New Firm Performance and the Replacement of Founders

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We construct a simple model of founder turnover in which there may be mismatches between the quality of a startup and the ability of the founder. When high-ability founders establish poor-quality businesses, they either choose to close the business or hire a less able CEO. In contrast, low-ability founders with high-quality businesses hire a more able CEO. We derive implications of the model for the relationship between firm performance and founder turnover. These predictions are tested using a large sample of Danish startups.

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1. Introduction

Under what circumstances do founders of new businesses cede operating control to a specialist manager? What implications does the departure of the founder have for subsequent business performance? And what happens to founders after they have left? In this paper, we construct a simple model to guide an empirical analysis of the causes and consequences of founder turnover among a cohort of new businesses founded in Denmark. Our empirical work uses the matched employer-employee database maintained by Statistics Denmark, and draws samples from the universe of new businesses created in Denmark during 1999 and 2000. These firms are generally small, they are not financed by venture capital, and they are generally not at risk of an IPO event. We know surprisingly little about founder turnover among such firms.

We do know a fair amount about changes of leadership in other types of firms. Executive turnover in established, typically public, firms has been extensively studied for many years. There is also a growing literature on the replacement of founders among VC-financed firms, especially among firms that are approaching major liquidity events, such as an IPO. These two areas of inquiry have yielded substantial evidence that the causes of executive turnover is context-dependent: CEO replacement in mature firms is most likely to occur after a period of poor or declining performance [e.g., Hofer (1980), Chen and Hambrick (2012)], while founder replacement in VC-financed firms is most likely to occur after a period of rapid expansion [e.g., Boecker and Karichalil (2002)] or upon attainment of critical milestones [e.g., Wasserman (2003)].

Much prior research lacks findings that we can extrapolate to the small firms that are the focus of the present study.[1] For example, it appears that VC-financed firms differ from firms that are not subject to significant control by outside equity investors. Hellmann and Puri (2002), for example, used survey data to collect information on 170 high-tech firms in Silicon Valley, some 30 percent of

[1] There has for some time been an active literature on succession in family-owned businesses, but the concerns of this literature are rather different from those in which executive control is passed outside the founder's family. Much of the literature focuses on succession resulting from death or retirement of the CEO, and is concerned with the planning and preparation that facilitates a smooth transition. See Handler (1994) for a review.

which did not receive VC funding. Boeker and Wiltbank (2005) similarly collected information on 86 semiconductor firms, among which the share of VC ownership varied widely. VC financing significantly increased the likelihood of founder replacement,[2] suggesting that turnover was more likely to be instigated by external investors than by the founders. Hellman and Puri did not have access to performance data and were unable to report the relationship between firm performance and turnover. Bocker and Wiltbank, however, found that both low-and high-performing firms were at greatest risk of founder turnover. Their results interestingly blend the distinct findings in the previous literature on CEO turnover in established firms and founder turnover in VC-financed firms. However, their sample is rather specialized.

The goal of founder or CEO replacement is generally held to be improving the match between the skills of the CEO and the expected demands of the enterprise. In established firms, underperforming CEOs have perhaps already demonstrated that they lack the skills necessary to induce a turnaround [Bibeault (1982), Miller (1991)];[3] founders of successful VC-financed firms are frequently supposed to have the skills necessary for early development of an idea, but not the management of a rapidly growing firm [e.g., Boeker and Wiltbank (2005)].[4] Perhaps surprisingly, then, there is no clear evidence that executive replacement on average secures an improvement in performance. Carroll (1984) and Haveman and Khaire (2004) offer extensive reviews of the consequences of CEO replacement in established firms: they report studies that found CEO replacement improved performance, others that found a deterioration in performance, and yet others where no effect was detected.[5]

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[2] Hellman and Puri report that 36 percent of firms without VC funding experienced founder turnover, compared with 62 percent of VC-financed firms.

[3] Finkelstein, Hambrick and Cannella (2009) argue that the quality of the match between the firm and the CEO inevitably drifts over time as the environment evolves. CEO replacements then offer an opportunity to reset the match quality to the altered conditions.

[4] Indeed, argues one venture capitalist, "[s]tepping aside as CEO may be a founder's single most important contribution to a company's success" [Kimzey (2012)].

[5] Perhaps as a result of these contradictory findings, researchers have begun to explore factors that moderate the effects of turnover on subsequent performance. See Carroll (1984), Kor (2003), Boone, et al. (2004), Zhang and Rajagopalan (2004), Boeker and Wiltbank (2005), Chen and Hambrick (2012), and Haveman and Khaire (2004).

In this paper we study founder turnover among a sample of 4,172 Danish startups created in 1999 and 2000. To ensure that the departure of the founder indicates a meaningful change in control, the sample consists only of firms that were created by a single founder, and where the founder worked as his primary job in the business. To eliminate pure self-employment, all firms in the sample had at least one employee for whom working at the firm was his primary job. The firms and founders we study represent all firms founded in Denmark that meet these criteria. Only 18 percent of them are classified as high-tech, while wholesale, retail, construction and manufacturing are well-represented; this is a much broader sample than has previously been used to study founder turnover. Our data are drawn from Denmark's national matched employer-employee dataset, so we are also in a unique position to explore what happens to the founders after they have left the firm. We study instances of founder turnover and we track the firms and founder until 2005. The data allow us to distinguish business turnover from founder turnover and, in this paper, we focus on the causes and consequences of events in which the founder retires from active management of the firm he founded but continues to retain controlling ownership. That is, our focus is on CEO succession in small firms, rather than business transfers.

To guide our empirical work, we develop a simple model of firm creation, survival, and founder turnover. The prior literature naturally leads us to frame our theoretical analysis in terms of a matching model. We suppose that firm performance is a function of the ability of the CEO and the quality of the business idea, both of which are random draws from stable population distributions. Ability and quality are complements in production so that there can arise mismatches of sufficient magnitude to justify replacing the founder with an outside CEO who is better suited to the business. We allow for more able founders to develop on average higher-quality ideas, so that most startups are founded on high-quality matches. However, there are occasions when low-ability entrepreneurs generate high-quality business ideas and seek a high-ability CEO to replace them, and there are occasions when high-ability entrepreneurs own low-quality ideas, and seek out a replacement CEO with a lower opportunity cost of time.

Our model yields several empirically testable predictions. First, founder replacement is more likely in the tails of the initial performance distribution. Second, while good early performance is on average associated with good future performance, this effect is stronger in firms that had no turnover; in fact, among firms

that had turnover the correlation may be zero or negative. The model also predicts that founders who were replaced in high-performing businesses earn more than those who left low-performing businesses, but they are no more likely to create another startup. We test these predictions in our sample and find considerable support. Consistent with prior theorizing, then, we conclude that matching of CEOs to businesses plays a central role in the turnover of founders.

Our theoretical framework is closely related to the theory of business transfers developed by Holmes and Schmitz (1990), and to our own recent model of self-employment based on skill mismatching in the labor market [Åstebro, Chen and Thompson (2011)]. In Holmes and Schmitz, performance depends on the sum of business quality and match quality. In contrast to the present paper, there is no variation in ability so all agents have the same outside option, and new CEOs only observe the quality of their match with a business after they have purchased the firm. These differences in the model also induce some different predictions. First, their model predicts that the best business ideas are most likely to be transferred to new owners, while firms and founders with good matches are most likely to continue without transfer. Second, because transfers may create a poor match, businesses that are sold are at greater risk of subsequent exit. Our empirical results on the effect of initial performance on turnover favor our model over Holmes and Schmitz, but we find evidence on the effect of turnover on firm survival that favors Holmes and Schmitz.

In Åstebro, Chen and Thompson (2011), we assumed that mismatches between an agent's ability and the quality of the firm that employed him might drive him into self-employment or entrepreneurship. That model, like the present one, predicted that mismatches were most likely in the tails of the ability distribution. However, it assumed that business creation serves the purpose of resolving mismatches. The present paper suggests that mismatches may be important also after business creation.

The layout of the remainder of the paper is standard. In the next section, we develop the model and derive our testable hypotheses. We then describe our data (Section 3) and report our results (Section 4). Section 5 concludes.

2. The Model

The model has two periods. In the first period, a founder with ability q has an idea of quality θ_1. The former variable captures general ability, and will determine both the success with which the founder can manage a firm that implements the idea, and his earnings in alternative employment. We assume that founder ability is innate, fixed over time and known to the founder. The latter variable incorporates a variety of factors influencing performance, including the quality of the underlying idea or technology, its adaptation and fit to the market, and the public's state of knowledge about the firm's product. Some of these factors may be regarded as fixed, while others evolve over time as the business model is refined. Upon entry, the founder knows q, but he only knows that θ_1 is a random draw from the distribution $F(\theta_1 \mid q)$. The realization of θ_1 is observed after entry. The business idea is refined and adapted to the market, yielding a new quality θ_2 in the second period, which is drawn from $G\left(\theta_2 \mid \theta_1\right)$.

In each period, $t = 1, 2$, output is given by

$$y_t = \theta_t^{1-\alpha_t} q^{\alpha_t}, \tag{1}$$

for some $\alpha_t \in [0, 1]$. Although, θ and q are assumed to be complements in both periods, we allow for the relative importance of ability and idea quality to vary from one period to the next.

Profit in period 1 is given by

$$\pi_1 = \theta_1^{1-\alpha_1} q^{\alpha_1} - wq\,. \tag{2}$$

The only cost is the opportunity cost of the founder's time, which is assumed to be linearly increasing in ability. For concreteness, we shall suppose this alternative use of the agent's time is in wage work.

At the end of the first period, θ_2 is observed and a decision is then made whether to contract with an outside CEO to replace the founder, to continue without change of leadership, or to exit. The outside founder has ability $\tilde{q}$ and must be paid a wage $w\tilde{q}$. If a replacement CEO is hired, a transition cost, c, must be paid. This cost reflects both direct costs of any disruption associated with a change in leadership, as well as any premium necessary to resolve agency problems arising from the separation of ownership and control [Fama and Jensen

(1983), Jensen and Meckling (1976)].[6] The rewards to recruiting an outside CEO are that the CEO's ability can be chosen optimally in light of the realization of θ_2, and the founder is released to earn wq elsewhere while remaining as the residual claimant on the firm's earnings. The founder will therefore be replaced by an outsider if

$$\arg\max_{\tilde{q}} \left(\theta_2^{1-\alpha_2} \tilde{q}^{\alpha_2} - w\tilde{q} - c \right) > \theta_1^{1-\alpha_2} q^{\alpha_2} - wq \,, \tag{3}$$

and if the term on the left hand side of (3) is positive. The profit-maximizing ability of the external CEO is given by

$$\tilde{q} = \left(\alpha_2 \,/\, w \right)^{1/(1-\alpha_2)} \theta_2 \,, \tag{4}$$

so maximized profits in period 2 are

$$\pi_2^* = \max \left(\theta_2^{1-\alpha_2} q^{\alpha_2} - wq, A\theta_2 - c \right), \tag{5}$$

where $A = (1-\alpha_2)(\alpha_2 \,/\, w)^{\alpha_2/(1-\alpha_2)}$. If $\pi_2^* < 0$, the firm exits.

The two terms on the RHS of (5) are plotted separately in Figure 1 for different values of θ_2 while holding q constant. The concave function $\pi_2(\theta_2, q)$ indicates profits when the founder continues, and the straight line $\tilde{\pi}_2(\theta_2)$ depicts profits when the founder is replaced. In the case illustrated in the figure, there are four distinct regions defined by the boundary values $0 < \theta_E \le \underline{\theta} \le \overline{\theta}$: if $\theta_2 \in [0, \theta_E]$, the firm exits at the end of period 1; if $\theta_2 \in [\theta_E, \underline{\theta}]$ or if $\theta_2 \ge \overline{\theta}$, the founder is replaced; and if $\theta_2 \in (\underline{\theta}, \overline{\theta})$, the founder continues to operate the firm. When $\theta_2 \in [\theta_E, \underline{\theta}]$, the founder is replaced because the opportunity cost of his time does not justify continued commitment to the business model; he is replaced by an external CEO who is less able than the founder. In contrast, when $\theta_2 \ge \overline{\theta}$ the founder is replaced by an external CEO with higher ability.

[6] He (2008), for example, documents that founder CEOs have lower incentive compensation and lower total compensation than professional CEOs.

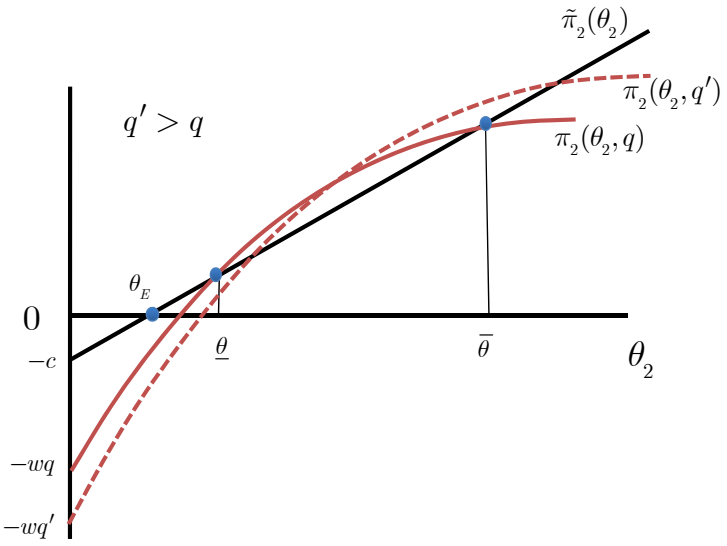


FIGURE 1. Second period payoffs; $c>0$.

Figure 1 also illustrates the effect of an increase in the founder's ability, from q to q'. This reduces the profitability of the founder continuing with the firm when the quality of the idea is low, and increases it when the idea is good. It is easy to verify that the intersection of $\pi_2(\theta_2, q)$ and $\pi_2(\theta_2, q')$ lies between $\underline{\theta}$ and $\overline{\theta}$, and hence that the effect of an increase in q is to raise both $\underline{\theta}$ and $\overline{\theta}$. The interval $[\theta_E, \underline{\theta}]$ will vanish if the founder's ability declines sufficiently so that $\overline{\theta} < \theta_E$. There are, therefore, two distinct cases. In one case, consisting of low-ability founders, the period 2 outcomes consist of three groups, with replacement of founders occurring only at higher values of θ. In the second case, founders are replaced in firms with business models drawn from the tails of the quality distribution among all surviving firms. Which of these cases arises depends on the founder's ability, as well as other parameters of the model. For example, an increase in the transition cost, c, shifts $\tilde{\pi}_2(\theta_2)$ down, which may eliminate the interval $[\theta_E, \underline{\theta}]$; that is, if the increase in c is large enough, replacement of founders occurs only at high values of θ_2 and in each case the replacement has higher ability than the founder. Clearly, the minimum value of c that eliminates the interval

$[\theta_E, \underline{\theta}]$ depends on the founder's ability.[7]

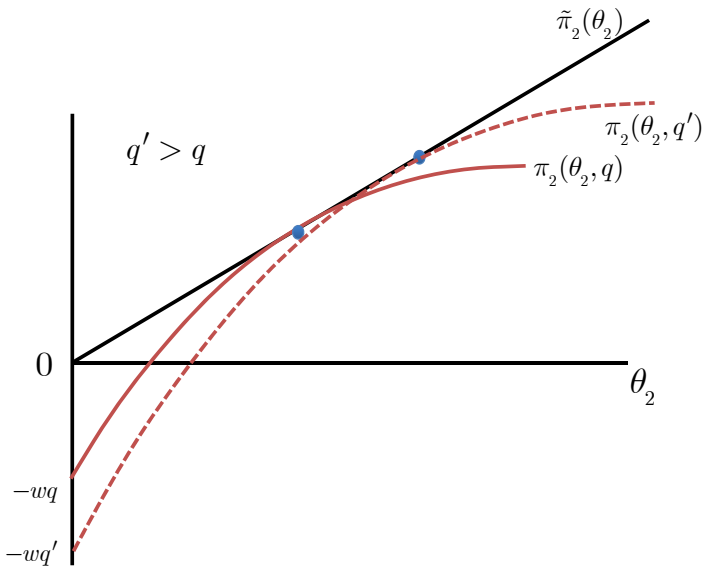


FIGURE 2. Second period payoffs; c=0.

Given the parameter values, the *empirical* predictions of the model about founder turnover depends heavily on the joint distribution of q and θ_2 (and, by virtue of the correlation between θ_1 and θ_2, on the joint distribution of initial idea quality and founder ability). For example, the implication that founder turnover occurs both when θ_2 is high (relative to q) and when it is low requires that we observe in any sample instances where contrasting values of θ_2 and q coexist. Similarly, the transition cost cannot be so high that it eliminates the interval $[\theta_E, \underline{\theta}]$. Because this may not be the case, and despite the simplicity of the model, there are no general results about the relationships between performance in the two periods,

[7] When $c > 0$, it is always the case that $\underline{\theta} < \overline{\theta}$. To illustrate the importance of the transition cost, Figure 2 illustrates the limiting case of $c = 0$. The function $\tilde{\pi}_2(\theta_2)$ is then tangential to $\pi_2(\theta_2, q)$ for any value of q. and $\underline{\theta} \to \overline{\theta}$. In this case, every founder is replaced, because it is always efficient to secure a perfect match between CEO ability to idea quality.

founder ability and turnover. We will therefore make use of some numerical simulations to explore the *possibilities* of the model.

However, it is useful to consider some reasonable ways in which we can limit the varied possibilities. We do so in two ways. The first imposes a constraint on the transition cost, c, such that in each case the model predicts an aggregate rate of turnover that approximates the rate (about 12 percent) that we observe in our data. We will then explore what the model has to say, conditional on generating an appropriate aggregate rate of turnover, about the effect of period 1 performance on turnover and the future earnings of departing founders, and of turnover on period 2 performance.

The second way we limit the possibilities makes use of a simple free-entry condition to help us constrain the relationship between ability and the quality of the idea. We want to admit entrepreneurs of all abilities. This will be the case if all agents, regardless of ability, are indifferent between entrepreneurship and wage work in period 1. If the quality of ideas and agent ability are independent of each other, then high-ability agents, who bear a higher opportunity cost of becoming an entrepreneur, will find business creation less attractive than low-ability agents. We will therefore assume that idea quality and agent ability are positively correlated. For our purposes, it suffices to suppose that ability and agents care only about expected first-period returns. In the simulations to follow we therefore impose the constraint[8]

$$E\left[\theta_1^{1-\alpha}\right] = wq^{1-\alpha}, \tag{6}$$

which ensures that all agents, regardless of ability, are indifferent between creating a business and wage employment.

2.1 *Baseline simulations*

In our baseline model, we assume that in both periods ability and the quality of

[8] A forward-looking agent will also consider the option value that entering gives by providing choices in the second period. In period 2, the founder may choose to remain in control of the business, replace a new CEO if doing so increases profits, or exit. Even if expected second-period earnings from continuation are the same as expected first-period earnings, the replacement and exit options imply for a forward looking agent that $E\left[\theta_1^{1-\alpha}\right] < wq^{1-\alpha}$.

the ideas are equally important. That is, we set $\alpha_1 = \alpha_2 = 0.5$. We assume that $q^{1-\alpha}$ has a lognormal distribution, with unit mean and standard deviation of 0.5. Consistent with (6), we then assume that, for agent i, $\theta_{1i}^{1-\alpha}$ is a draw from a lognormal distribution with mean $wq_i^{1-\alpha}$. Finally, consistent with the assumption that $G(\theta_2 \mid \theta_1)$ is decreasing in θ_1, we assume that $\theta_{2i}^{1-\alpha}$ is a draw from a lognormal distribution with mean $\theta_{1i}^{1-\alpha}$. The wage, w, is normalized to 1. Finally, we set $c = 0.35$, so that our baseline produces an aggregate rate of founder turnover of about 12 percent, consistent with evidence we shall show later.

Figure 3 illustrates the behavior of 5,000 random draws in the baseline model. The upper panel plots the second-period idea quality against founder ability, distinguishing observations by exits, firms that continue with their founder, and firms that continue with a new CEO. Among the firms that replace their founder, the panel distinguishes between CEOs that have higher and lower ability than the founder. The lower panel plots second-period sales against first-period sales for all continuing firms, again distinguishing by founder status.

The upper panel illustrates several features of the model. First, firms that are closed down are those with low-quality ideas. If the founder does not want to continue with the firm, continuation requires a new CEO. However, payment of the transition cost cannot be justified in low-quality firms. Although founders of exiting firms on average have relatively low ability, this is incidental and driven by the correlation between idea quality and founder ability. Indeed, once one conditions on idea quality, low-ability founders are less likely to close down the firm. The boundary separating firms that are discontinued from those that are continued with the founder at the helm is given by the pairs $\{\theta_2, q\}$ satisfying $\theta_2 = w^{1/(1-\alpha_2)}q$, showing that low-ability founders may continue to operate a business that a high-ability founder would close down.

Founder turnover in continuing firms occurs in two distinct groups. First, there is a group of firms with high-quality ideas but that were in general founded by agents of sufficiently low ability to merit replacement with a more able CEO. Because of the positive correlation between ability and idea quality, this is a rather sparsely populated group. The boundary between this group and the group of founders that continue to operate their own firm is defined by the function $\overline{\theta}(q)$ that provides the larger of the solutions to the equation $A\theta_2 - c = \theta_2^{1-\alpha_2}q^{\alpha_2} - wq$

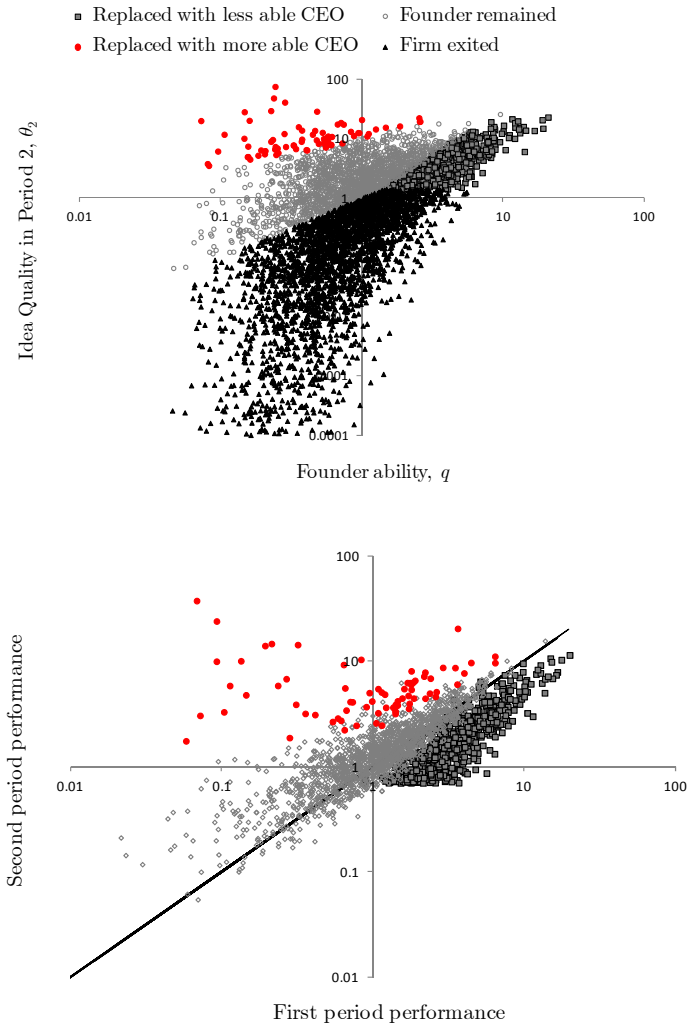


FIGURE 3. *Baseline simulations, 5000 observations.* **Upper panel:** Founder ability versus second-period idea quality, by outcome. **Lower panel:** First-period versus second-period performance among surviving firms, by outcome. Parameters: α_1=α_2=0.5, w=1, c=0.35. Each $q^{1-\alpha}$ is a draw from the lognormal with mean one, $\theta_1^{1-\alpha}$ is lognormal with mean $q^{1-\alpha}$, and each $\theta_2^{1-\alpha}$ is lognormal with mean $\theta_1^{1-\alpha}$;all three distributions have a standard deviation of 0.5. Founder turnover occurs in about 12% of the observations. Solid line in lower panel indicates equal performance in both periods.

(see Figure 1). As the transition cost rises, $\overline{\theta}(q)$ unambiguously shifts upwards. The second group consists of firms with able founders but whose firms are of middling quality. The quality of the idea is high enough to prefer continuation over exit, but not high enough to merit continuation of the founder. The replacement CEO has lower ability than the founder. The boundary between this group and those that exit is a horizontal line at $\theta_2 = cA^{-1}$. The boundary between this group and the group of founders that continue to operate their own firm is given by the function $\underline{\theta}(q)$ that provides the smaller of the solutions to $A\theta_2 - c = \theta_2^{1-\alpha_2} q^{\alpha_2} - wq$. An increase in the transition cost shifts $\underline{\theta}(q)$ downwards. Figure 3 shows that $\overline{\theta}(q)$ and $\underline{\theta}(q)$ are both positively sloped, and this is consistent with the discussion around Figure 1.

The boundaries between the distinct groups in the upper panel of Figure 3 do not depend on the distributions of ability and idea quality; they can thus be represented analytically, as in Figure 4. However, what this figure implies for empirical predictions depends critically on the distributions. For example, if there are no observations in the upper left of Figure 4 (because we never see good ideas developed by founders with little ability), we would predict that the best founders are the only ones at risk of being replaced. In contrast, if there are sufficient observations in the upper left quadrant, we might expect to find founder replacement occurring in the tails of the ability distribution. In stating our empirical predictions, we shall suppose throughout this section that the distributions of founder ability and idea quality are sufficiently wide to yield sample observations in all quadrants of Figure 4. Our simulations are consistent with this assumption.

We do not get to observe q and θ separately: in the data, we observe only their combined contribution to revenues. The lower panel of Figure 3 therefore plots simulated first- and second-period revenues of surviving firms by founder status for our baseline simulations. The two distinct groups of founders that experience turnover are also clearly evident when we look at first-period performance. There is a group with above-average performance in the first-period whose founders are replaced with less able CEOs. There is also a group of firms whose founders are replaced with more able CEOs. This group consists of firms with low-ability founders, but their poor ability is offset by ideas that, in the second-period are sufficiently high quality to justify payment of the transition cost (firms with the

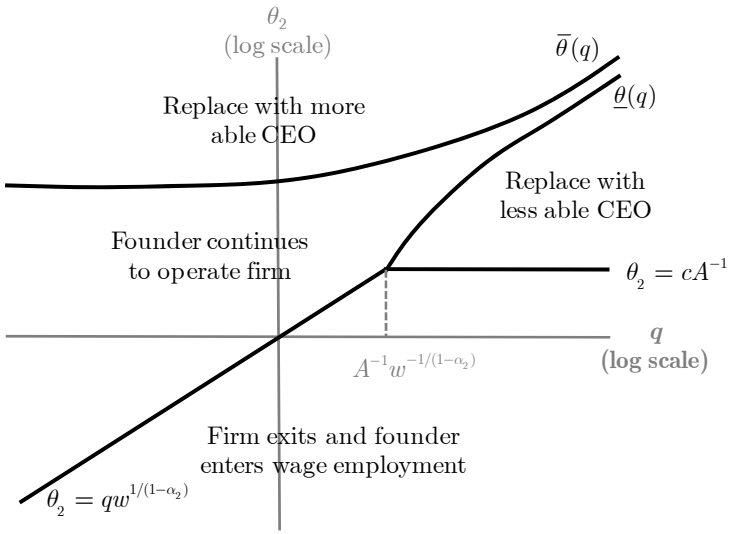


FIGURE 4. *Ability, idea quality, and outcomes.*

worst ideas in the second period are typically closed down). Although these firms have a mean first-period performance that is not much different from the population average, they are overrepresented in the lower tail of the first-period performance distribution. Therefore, our first prediction is

H1. *Founder replacement is more likely in the tails of the initial performance distribution.*

A distinctive feature of the lower panel of Figure 3 concerns the effect that CEO turnover has on the relationship between first-period performance and second-period performance. Performance among the group of surviving firms with no turnover tends to be more consistent from one period to the next than in the case of firms that experienced turnover. Firms in which founders are replaced by less-able CEOs see on average a decline in their performance, while the arrival of a more capable CEO induces on average an improvement in performance. Among surviving firms with no turnover, therefore, the correlation between first and second-performance is strongly positive. In contrast, the correlation among firms that experienced turnover is much weaker in absolute value, and appears to be negative.

H2. *Among all surviving firms, first- and second-period performances are positively related. The relationship is weaker, and may be negative, among firms that experience founder replacement.*

Finally, what happens to the founders that are replaced? Among all founders, first-period performance is positively correlated with ability. However, some founders are replaced because they have low ability but good ideas, so it is not clear that the positive correlation between firm performance and ability survives among the subset of founders that are replaced. Because future earnings depend on ability, the relationship between first-period performance against future earnings is also *a priori* unclear. However, as Figure 5 indicates, the positive relationship survives in our baseline analysis among founders selected for replacement. Figure 5 suggests also a nonlinearity in the relationship likely driven by the exit of firms with the worst ideas.

H3. *Subsequent earnings of founders that are replaced is an increasing, concave, function of initial firm performance.*

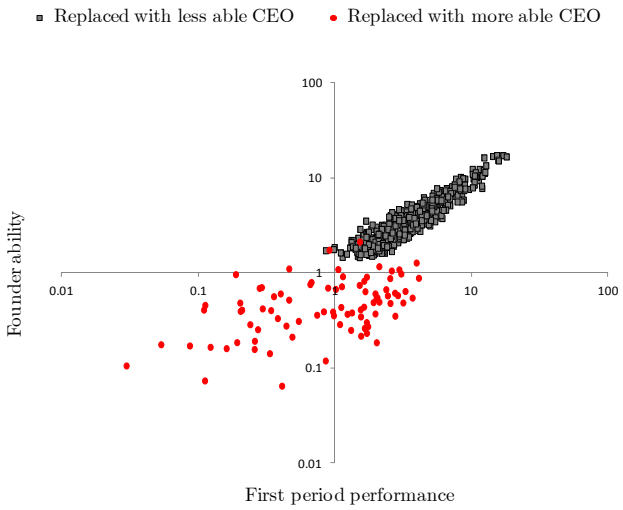


FIGURE 5. *Ability versus first-period performance among founders that are replaced.*

Finally, recall that our model assumes a correlation between idea quality and founder ability such that all agents are indifferent between founding a business and working as an employee. The final prediction immediately follows from this assumption:

H4. *Initial performance is unrelated to the probability that replaced founders re-enter entrepreneurship.*

2.2 *Alternative Scenarios*

Do these results persist in the face of significant changes in parameter values? Figures 6 through 8, which replicate the lower panel of Figure 3 for five alternative scenarios, suggest that the possibilities depicted so far are, in fact, quite robust. In Figure 6, the relative importance of idea quality and ability is altered across the two periods. In the upper panel, ability is most important in the first period $(\alpha_1 = 0.8, \alpha_2 = 0.2)$, while in the lower panel it is more important in the second $(\alpha_1 = 0.2, \alpha_2 = 0.8)$. The results reported in the baseline are not sensitive to these significant changes in the production technology. Figure 7 sharply alters the correlations between idea quality and ability. In the upper panel, the standard deviation of the distribution of θ_2 is reduced by 80 percent, to 0.1, while maintaining its mean equal to the realized value of θ_1; the lower panel similarly increases the correlation between q and θ_1 by reducing the variance of the distribution of θ_1. The three groups of surviving firms become even more distinct than in the baseline, but the original pattern is preserved. Finally, in Figure 8 the cost of transitioning to a new CEO is reduced sharply, so that the fraction of firms that experience turnover is increased from about 12 percent to 35 percent. Again, the baseline results are robust to this change.

Figure 9 replicates Figure 5 for each of these scenarios. In all cases the relationship between ability and first-period performance is positively related, although in several cases the effect is, as in Figure 5, much weaker among founders that are replaced with more able CEOs.

3. Data and Sample Construction

Our empirical analysis focuses on all new business founded in Denmark in 1999 and 2000. We study the effects of early performance on subsequent founder replacement (H1), the effects of founder replacement on the relationship between

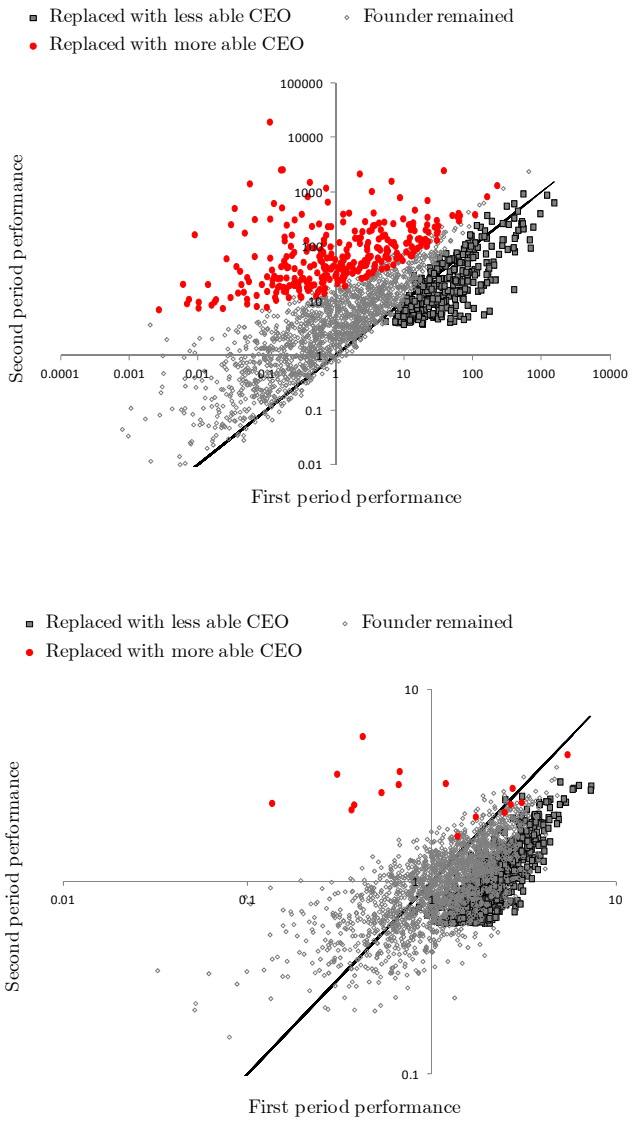


FIGURE 6. *Alternative scenarios* I. *First-period versus second-period performance among surviving firms, by outcome.* **Upper panel:** Ability matters more (less) than idea quality in the first (second) period; α_1=0.8, α_2=0.2. **Lower panel:** Idea quality matters more (less) than ability in the first (second) period; α_1=0.2, α_2=0.3. In each case c is adjusted to maintain turnover rate of about 12%.



FIGURE 7. *Alternative scenarios* II. *First-period versus second-period performance among surviving firms, by outcome.* **Upper panel:** First- and second-period idea qualities more highly correlated (standard deviation of distribution of θ_2 reduced to 0.1). **Lower panel:** First-period idea quality and founder ability more highly correlated (standard deviation of distribution of θ_1 reduced to 0.1). In each case c is adjusted to maintain turnover rate of about 12%.

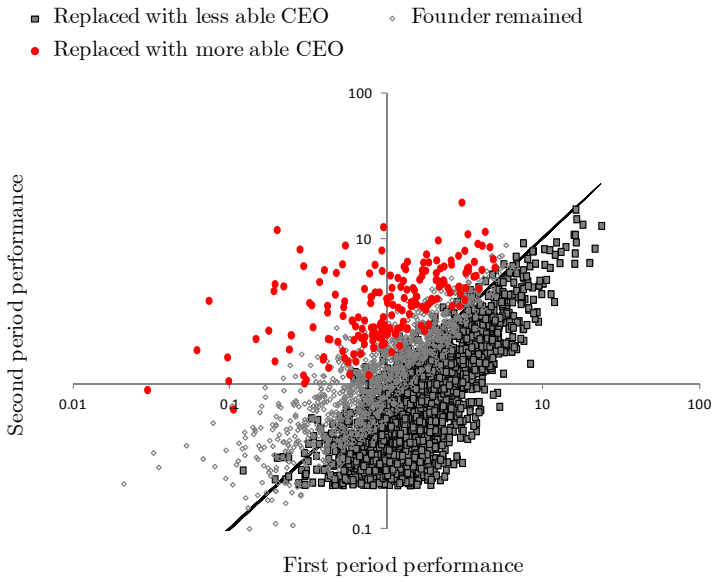


FIGURE 8. *Alternative scenarios* III. *First-period versus second-period performance among surviving firms, by outcome.* Transition cost reduced to c=0.1, increasing founder turnover rate to about 35%.

initial and subsequent performance (H2), the subsequent earnings of replaced founders (H3), and the likelihood that they found another business (H4). We construct our sample out of three databases maintained by Statistic Denmark: the Entrepreneur Database, the Firm Database, and the Integrated Database for Labor Market Research (IDA).

The Entrepreneur Database is the primary source for identifying new businesses (partnerships or sole proprietorships) registered in Denmark each year, and provides unique identifiers for each firm, each plant, and one individual identified in the registration documents. The Entrepreneur Database spans the period 1996 to 2006. However, accounting information is not collected for all industries until 1999, so this is the earliest cohort we study.

There are several limitations to the Entrepreneur Database. First, since only one person associated with the new business is recorded, the database provides no

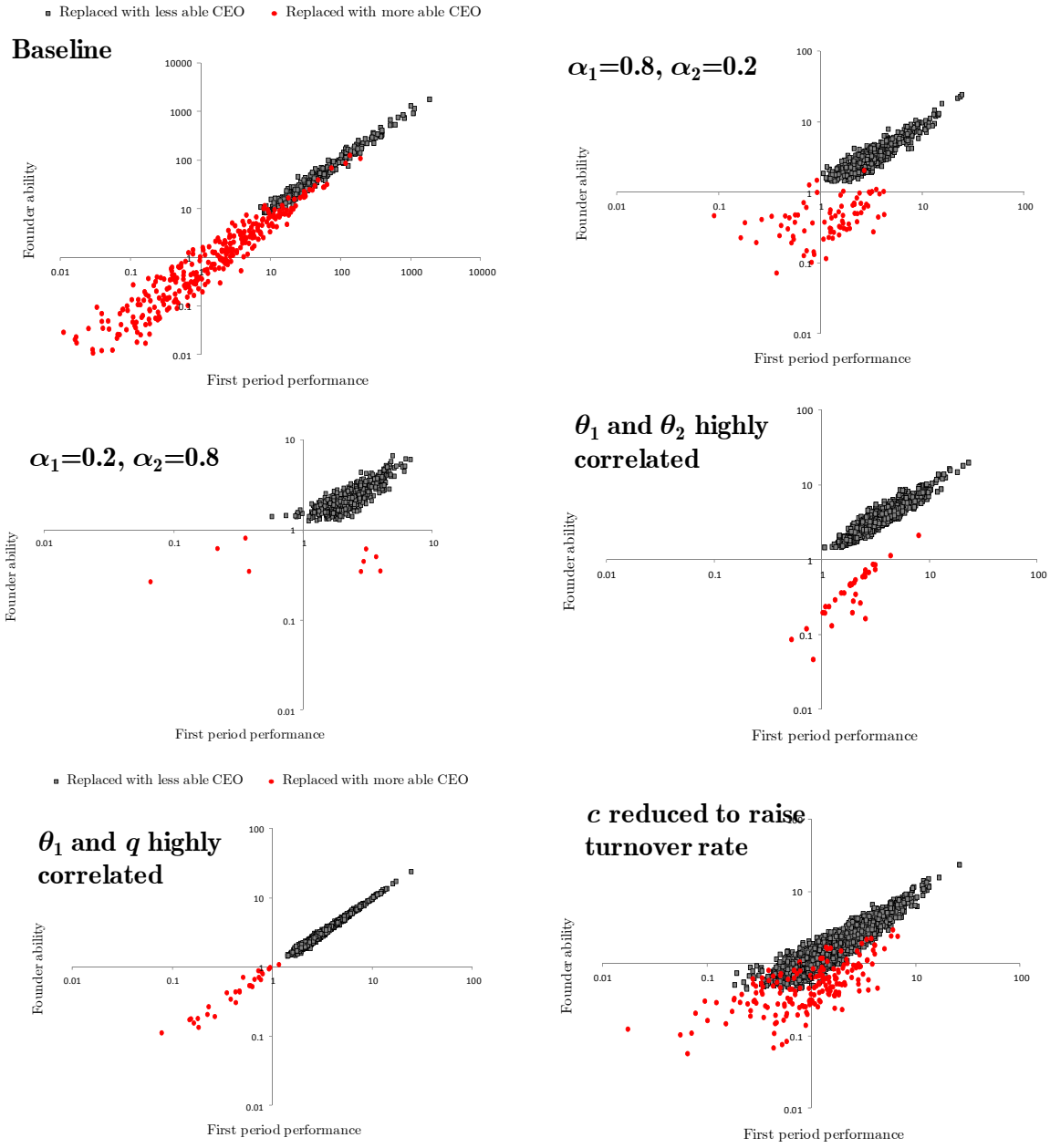


FIGURE 9. *All scenarios: Ability versus first-period performance among founders that are replaced.*

information for identifying possible co-founders. Second, some of those who appear in the database may not be the "real" founder. For example, there are cases in which husbands used their wives' names to register a business. Third, it is unclear from the Entrepreneur Database whether or not the identified entrepreneur actually works at their startup. Although it is possible that entrepreneurs do not operate businesses themselves, this study focuses on those who were actually working for their own businesses. In order to identify these entrepreneurs and possible co-founders, the data obtained from the Entrepreneur Database are combined with information provided in the Firm Database.

The Firm Database consists of annual employment information on all workers (full-time and part-time) at all firms operating in Denmark. The variable of particular interest is their position in the firm, through which founders of each new business are identified in the following way. First, founders are those whose positions are classified as self-employed, employers, or business tax payers. Second, for businesses with fewer than four employees, people whose positions are top managers are also defined as founders.[9] Third, if nobody in a business with fewer than four employees is identified as a founder based on the previous two criteria, all employees are considered as cofounders. The majority of founders identified in the sample belong to this third category. The fourth group of founders consists of those who registered the business, were working for the business, but did not meet the first three criteria for being a founder. Lastly, we identify individuals who registered the business, but did not appear to be working for the new firms (we will exclude this last category from the final sample).

We further restrict our sample to startups that hired at least one employee who was working in the firm as his or her primary occupation. Doing so allows us to link these businesses to the IDA, where more detailed information such as industry classification and employee demographics is available. The IDA is an employer-employee matched database, which provides mainly employment information at firm, establishment, and employee levels. The IDA enables us to track over time the turnover of founders, changes in firm status, and occupational choices of individuals each year until 2008. However, because of incomplete accounting and earnings data in the most recent years, we will follow firms only through 2004

[9] This way to identify founders was first used by Sørensen (2007).

and individuals through 2005.

Although firm identifiers in the IDA are time-invariant, they are attached to a specific owner. As a result, the firm identifier changes whenever there is a change of ownership. This design makes it possible to distinguish three firm-level events in each year. Survival is assumed if the same firm identifier from the previous year appears in the current period. An ownership change occurs if the same establishments of the firm from the previous year are identified in the current period except that they are associated with a different firm identifier. A business exit is identified if all the establishments of the firm can no longer be found in the data.

In our analysis, the original founder of a startup must meet the following criteria: (1) He or she formed a startup in 1999 or 2000 as a sole proprietor; (2) The person was currently working at the new venture; and (3) The new business could be identified in the Firm Database and the IDA database, indicating that at least one employee was working in the business as his or her primary job. Using the unique person and firm identifiers, we can track these founders' employment in the following year to identify whether or not the founder was still working at the startup, and whether he was still an employer. A founder was staying at the startup if he could be identified in the firm in the following year, whether as an employee or as an employer. Otherwise, the founder is assumed to have left the original firm because of turnover, business exit, or ownership change. In a few cases, the founder might stay at the startup after a change of ownership, but in each of these cases a new firm identifier is assigned to the startup.

Table 1 provides tabulations of changes in the status of startups and their founders from the founding year to 2005. Of 4,172 firms in the sample, a total of 533 (12.8 percent) of them experienced founder turnover. Turnover was twice as common as ownership change (6.5 percent), but much less common than firm exit (50.6 percent). Turnover was also likely to happen relatively quickly: over two-thirds of all turnovers occurred within two years of the firm's birth.[10] Based on the baseline sample, we create three subsamples for the purpose of testing our hypotheses. More details about these subsamples are provided below as we pro-

[10] The declining hazard of turnover is consistent with gradual *learning* about match quality [Jovanovic (1979)], which we have not attempted to model.

ceed to each part of the analysis.

Table 1

Status Change of Startups by Year

	2000	2001	2002	2003	2004	2005
Panel A. 1999 Cohort						
Surviving: founder stays	1,164	890	737	623	545	475
Surviving: founder turnover	65	43	34	19	17	17
Firm exit	336	194	105	79	45	42
Firm acquired	23	37	14	16	16	11
Total	1,588	1,164	890	737	623	545
Panel B. 2000 Cohort						
Surviving: founder stay		1,832	1,357	1,092	912	776
Surviving: founder turnover		148	84	48	35	23
Firm exit		562	356	186	114	95
Firm acquired		42	35	31	31	18
Total		2,584	1,832	1,357	1.092	912

4. Results

We describe our analyses and results in four subsections. First we evaluate H1, that founder replacement is more common in the tails of the prior performance distribution. We then evaluate the relationship between founder turnover and subsequent firm performance (H2). Finally, we follow founders who left their firms and explore the relationship between the performance of their former firm, their subsequent earnings (H3), and employment choices (H4).

4.1 *Startup performance and founder turnover*

To test the first hypothesis, we remove from the baseline sample 2,388 startups (918 from the 1999 cohort, and 1,470 from the 2000 cohort) that exited or were acquired before any occurrence of a founder turnover during the observation window between the founding year and 2005. Table 2 provides descriptive summary statistics for the remaining 1,784 startups and their founders. There are no large differences in means between founders that continued and founders who were replaced. However, the latter group are somewhat younger and less likely to have had vocational training; they are also more likely to come from the tails of the

Table 2

Descriptive Summary of Subsample 1

	All	No Turnover	Turnover
Age (mean years)	40.07	40.23	37.91
Male (%)	0.76	0.76	0.77
Married (%)	0.64	0.64	0.54
Education (%)			
less than high school	16.84	16.55	21.01
exact high school	6.66	6.34	11.07
vocational training	50.91	51.75	39.21
some college	14.72	14.66	15.57
bachelor	1.13	1.02	2.63
Master	7.66	7.66	7.69
Phd	0.69	0.69	0.75
others	1.38	1.33	2.06
Founded in 1999 (%)	42.28	42.69	36.59
Initial sales (1,000 DKK)	2,149	2,135	2,347
Initial no. of full-time employees	1.87	1.85	2.09
Industry (%)			
Agriculture	0.29	0.28	0.38
Manufacturing	7.25	7.34	6.00
Construction	17.57	17.86	13.51
Wholesale and retail	37.57	37.55	37.9
Transport, post, telecom	4.89	4.90	4.69
Low-tech businesses	6.93	6.93	6.94
Public Services	0.43	0.42	0.56
Personal Services	6.05	6.26	3.19
Kibs	0.44	0.34	1.88
High-tech	18.24	17.77	24.77
Others	0.34	0.35	0.19
Obs.	7,961	7,428	533

earning distribution (either less than high school or at least college); they are also somewhat less likely to have founded businesses in construction, and more likely to be in engaged in high-tech activities.

We first estimate the following logit model,

$$\ln\left(\frac{p_t}{1-p_t}\right) = \alpha + \beta_1 logsale_{t-1} + \beta_2 (logsale_{t-1})^2 + \gamma X_i + \delta Z_{i,t-1} + \varepsilon_{i,t} \quad (7)$$

where p_t is the probability that the founder leaves a continuing firm in period t, X_i is a vector of time-invariant variables related to founder demographics (e.g., gender) and startup founding conditions (e.g. founding year and industry), and $Z_{i,t-1}$ is a vector of potentially time-varying variables, such as firm age, founder age, marital status, and highest completed education.

The key independent variable is the logarithm of sales in the previous period, along with its quadratic to allow for the possibility of a non-monotonic effect as predicted by the model.[11] Columns (1) and (2) of Table 3 present the results. In column (1), we include controls for firm age and founding year. The results show a U-shaped relationship between the log of sales in the previous period and the likelihood of founder turnover in the current period, indicating that founders are more likely leave their firm if it is in the tails of the performance distribution among all surviving firms. In column (2), we include founder demographics without changing our key result. Columns (3) and (4) replace sales in the previous period with sales in the startups' first year of operation. The results continue to show the U-shaped relationship. The minimum of the u-shaped relationship between prior performance and the probability of turnover occurs at revenue levels of DKK580,000 to DKK800,000, equal to 15 to 37 percent of the sample mean. This is also well within the sample range. Consistent with H1, therefore, we find that turnover is more common in the tails of the observed earnings distribution than in the middle.

4.2 *Founder turnover and the subsequent performance of startups*

To test the second hypothesis, we use a subset of startups in the baseline sample and limit the observation window to the interval between the founding year and 2004. The choice of 2004 as the ending year is governed by the availability of accounting information. The startups included in this subsample must meet two criteria. First, we eliminate firms in which the founder was replaced after 2002. That is, firms included in the sample either experienced founder turnover by

[11] For six observations with zero sales, we added one DKK to sales prior to taking the logarithm.

2002, or never had founder turnover during the observation period. Second, we remove startups that failed or were acquired between the initial founding year and 2002 but prior to any observed founder turnover event. However, we retain in the subsample startups that experienced founder turnover and then exited or were acquired. Table 4 illustrates how we construct the subsample.

TABLE 3

The Effect of Startup Performance on the Probability of Founder Turnover

	Dept Var: = 1 if founder replaced in year t			
	Using sales in year $t-1$		Using sales in founding year	
	(1)	(2)	(3)	(4)
Log of sales	-0.940^{***}	-0.966^{***}	-1.159^{***}	-1.270^{***}
	(-5.08)	(-5.10)	(-3.30)	(-3.43)
(Log of sales)^2	0.072^{***}	0.076^{***}	0.084^{***}	0.095^{***}
	(5.71)	(5.87)	(3.36)	(3.61)
Founder characteristics				
Founder age	−−	-0.017^{***}	−−	-0.019^{***}
		(-3.05)		(-3.40)
College educated = 1	−−	-0.235^{*}	−−	-0.090
		(-1.38)		(-0.54)
Male = 1	−−	-0.154	−−	-0.104
		(-1.28)		(-0.86)
Married = 1	−−	-0.331^{***}	−−	-0.303^{***}
		(-3.25)		(-2.98)
Firm characteristics				
Firm age	-0.366^{***}	-0.340^{***}	-0.324^{***}	-0.288^{***}
	(-10.39)	(-9.47)	(-9.68)	(-8.46)
Cohort dummy (= 1 if founding year = 2000)	0.130	0.10 3	0.095	0.069
	(1.34)	(1.04)	(0.96)	(0.69)
Controls for industry	No	Yes	No	Yes
Ave Log Likelihood	−0.239	−0.235	−0.241	−0.237
No. of observations	7,357	7,348	7,305	7,305

Sales in thousand DKK. z-scores are in parentheses. Significance levels: *** 0.01, ** 0.05, * 0.1.

Table 4
Firms Included in Subsample 2

	Turnover by 2002	Turnover after 2002	No Turnover
Exited or acquired by 2002	✓	×	×
Exited or acquired after 2002	✓	×	✓
Survived to 2004	✓	×	✓

Starting with the 1,588 startups in the 1999 cohort, we removed 709 firms that exited or went through ownership change by the end of 2002 and before any occurrence of founder turnover, and 36 firms that experienced founder turnover in 2003 or 2004. For the 2,584 startups in the 2000 cohort, we removed 995 and then 83 of them for the same reasons. We are left with a sample of 2,349 startups, 843 of which come from the 1999 cohort, and 1,506 from the 2000 cohort.

Table 5 summarizes the number of startups in our sample that survived, exited, or experienced ownership change during the observation period. Among the 843 startups founded in 1999, 142 of them had founder turnover before 2002. Among them, 50 survived to 2004, 56 exited or changed owners before 2002 but after founder turnover, and 36 exited after 2002. Among the 1,506 startups founded in 2000, 232 had founder turnover before 2002. Of these, 82 survived the entire observation period, 70 exited or changed owners before 2002, and 80 exited after 2002.

Table 6 provides the descriptive summary of this subsample (the distributions of firms in each column across industries is very similar to those shown in Table 2, and are not reported). Also note that sales and the number of full-time employees in 2004 is larger for startups that experienced founder turnover than for those that did not, suggesting that on average turnover may have had a positive impact on subsequent performance of startups.

We estimate the following model

$$\ln(sales)_{i,2004} = \alpha + \beta_1 \ln(sales)_{i,0} + \beta_2 turn_i + \beta_3 \ln(sales)_{i,0} \times turn_i + \gamma X_i + \varepsilon_{i,2004}, \quad (8)$$

Table 5

Survival, Exit, and Ownership Change after Founder Turnover

	1999 Cohort		2000 Cohort	
	Turnover	No Turnover	Turnover	No Turnover
Total	**142**	**701**	**232**	**1,274**
Survived	50	545	82	912
Exited before 2002	56	0	70	0
Exited after 2002	36	156	80	362

Table 6

Descriptive Summary of Subsample 2

	All	No Turnover	Turnover
Obs.	**2,349**	**1,975**	**374**
Survival in 2004 (%)	67.65	73.77	35.29
Founded in 1999 (%)	35.89	35.49	37.97
Initial sales (1,000 DKK)	2,008	1,962	2,253
Sales in 2004 (1,000 DKK)	5,168	4,929	7,639
Initial no. of full-time employees	1.68	1.62	2.00
No. of full-time employees in 2004	4.08	3.86	6.39

where $turn_i$ equals one if the startup experienced founder turnover between its founding year and 2002, and zero otherwise, and the vector X_i includes controls for cohort and industry.

Table 7 presents OLS estimates of (8). In the first three columns, we focus on startups that survived during the entire observation period between their founding year and 2004. Column (1) shows that both initial sales and founder turnover have a positive impact on startups' sales in 2004. Interacting the two factors in column (2), we further find that the marginal effect of founder turnover on future sales is decreasing with the initial performance of startups (or, equivalently, that the marginal effect of initial performance is lower for firms that had turnover). This is consistent with H2. However, this positive effect of turnover is reduced to zero only at about the 95^{th} percentile in the distribution of initial sales. In column (3), we replace the log of initial sales with three categorical variables that indi-

cate membership in the bottom quartile, the upper quartile, or the middle of the distribution of the log of initial sales. The result confirms a positive correlation between initial and future performance. Meanwhile, founder turnover has a positive impact on a startup's future performance for the first two categories, but the effect is insignificant for the third category.

Table 7

Founder Turnover and Future Performance of Startups

	Dept Var: log of sales in 2004					
	Surviving Firms OLS			All Firms Tobit		
	(1)	(2)	(3)	(4)	(5)	(6)
Log.sale_0	0.437***	0.453***	−−	0.724***	0.817***	−−
	(18.8)	(18.6)		(5.92)	(6.12)	
Turnover	0.336***	1.524***	−−	-5.00***	-1.032	−−
	(4.15)	(2.80)		(-14.4)	(-0.45)	
Log.sale_0*turnover	−−	-0.165**	−−	−−	-0.552*	−−
		(-2.21)			(-1.73)	
log.sale_0 percentile: $<25^{\text{th}}$ (D1)	−−	−−	-1.108***	−−	−−	-1.817***
			(-16.6)			(-5.04)
log.sale_0 percentile: 25^{th} -75^{th} (D2)	−−	−−	-0.700***	−−	−−	-1.666***
			(-12.5)			(-5.48)
D1 × turnover	−−	−−	0.441***	−−	−−	-5.879***
			(2.60)			(-8.83)
D2 × turnover	−−	−−	0.483***	−−	−−	-3.605***
			(4.19)			(-7.12)
D3 × turnover	−−	−−	-0.046	−−	−−	-6.427**
			(-0.29)			(-9.67)
2000 cohort	0.072	0.068	-0.081*	-0.441*	-0.452*	-0.666***
	(1.56)	(1.49)	(-1.76)	(-1.80)	(-1.85)	(-2.76)
Adj R-sq	0.214	0.216	0.188	--	--	--
Obs.	1,440	1,440	1,440	2,142	2,142	2,142

Columns (1) - (3): t statistics in parentheses. Columns (4) - (6): z scores in parentheses. The omitted category in columns (3) and (6) is the top quartile of the log of initial sales. All regressions include controls for industry. Significance levels: *** 0.01, ** 0.05, * 0.1.

In columns (4) to (6), we estimate Tobit regressions including all firms in the subsample. For startups that exited or went through ownership change before 2004, we recode the logarithm of their sales as zero [cf. Dunne, Roberts and Samuelson (1989)], and make zero our threshold for inclusion in the linear portion of the model. The inclusion of exiting firms changes the results. Turnover is now associated with lower future performance for *all* firms, although as in the first three columns, the effect of turnover is worse for firms with good initial performance.

The effect of including failing firms in the sample recalls Holmes and Schmitz' (2005) prediction that turnover is associated with higher failure rates. To explore this more directly, in Table 8 we report the result of logit regressions, where the dependent variable equals one if the firm survived to 2004. Columns (1) and (2), which include all firms in our sample, yield point estimates that suggest lower survival rates for firms that experienced founder turnover. There is, however, a potential endogeneity problem in these two columns. It is possible the founders leave firms because they are already in the process of exiting, but our data do not record exits until after they have left. In columns (3) and (4), we therefore remove from the sample 100 firms that had failed after founder departure but by 2002; these firms must have failed very soon after the founder left. Doing so does not alter the evidence in favor of Holmes and Schmitz's prediction.

4.3 *Turnover and Founder's Future Earnings*

To test H3, we construct a subsample that consists of all the founders that left their startups. We then track their income and occupational choice for three years after turnover occurred. Table 9, which provides a descriptive summary of the founders in this dataset by the year of their turnover, shows that founder turnover is more common in the first couple of post-founding years. This is consistent with the finding in Table 3 that older firms are less likely to experience founder turnover. The demographic characteristics of founders are similar across different turnover years, except that founders who left businesses in early years have on average less education.

Table 8

Survival and Turnover

	Logit Model Dept Var: =1 if firm survived to 2004			
	1	2	3	4
Log sale$_0$	0.198***		0.190***	
	(3.48)		(3.35)	
log.sale$_0$ percentile:		-0.458***		-0.450***
<25th (D1)		(-2.80)		(-2.75)
log.sale$_0$ percentile:		-0.540***		-0.537***
25th -75th (D2)		(-3.83)		(-3.81)
D1 × turnover		-2.002***		-1.446***
		(-8.01)		(-5.36)
D2 × turnover		-1.276***		-0.368
		(-6.90)		(-1.62)
D3 × turnover		-2.178***		-1.337***
		(-8.61)		(-4.59)
Turnover	-0.538		-1.128	
	(-0.63)		(-1.18)	
Log.sale$_0$*turnover	-0.163		0.028	
	(-1.39)		(0.21)	
2000 cohort	-0.224**	-0.270***	-0.262**	-0.319***
	(-2.14)	(-2.61)	(-2.41)	(-2.97)
Ave. Loglikelihood	-0.582	-0.580	-0.582	-0.579
Obs.	2153	2153	2035	2035

Z-scores in parentheses. Industry controls included. Significance levels: *** 0.01, ** 0.05, * 0.1.

To explore the relationship between founder's ability and his performance after turnover, we estimate

$$\ln(\overline{y})_{i,t+3} = \alpha + \beta_1 \ln(sales)_{i,0} + \gamma X_{i,t-1} + \varepsilon_{i,t+3}\,, \tag{9}$$

where the dependent variable is the log of gross income averaged over three years after the founder left his startup at time t. The key independent variable is the log of the startup's initial sales. The vector $X_{i,t-1}$ includes the founder's demographic characteristics in the year before turnover.

Table 9

Descriptive Summary of Subsample 3 (Mean Values Reported)

	Turnover Year (t)					
	2000	**2001**	**2002**	**2003**	**2004**	**2005**
Obs.	65	191	118	67	52	40
Age_{t-1}	37.54	35.49	38.08	40.13	39.23	44.05
Male	0.69	0.76	0.75	0.87	0.79	0.80
College	0.18	0.26	0.25	0.30	0.35	0.30
Married	0.57	0.48	0.59	0.48	0.54	0.70
Sale_0 (1,000 DKK)	2,554	2,125	2,379	2,193	2,574	3,243
Gross income_{t+1} (1,000 DKK)	301.8	388.5	333.6	349.7	356.8	422.4
Ave. gross income (1,000 DKK)	301.0	350.9	323.3	349.8	392.7	384.6
$\text{Self-employed}_{t+1}$	0.18	0.12	0.22	0.13	0.10	0.08
No. Of years in SE	0.40	0.35	0.54	0.40	0.29	0.18

Sales and income are all converted to 2000 prices.

Table 10 reports the OLS results. Column (1) shows that, after controlling for founders' education, founders who achieved higher sales in the first year of their startups also have higher average gross income in the next three years after turnover. Adding controls for turnover year does not change the results. In column (3) we add a quadratic term of the (log of) initial sales, to test for the concavity suggested by H3. However, we do not find any evidence of a non-linear effect. In columns (2) and (4), we replace initial sales with sales in the year before turnover, and obtain similar results. Column (2) returns results similar to those in column (1). Column (4) reveals a significant *convex* relationship between the log of pre-turnover sales and the founder's average income after turnover. At the minimum of this u-shaped relationship, the (log of) pre-turnover sales is 5.61, which is at the lower 5^{th} percentile of the sales' distribution. Thus, over most of the sample range, column (4) returns an increasing convex relationship between pre-turnover earnings and subsequent earnings of replaced founders. This provides some tentative evidence against the concavity suggested by H3.

4.4 *Turnover and Founder's Future Employment Choice*

Finally, we investigate the likelihood of founders becoming an employer again, and its relationship with the performance of their startups (H4). Hypothesis 4 says we should not expect to find any relationship.

Table 10

Founder's Performance after Turnover

	OLS Regressions Dept Var: Log of ave. gross income			
	(1)	(2)	(3)	(4)
Log $sale_0$	0.123***	−−	-0.267	−−
	(3.93)		(-1.01)	
Log $sale_0^2$	−−	−−	0.028	−−
			(1.49)	
Log $sale_{t-1}$	−−	0.087***	−−	-0.348***
		(3.12)		(-2.91)
Log $sale_{t-1}^2$	−−	−−	−−	0.031***
				(3.73)
Age_{t-1}	0.004	0.004	0.003	0.004
	(0.93)	(1.14)	(0.88)	(1.03)
$Married_{t-1}$	0.139*	0.129*	0.130*	0.118
	(1.85)	(1.72)	(1.72)	(1.59)
Male	0.279***	0.296***	0.280***	0.268***
	(3.34)	(3.56)	(3.36)	(3.25)
$College_{t-1}$	0.441***	0.408***	0.425***	0.336***
	(5.73)	(5.26)	(5.49)	(4.26)
Adj. R^2	0.154	0.138	0.157	0.164
Obs.	427	431	427	431

t statistics in parentheses. Industry controls included. Significance levels: *** 0.01, ** 0.05, * 0.1.

The estimated model is as follows:

$$\ln\left[\frac{\Pr(SE_{i,t+1})}{1-\Pr(SE_{i,t+1})}\right] = \alpha + \beta_1 \ln(sales)_{i,0} + \gamma X_{i,t-1} + \varepsilon_{i,t+1}\,, \tag{10}$$

where the dependent variable equals one if the founder was an employer in the year after he left his startup. The independent variables are the same as in (9). Table 11 reports the estimates of (10). Columns (1) and (2) returns no significant relationship between a startup's initial performance and the likelihood of the founder being an employer again in the period after turnover. Adding a quadratic term in column (2) shows a non-linear relationship, suggesting that founders from both the highest and lowest-performing businesses are more likely to be self-employed again after turnover. However, as shown in column (4) this relationship

disappears if we look at a startup's performance immediately before founder turnover

To exclude the possibility that the results in Table 11 only reflect founders' occupational choice in one specific period, we examine in Table 12 founders' occupational choice for three years after they left the startups. The dependent variable is the total number of years that founders were an employer. We still find no significant relationship between the dependent variable and startups' performance in the initial year or in the year immediately prior to founder turnover.

Table 11

Founder's Occupational Choice after Turnover

	Logit Regressions Dept Var: =1 if being an employer at t+1			
	(1)	(2)	(3)	(4)
Log $sale_0$	-0.047	-1.759*	−−	−−
	(-0.38)	(-1.92)		
Log $sale_0$^2	−−	0.124*	−−	−−
		(1.88)		
Log $sale_{t-1}$	−−	−−	-0.014	0.294
			(-0.12)	(0.35)
Log $sale_{t-1}$^2	−−	−−	−−	-0.021
				(-0.38)
Age_{t-1}	-0.007	-0.009	-0.004	-0.004
	(-0.52)	(-0.64)	(-0.32)	(-0.32)
$Married_{t-1}$	0.634**	0.607**	0.575*	0.580*
	(2.08)	(1.96)	(1.92)	(1.94)
Male	-0.093	-0.092	-0.064	-0.053
	(-0.30)	(-0.29)	(-0.21)	(-0.17)
$College_{t-1}$	-1.147***	-1.230***	-1.030***	-0.996***
	(-2.91)	(-3.08)	(-2.73)	(-2.59)
Ave. Loglikelihood	-0.376	-0.373	-0.384	-0.384
Obs.	498	498	502	502

z scores are in parentheses. Significance levels: *** 0.01, ** 0.05, * 0.1.

Table 12

Founder's Occupational Choice after Turnover
(No. of years of being an employer)

	OLS Regressions			
	Dept Var: Number of years of being an employer			
	(1)	(2)	(3)	(4)
Log $sale_0$	0.002	-0.081	−−	−−
	(0.06)	(-0.28)		
Log $sale_0$^2	−−	0.006	−−	−−
		(0.29)		
Log $sale_{t-1}$	−−	−−	0.002	0.098
			(0.08)	(0.72)
Log $sale_{t-1}$^2	−−	−−	−−	-0.007
				(-0.72)
Age_{t-1}	0.001	0.001	0.001	0.001
	(0.19)	(0.19)	(0.33)	(0.34)
$Married_{t-1}$	0.097	0.096	0.087	0.090
	(1.22)	(1.19)	(1.09)	(1.13)
Male	0.055	0.054	0.062	0.068
	(0.62)	(0.61)	(0.70)	(0.76)
$College_{t-1}$	-0.238***	-0.242***	-0.233***	-0.220***
	(-2.91)	(-2.92)	(-2.83)	(-2.60)
Adj R-sq	0.010	0.008	0.009	0.008
Obs.	498	498	502	502

t-statistics are in parentheses. Significance levels: *** 0.01, ** 0.05, * 0.1.

5. Conclusions

There is a large literature analyzing the causes and consequences of CEO turnover in established firms and of founder replacement in VC-financed firms. Little work has been done on the typical start-up: a small firm, not VC-financed, and highly unlikely to experience an IPO. In this paper, we have analyzed the relationships between firm performance before and after founder turnover in a large sample of Danish startups with a single founder. Because our sample is drawn from the matched employer-employee panel developed by Statistics Denmark, we are also able to follow founders after they have left the business they created.

To guide our empirical work, we developed a simple model of potential mismatches between business quality and founder ability. Our model predicts that

founder turnover is more likely in the tails of the performance distribution, that founder turnover is associated with a decline in the correlation between initial and subsequent firm performance, that founder earnings after departure are positively correlated with the performance of the firm, but that replaced founders are not more likely to start another business if the business they had created was more successful. Our results are consistent with these predictions. The model does not attempt to predict firm exit after turnover, but we find tentative evidence that turnover raises the likelihood of exit. This last finding is consistent with an alternative characterization of the matching problem developed some time ago by Holmes and Schmitz (1995).

Both our model and our empirical analysis have focused on the turnover of operating control while the founder retains ownership. In our sample, turnover of operating control is more common than business turnover, but both are important features of the data. Our paper leaves unanswered the interesting question of how owners decide between selling a business and hiring a CEO. Our dataset may also allow us to compare some characteristics of outgoing founders and incoming CEOs, and assess whether founder-CEO pairs differ from each other in ways consistent with mismatching models. These are questions we intend to address in future work.

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