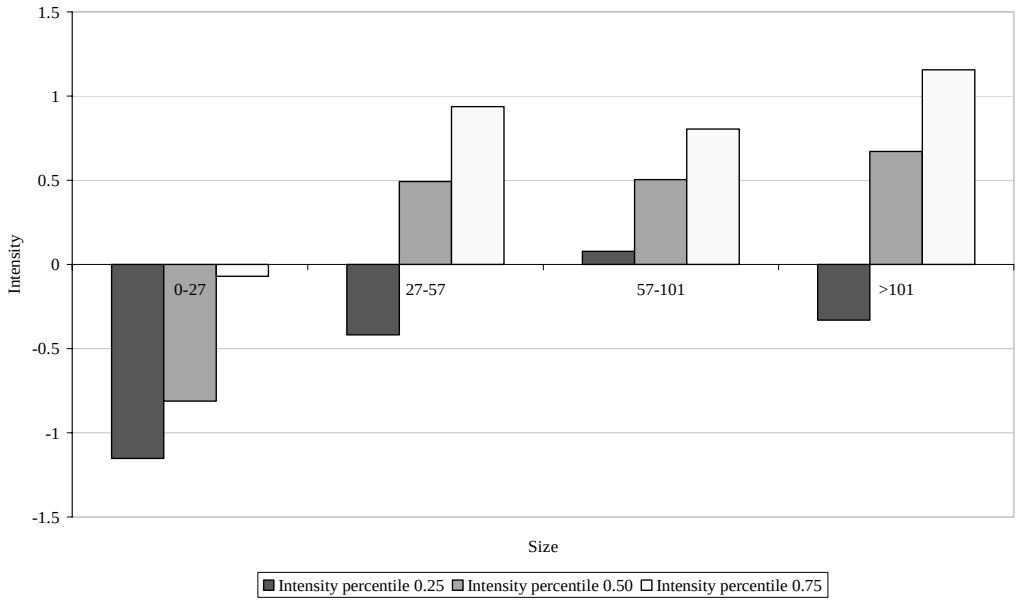
The figure in Panel A (Panel B) plots the evolution of average management control system intensity for each of the eight types of systems examined over time (by portfolio size of equal number of observations). Intensity is defined as the sum of systems within each group adopted in a particular year since the founding of the firm (Panel A) or in a particular portfolio size (Panel B), divided by the total number of systems within each group. The y-axis is the average intensity for the firms in the sample. The x-axis is years since founding (Panel A) or size portfolios (Panel B).

Figure 2
Variation in management control system intensity across firms

Panel A: Management control system intensity percentiles over time

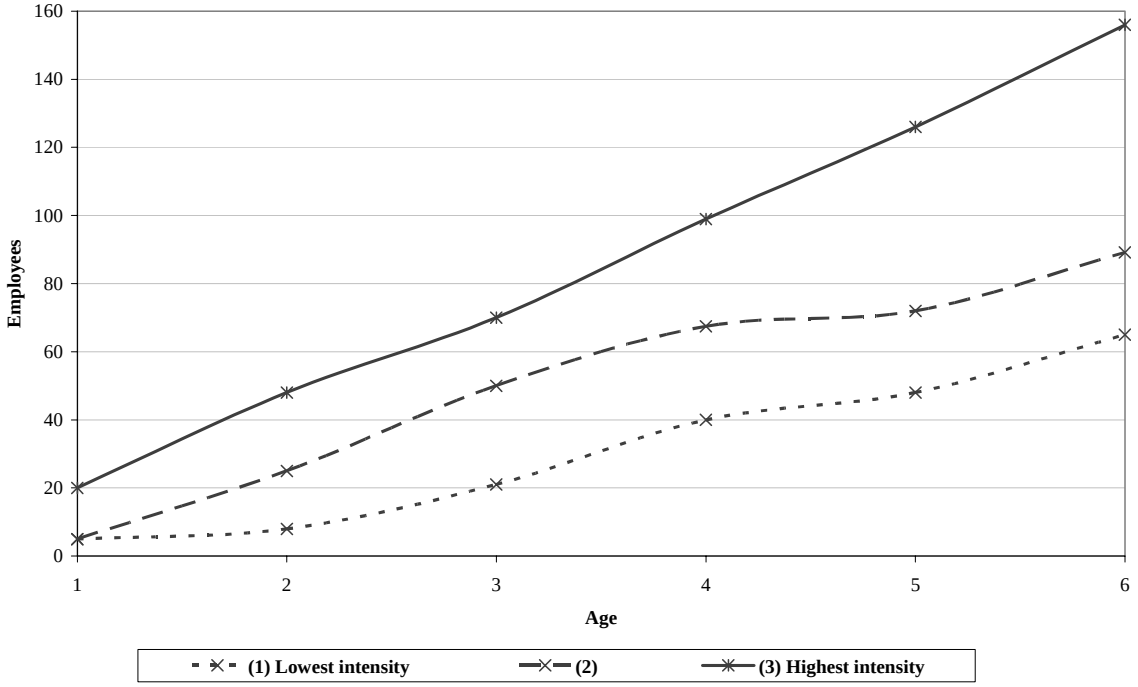


Panel B: Management control system intensity percentiles by size



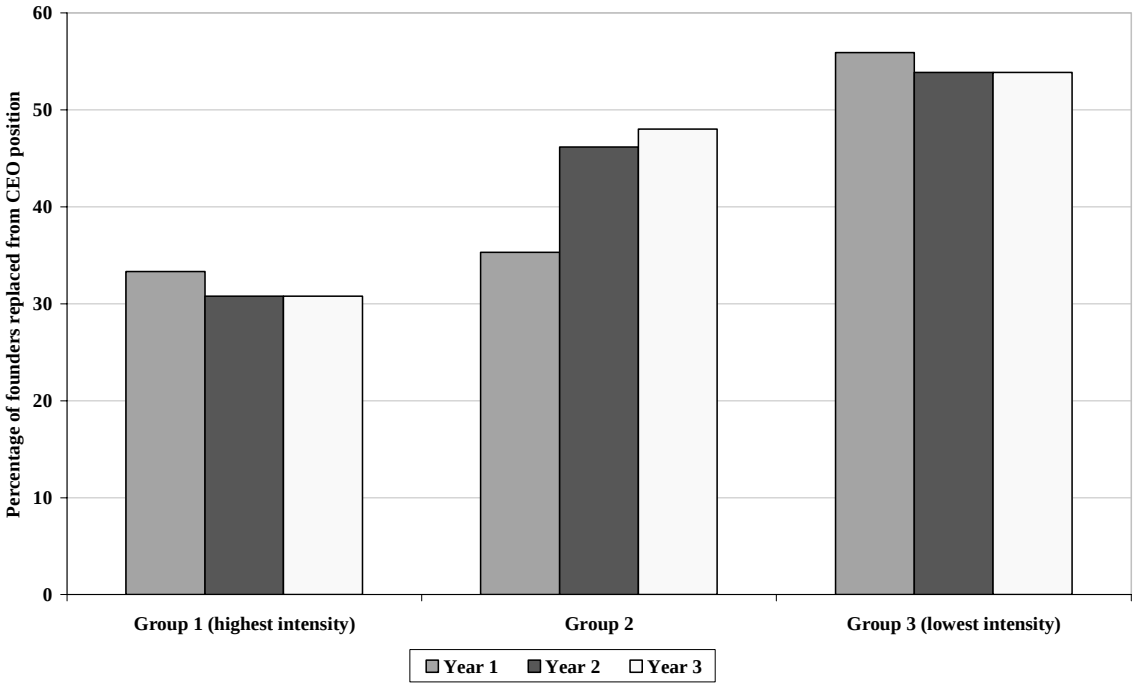
The figure in Panel A (Panel B) plots the 0.25, 0.50, and 0.75 percentiles of management control systems' average intensity over time (by portfolio size of equal number of observations). Intensity is the overall measure of management control systems intensity, defined as the sum standardized intensities for each one of the eight types of systems examined. Intensity within a group is the sum of systems within each group adopted in a particular year since the founding of the firm (Panel A) or in a particular portfolio size (Panel B), divided by the total number of systems within each group. The y-axis is the average intensity for the firms in the sample. The x-axis is years since founding (Panel A) or size portfolios (Panel B).

Figure 3
Management control system intensity and employee growth



This figure plots average company size over time for three portfolios. Each company in the sample is assigned to one of the portfolios according to its system intensity in its second year of existence. Each portfolio has an equal number of firms. Portfolio (1) is formed with the 33% of companies with lowest intensity, portfolio (3) is formed with the 33% of companies with highest intensity, and portfolio (2) is made up of the rest of firms.

Figure 4
CEO turnover and management control system intensity



This figure plots the percentage of founder CEOs replaced per level of management control system intensity. Firms were grouped into three portfolios, from lowest to highest intensity, in each of the first three years. The y axis is the percentage of founders replaced and the X-axis are the three portfolios from highest (group 1) to lowest intensity (group 3).

Table 1
Sample construction

	Companies in the initial database	624
Minus		
	Companies that went out of business	94
	Companies acquired	88
	Companies ineligible in some other way[1]	41
	Companies that did not respond[2]	188
	Companies that declined participation	135
	Final sample of companies	**78**

[1] These are companies that are too small, too old, or subsidiaries of other companies.
[2] These are companies that did not respond to the five telephone contacts.

Table 2
Descriptive statistics on sample of companies

Panel A: Industry Statistics

Industry	Number of companies
Biotechnology	12
Information technology	48
Other industries[1]	18
Total	**78**

[1] Other industries include business services and consumer products.

Panel B: Financing Statistics

Financing type	Number of companies
Venture capital financed	60
Other forms of financing	18
Total	**78**

Panel C: Company Statistics

	Mean	Std. Dev.	Q1	Median	Q3
Number of CEOs	1.65	0.78	1	1	2
Years of total experience of CEO[1]	18.42	8.48	12	20	25
Age of the company	5.47	2.44	3	5	7
Number of employees[2]	118	62	71	113	155
Revenues ('000)[3]	10,923	11,853	2,437	7,300	15,000
Income ('000)[3]	-9,455	15,668	-12,469	-4,700	29
Number of VC rounds	3.43	1.78	2	3	5
Valuation (millions)[4]	168.600	229.6	21.5	67.25	192.7

[1] Estimated for all CEOs in the sample.
[2] Employees is calculated at the peak of each company's size.
[3] Revenues and profits are for the last year of data available.
[4] Valuation statistics are for the largest valuation round available.

Table 3
Construction of the eight categories of management control systems

Financial planning	Cash flow projections Sales projections Operating budget
Human resource planning	Organizational chart Written job descriptions Codes of conduct Mission statement Core values Orientation program for new employees Company-wide newsletter
Strategic planning	Investment budget Definition of strategic (non-financial) milestones Product portfolio plan (plan about future products) Customer development plan (plan to develop market) Headcount/human capital development plan
Financial evaluation	Product profitability analysis Customer profitability analysis Customer acquisition costs Routine analysis of financial performance against target Capital investment approval procedures Operating expenses approval procedures
Human resource evaluation	Written performance objectives for managers Written performance evaluation reports Performance-related pay Individual incentive programs
Product development management	Project milestones Budget for development projects Reports comparing actual progress to plan Project selection process Product portfolio roadmap Project team composition guidelines Product concept testing process
Sales management	Sales force training program Sales force hiring and firing policies Sales targets for salespeople Sales force compensation system Marketing collaboration policies Market research projects Reports on open sales Sales process manual Customer satisfaction feedback Customer relationship management system
Partnership management	Partnership development plan Policy for partnerships Partnership milestones Partner monitoring systems

For each system, we asked respondents for the date when the system was adopted. The instructions were: “For each system below, please indicate when your company formalized it; “formalized” means having documented a process and/or periodically and purposefully executing the process.”

Table 4
Descriptive statistics on management control systems

Panel A: Descriptive statistics on management control systems

	Time to adoption				
	Mean	**Q1**	**Median**	**Q3**	**Percentage of companies**
Financial planning	2.36	1	2	3	87.2
Strategic planning	2.45	1	2	4	76.9
Human resource planning	2.58	1	2	4	80.8
Financial evaluation	2.75	1	2	4	85.9
Human resource evaluation	2.80	1	2	4	78.2
Product development	3.06	1	3	5	78.0
Sales management	3.20	2	3	5	69.2
Partnership management	3.38	2	3	5	47.4

Time to adoption is the average across companies in the sample of the time to adopting half of the median number of systems adopted within each category of management control systems (in years). The median is estimated using those firms that report the adoption of at least one system within each category. *Percentage of companies* is the percentage of companies that have adopted half of the median number of systems by the end of the observation period. Percentage of companies for product development systems is relative to the part of the sample where product development is relevant.

Panel B: Ranking of adoption of management control systems

	Ranking of adoption			
	Mean	**Q1**	**Median**	**Q3**
Financial planning	1.82	1	1,0	2,0
Strategic planning	2.03	1	1,0	3,0
Human resource planning	2.59	1	2,0	3,0
Financial evaluation	2.62	1	2,0	4,0
Human resource evaluation	2.52	1	2,0	3,0
Product development	3.13	1	3,0	5,0
Sales management	4.14	3	4,0	5.5
Partnership management	4.31	3	4.5	6,0

For each firm and each type of system, we estimate when half of the median of systems adopted is reached. We then rank these milestones for each firm. The table reports the descriptive statistics.

Table 5
Illustrative quotes for variables potentially affecting management control system intensity

Variable	Illustrative quotes
Number of employees	"And frankly, balance the need to be flexible with the need for getting the right kind of processes in place. So on the one hand, you can't have chaos, but having 110 people in a company and having like IBM-type policies and procedures doesn't make any sense either. So it's eternally a struggle, but I think that the companies that probably succeed in developing, have an instinct for when to implement things and what not to. And I think that we've probably done reasonably well, though certainly some things we're probably overdue." "I think the systems are more important in the scaling period because what works for 20 people won't work for 50 or 200 people, in terms of communication, decision making, etc. So you need the systems to formalize and structure it more." "It definitely happened to us, when you couldn't fit everyone into one space and the dynamic shifts and communication gets a lot harder."
Venture-backed	"We manage by the numbers in a lot of ways. Everything we do is numbers focused. So, in order to manage by the numbers, you need to have formal reporting structures in place, obviously. The marketing planning process is more formal, because that's what the board requires—you're going to spend this money, we want to know what you're spending it on and why you're spending it on that. "(These systems) were put in through a combination of the then Chief Financial Officer as well as the minimum expectations set by the VCs. So the board itself had a very strong hand in terms of what minimum it was prepared to accept." "I just find that you can't get hurt by over reporting to the board. And reporting early."
Managers' experience	"I think some of it is just something that I've learned or I've developed over the years from experience, things that work." "He came from McKinsey and he was a very process oriented guy. So that's when the process began, I would say." "A lot of small companies don't have budgets till very far along, but it's just unthinkable not to have them from my point of view, so that's probably just one that I brought. Let's have budgets, let's get more formal about tracking capital expenditures." "Some systems expertise you import when you import the right people."
Founder replaced	"Originally, the sales organization was run by one of our founders, who was a very, very young guy, like 22 at the time or something. But that wasn't, he just didn't have a lot of experience running this type of organization and putting this kind of systems in place. And then eventually we ended up having an experienced VP of sales and marketing join, who then implemented kind of his vision of things."
Past pre-revenue stage	"So there is a clear need for a formalized policy on communicating with each other. And also because we are getting closer to commercialization, there is a need to have a better understanding of our cost structure, which needs a very formalized approach." "There's no need to do a product profitability report because we're not shipping product." "So part of where I said I think one of our biggest weaknesses was lack of marketing information and marketing analysis was that we didn't have the reporting tools."

Table 6
Correlation table

	Number of employees	System intensity	Revenues	Ln(cum. Funding)	CEO experience
Number of employees		0.38 ***	0.50 ***	0.43 ***	0.17 ***
System intensity	0.44 ***		0.10 *	0.45 ***	0.16 ***
Revenues	0.60 ***	0.23 ***		0.15 ***	0.11 *
Ln(cum. Funding)	0.55 ***	0.47 ***	0.19 ***		0.23 ***
CEO experience	0.15 **	0.16 ***	-0.03	0.25 ***	

The upper triangle reports Pearson correlation and the lower triangle reports Spearman correlation. *, **, *** indicates significance at 10%, 5% and 1% respectively.

Table 7
Firm growth and management control system intensity

Equation 1: Employees	
Constant	-94.88 **
	(-2.49)
Intensity	27.70 **
	(2.35)
Revenues	0.002 ***
	(5.47)
Ln(cumulative funding)	66.56 ***
	(3.69)
Chi-sq.	183.01 ***
Overall R^2	0.34
Equation 2: Intensity	
Constant	-0.93 ***
	(-3.40)
Employees	0.007 ***
	(4.27)
Venture backed	0.242 *
	(1.65)
CEO experience	0.002
	(0.18)
CEO replaced	0.178
	(1.42)
Time to revenue	0.314 **
	(2.33)
Information technology	0.365 *
	(1.80)
Chi-sq.	55.02 ***
Number of obs.	264

The table reports iterative, random effects simultaneous equations model estimation. z-stat in parenthesis. *, **, ***, indicate significance at the 10%, 5%, 1% level. *Employees* is the number of employees at the end of each year. *Intensity* is the sum of the standardized percentage of systems adopted within each type of management control system. *Venture backed* takes the value of 1 for those company-years in which the company had venture capital in its equity and 0 otherwise. *CEO experience* is the CEO's years of experience when (s)he became CEO. *CEO replaced* is a dummy variable that takes the value of 1 for company-years in which the CEO is not the founding CEO. *Time to revenue* is a dummy variable that takes the value of 1 for company-years beyond the pre-revenue stage. *Information technology* is a dummy variable that takes the value of 1 for firms in the IT sector.

Table 8
Management control system intensity and CEO rotation

	Time to replacing founder as CEO		Time to CEO replacement	
	Hazard ratio	**z-statistic**	**Hazard ratio**	**z-statistic**
MCS intensity	0.537 **	-2.10	0.385**	-2.57
Information technology industry	2.271 *	1.73	3.514**	2.23
Number of employees	1.004	1.18	1.010**	2.39
CEO experience	1.071 **	2.29	0.996	-0.15
Venture backed	2.386	1.35	1.686	0.34
Number of observations	201		272	
Number of subjects	52		80	
Chi sq.	21.26		10.50	

The table presents a Cox regression model with right censoring and time-varying covariates of CEO tenure. A coefficient of one indicates that the variable has no influence on the time to the event; a coefficient of less (more) than one indicates that the variable is associated with a longer (shorter) time to the event. * and ** indicate significant at the 10% and 5% level respectively. *MCS intensity* is the sum of the standardized percentage of systems adopted within each type of management control system. *Number of employees* is the number of employees at the end of each year. *Venture backed* takes the value of 1 for those company-years in which the company had venture capital in its equity and 0 otherwise. *CEO experience* is the CEO's years of experience when (s)he became CEO. *Information technology industry* is a dummy variable that takes the value of 1 for firms in the IT sector.

Table 9
Management control system intensity and company valuation

	Company valuation	
	Coefficient	**Standard error**
Constant	71.20 ***	28.59
Employees	0.217 ***	0.06
Intensity	0.023	0.03
Employees * Intensity	0.102 ***	0.04
Age	2.111	1.64
Information technology	-6.372	8.13
Income	-0.222 ***	0.07
Revenues	-0.147 ***	0.05
Number of observations	101	
Chi-sq.	24.86 ***	

The table reports a rank regression specification with robust standard errors. *** indicates significance at 1%. *Intensity* is the sum of the standardized percentage of systems adopted within each type of management control system. *Age* is the age of the firm at the time of the valuation round. *Information technology* is a dummy variable that takes the value of 1 for firms in the IT sector. *Income* is the profit for the most recent year for which profit information is available. *Revenues* is the revenue for the most recent year for which revenue information is available.

Table 10
Time to management control system adoption

	Model #1						Model #2					
	HR planning		Strategic		Financial		HR planning		Strategic		Financial	
Employees	1.01	***	1.01	**	1,00		1.02	**	1.01	**	1,00	
	-2.97		-2.4		-0.93		-2.67		-2.13		-1.61	
Venture backed	3.01	**	3.06	**	2.32	**	2.7	*	2.75	**	1.97	*
	-1.98		-2.26		-2.3		-1.74		-2.08		-1.76	
CEO experience	0.96	**	0.97		1.03	*	0.97		0.99		1.03	*
	(-1.96)		(-1.64)		-1.87		(-1.14)		(-0.31)		-1.72	
CEO replaced	1.30		1.7		1.25		1.61		2.79	*vv	1.12	
	-0.75		-1.59		-0.76		-1.11		-2.86		-0.34	
Information technology	3.20	***	3.69	***	0.87		2.11	*	2.36	**	0.82	
	-3.19		-3.73		(-0.43)		-1.96		-2.17		(-0.59)	
Time to revenue	1.82		0.62		1		1.93		1.07		0.59	
	-1.14		(-1.02)		-0.01		-1.26		-0.15		(-0.95)	
HR planning systems									4.46	***	0.29	
									-2.91		(-1.46)	
Strategic planning systems							1.40	*			1.34	
							-1.69				-0.94	
Financial planning systems							0.28	**	0.22			
							(-2.29)		(-2.81)			
Chi-sq.	39.13	***	25.57	***	11.81	*	44.32	***	52.50	***	15.96	*
Number of observations	135		129		173		133		125		173	

The table presents a proportional hazard model (Cox model) of the time to adoption. z-statistic in parenthesis. *, ** and *** indicate significance at the 10%, 5%, and 1% level respectively. *Employees* is the number of employees at the end of each year. *Venture backed* takes the value of 1 for company-years in which the company had venture capital in its equity and 0 otherwise. *CEO experience* is the CEO's years of experience when (s)he became CEO. *CEO replaced* is a dummy variable that takes the value of 1 for company-years in which the CEO is not the founding CEO. *Time to revenue* is a dummy variable that takes the value of 1 for company-years beyond the pre-revenue stage. *Information technology* is a dummy variable that takes the value of 1 for firms in the IT sector. *HR, strategic,* and *financial planning systems* are the residuals from the first stage regression.