The Horse or the Jockey? Evidence from Nascent Firms where a Founder Dies*

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Abstract

We know little about what the most critical factors are for the performance of new firms, whether it be market conditions, ideas, financial capital, or people. I analyze the importance of the founder for firms in their infancy by using the occurrence of founder death. Both cross-sectional and within-firm estimates suggest that founder death has a slight effect on firm performance, as measured by firm survival, profitability, or growth. I interpret this as the founder being substitutable even in a firm's infancy and the entrepreneur main role is discovering new opportunities and setting up the firm rather than managing it.

Keywords: critical resource, entrepreneurship, human capital, natural experiment, start-up, theory of the firm.

1 Introduction

Entrepreneurship has for long been viewed as central to economic performance and long-run economic development (e.g., Schumpeter, 1943). We know very little, however, about

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what are the most critical factors behind the growth and survival of nascent firms, whether it is market conditions, ideas, financial capital, or people. This is unfortunate because better knowledge would be valuable to understand economy-wide creative destruction and growth.

The purpose of this paper is to empirically analyze the importance of founders to nascent firms. How much does a start-up, after its inception, rely upon its founder? One reason to be concerned about this question is that theory suggests that firms that are highly dependent on the founder would encounter constraints to growth such as being less likely to obtain external finance (Hart & Moore, 1994), and scale limitations due to limited attention span of the founder (Gifford, 1998). Thus if the nascent firm rely to a large extent on the founder then this could, at a higher level, be an important detriment to economic growth.

That the founder is an important asset for nascent firms is indirectly supported by findings from Bhide (2000). Bhide studies 100 fast-growing companies from the Inc 500 list in 1989 and finds that 71% of the entrepreneurs in his sample, "[...] replicated or modified an idea encountered through previous employment". The founders typically did little formal planning before setting up a business, and the initial business idea was frequently adjusted and modified along the way. This evidence is most reasonably interpreted as the founder being important as a "jockey" in the in the formative phase of the start-up's life.[1]

Theoretical support for the founder being crucial for nascent firms comes from critical resource theory (Wernerfelt, 1984, and Rajan and Zingales, 2001), where a firm is "a web of specific investments built around a critical resource or resources... At some point the critical resource becomes the web of specific investments itself." (Zingales, 2000). As pointed out by Kaplan et al. (2006), for nascent firms it is reasonable to think of the founder as the critical resource, while after some time non-human assets, or other human assets than the founder, become more important.

The question I ask is how important a founder is to the performance of a nascent firm.

[1] Research on the returns to entrepreneurial activity suggests that the economic benefits from start-up activity is on average low (Hamilton, 2001, Moskowitz & Vissing-Jorgensen, 2001). This finding has been interpreted as that a main role of a start-up is to provide private benefits for the founder, such as more flexible work hours or a sense of control. If the founder sets up a company to cater for his own needs, it does not seem unreasonable to think that the start-up would wither away without the founder's presence.

Answering this question is hard because we usually do not observe a founder's level of engagement in developing the nascent firm, and if we do the level of engagement is likely to be highly non-random. For example, the founder being unactive could indicate that the start-up is less promising or that there are serious conflicts between founders.

To learn more about the role of founders we would, as a thought experiment, like to randomly take entrepreneurs out of nascent firms, deport them to a desolate island without means of communication, and study how well their firms fared relative to a control group of firms where the founder stays engaged. The empirical strategy I use attempts to mimic this thought experiment. Using a unique dataset on a large representative sample of new firms from Norway, I exploit the random variation in founder presence through the occurrence of founder death. I analyze the performance of firms where the founder dies and compare it with the performance of firms where the founder stays alive. Differences in performance, after controlling for observable founder characteristics such as age and prior wealth and observable firm characteristics such as size and industry, will be interpreted as due to the importance of the founder. For example, if nascent firms where the founder dies have a much lower survival rate than nascent firms where the founder stays alive, I would interpret this as support for the notion that founder has an important, and non-substitutable, role in the nascent firm.

There are two main issues with interpreting death effects as causal. The first is reverse causality; bad performance of the firm could cause "bad" stress and increase the founder's death probability (Kivimäki et al., 2002). Such an effect, if present, would tend to bias our estimates on the importance of the founder downwards. The second issue with interpreting death effects as causal is that founder death could be related to unobservable founder characteristics that affect performance, in particular founder ill health. One possibility is that ill health of the founder unexpectedly occurs after the start-up date. Ill health could then affect both the founder's probability of dying and firm performance through reduced productivity of the founder. This possibility is perhaps less of a worry, as poor performance due to illness of the founder would also be evidence of a causal effect going from founder presence to firm performance. Note that this argument underlines that we do not need death to come unexpected for λ to be interpreted as a causal effect; the identifying assumption would be that illness is unanticipated at the start-up date. Given

the many undoubtable strains with starting up a company, it seems unlikely that persons that has, or expects, ill health would even start up a company.

The basic results of the paper can easily be summarized. I study the effect of a founder dying on the performance of nascent firms. I find that across a variety of performance measures, such as sales, asset growth, survival, and profitability, the performance of the firms where the founder dies seem only slightly inferior to the firms where the founder stays alive. For example, after controlling for founder and firm characteristics, firms where the founder dies has 5 percentage points lower probability of surviving the first 4 years of operations than firms where the founder stays alive. The effect on sales and asset growth of founder death seems negligible.

If the founder were crucial in jockeying the nascent firm, I would expect strong negative effects from the death of founders with a majority ownership share in the firm. While the basic regression analysis is on all the founders, I redo the analysis confining attention to majority founders. It turns out that the results are very similar, in that the effect of founder death seems very slight. For example, if the founder dies the estimate of the 4-year survival probability of the firm is still only 5 percentage points lower than for alive founders. For 6-year survival, there is no difference between the two groups of founders.

Those results are derived by comparing the performance of firms where the founder dies with firms where the founder stays alive. The panel structure of the data allows us to, as an alternative regression strategy, consider within-firm effects. I analyze survival, growth and profitability in a two-year window around the founder death event. Consistent with the cross-sectional analysis, the estimates suggest that the effect of founder death is slight. For example, the one-year survival rate going into the year of death is almost identical to the one-year survival rate going out of the year of death. Moreover, the firms seem to experience healthy sales and asset growth in the window around founder death.

Overall, the results suggest that the entrepreneur's importance as a jockey to the nascent firm is quite limited; once firms are set up, the founder seems to be substitutable. The results should not, however, be interpreted as the founder being unimportant but rather that, as emphasized long ago by Hayek and Schumpeter, the main function of the entrepreneur could be to discover new opportunities or to, so to speak, create the horse.

As economists we know surprisingly little about where firms come from and what

constitutes a firm in its infancy. One related strand of work is the Stanford Project on Emerging Companies. As we do, they study a panel of young firms but ask a different set of questions. Baron and Hannan (2002) summarize the findings of the project as showing that initial models of employment tend to persist. When the employment models are changed, employee turnover increases and performance declines. Kaplan et al. (2006) study strategy and management changes in a sample of 156 fast-growing companies that eventually go public. They find that between being venture capital financed and the initial public offering, almost none of these companies change their line of business, while the management team changes quite frequently. Thus for this sample of companies, the initial idea seemed more stable than the initial management team. Since all the companies in this study were very successful, it was hard to evaluate whether the idea or the personnel were more important to performance.

Worrel et al. (1986) study the stock market response of the death of 127 key executives of listed US companies. They find that the effect of chairmen dying is neutral or even positive, while the effect of a CEO dying is negative.[2] The current study differs from all the above in that we focus on the firm in its nascency. From a methodological standpoint, this has the advantage that the individuals we study have significant ownership stakes in their company. This means that we are unlikely to confound the issues we are interested in - the role of the founder in jockeying the nascent firm - with issues of weak corporate governance and managerial entrenchment.

The horse/jockey terminology comes from the venture capital community, where a long-standing debate concerns whether the key determinant of the success of a young company is a strong business/market (the horse) or strong management/founders (the jockey). While venture capitalists would prefer to invest in young companies with both a strong business and a strong founder team, different venture capitalists tend to resolve trade-offs differently. For example, Gompers and Lerner (2001) describe how Tom Perkins of Kleiner Perkins mainly considered a company's technological position, and Don Valentine of Sequoia assessed the size and growth of the market. On the other hand, Arthur Rock, an early investor in Apple, put more weight in the quality of the founding team.

[2] An earlier paper by Johnson et al. (1985) obtained the same type of result for the sudden death of top executives. Bennedsen et al. (2007b) consider a large sample of (predominantly) non-listed firms and find that the manager dying has a negative effect on profitability.

In support of the latter view, Gladstone and Gladstone (2002, p. 91-92) quotes an old saying as "You can have a good idea and poor management and lose every time. You can have a poor idea and good management and win every time."

The paper is structured as follows. Section 2 presents the data and some summary statistics. Section 3 discusses the empirical strategy, Section 4 contains the basic results, and Section 5 additional results. Section 6 concludes.

2 Data and empirical strategy

2.1 Data

I use a dataset consisting of 6,800 incorporated limited liability firms started up between 1996 and 2003 in Norway.[3] The dataset contains incorporation and accounting information on the start-ups in addition to sociodemographic information about the founders. The dataset is compiled from three different sources:

1. *Accounting information from Dun & Bradstreet's database of accounting figures based on the annual financial statements.*[4] This data includes variables such as sales, assets, and profits for the years 1992-2006, as well as 5-digit industry codes.

2. *Data on individuals from 1986 to 2005 prepared by Statistics Norway.* These records are based on register data and tax statements, and include the anonymized personal identification number and yearly sociodemographic variables such as gender, age, education in years, taxable wealth, and income.[5] The records identifies the year of death (if applicable), but not the cause of death.

3. *Founding documents submitted by new firms to the government agency 'Brønnøysundregisteret'.* These data includes the start-up year, total capitalization, and the personal identification number and ownership share of all founders with at least 10 percent ownership share.

[3] The data has previously been used in Hvide & Møen (2007).

[4] Dun & Bradstreet is Bureau van Dijk's Norwegian subsidiary.

[5] Earnings and wealth figures are public information in Norway. This transparency is generally believed to make tax evasion more difficult and hence our data more reliable.

For each new firm identified in 1) we compile a list of founders identified through 2) and match their associated sociodemographic information from 3). Due to alterations in the reporting requirement in 1997 we were able to match around 80% of the founders in companies founded after 1997 and around 20% before. We are then left with about 12,500 unique founders. For some firms, the first year of financial reporting, defined through 1), is later than the year of incorporation defined by 2). For these firms, I define the first year as the first year of reporting.[6]

An adverse consequence of the low barriers to starting up an incorporated company and its favorable tax treatment, is that many start-ups, particularly within real estate, are tax-shelters or have minimal activity. This problem was dealt with in two ways. First, by over-sampling manufacturing and IT since tax shelters are less likely to occur in these industries (also these industries include companies with high growth potential and exhibit high variation in capital-intensity). We selected all start-ups within the high tech sectors NACE 23-35 and 72 from 1994-1998, and all start-ups within manufacturing and IT, NACE 15-37 and 72 from 1999-2002. We added a random 25 percent sample of other non-financial private sector start-ups from 1999-2002. We expanded the sample after 1998 because the cost of collecting data for the more recent period is lower. Second, to further reduce the share of "empty shells" firms are included only if they have at least NOK 500 000 in sales and at least two persons employed during one of the first two years of operation. Avoiding sampling empty companies is important as the incorporation documents had to be hand-collected by research assistants at considerable cost.

2.2 Summary statistics

The following table describes the characteristics of founders that are alive at the end of 2005 ($d = 0$) versus those that die sometime before the end of 2005 ($d = 1$).

[6] This means that a handful of founders die before the start-up year. This has no impact on the results.

Table 1: Summary statistics, first year

Variable	d=0		d=1	
Panel A: Founders	Mean	(St.dev.)	Mean	(St.dev)
Age	40.0	(10.4)	54.2	(12.9)
Years of education	12.3	(2.5)	11.2	(2.4)
Fraction male	0.87	(0.34)	0.88	(0.33)
Previous income (NOK 1000)	338	(300)	3,346	(327)
Previous wealth (NOK 1000)	864	(6,000)	1,400	(4,000)
Ownership share	0.45	(0.27)	0.50	(0.28)
Firm age at death	.	.	3.2	(2.6)
Die before end of 6th year	.	.	0.78	(0.41)
N	12,571		181	
Panel B: Firms				
Year	1999.6	(2.1)	1998.7	(2.02)
Equity (NOK 1000)	195	(572)	221	(625)
Number of founders	2.8	(1.4)	2.7	(1.5)
Assets (NOK 1000)	2,364	(8,878)	3,475	(21,242)
No employees	3.9	(8.6)	4.9	(14.0)
Leverage ratio	0.88	(2.8)	0.78	(0.32)
IT	0.30	(0.46)	0.22	(0.41)
N	12,571		181	

The table depicts summary statistics of founders and the firms they start up, broken down on whether the founder dies or not. Previous income and previous wealth are calculated as means over five years prior to start-up year. No founders is the number of founders with at least 10 percent ownership share. Leverage ratio is defined as book value of debt divided by assets. IT is defined as fraction of IT start-ups (NACE 72). Krone values are expressed in 2002 kroners.

Panel A contains summary statistics on the founders, evaluated in the start-up year. Of the about 12 500 entrepreneurs, 181 (1.7%) die at some point between starting up the firm and the end of 2005. The firm is on average 3.2 years old when the founder dies. 78 percent of the founders that die do so before the end of the sixth year of operations. Not surprisingly, the entrepreneurs that consecutively die are on average older on the start-up date than the entrepreneurs that stay alive. They are also more wealthy and have a slightly higher ownership share in the firm, and about one year less of education

on average. Panel B describes summary statistics for firms, broken down on whether the founder died or not.[7] The firms with subsequently dead founders are somewhat larger both in terms of initial equity, assets, and the number of employees. Since being older is correlated with both higher death probability and a higher wealth, these findings are not surprising.[8]

2.3 Empirical strategy

The question I ask is how important a founder is to the performance of a nascent firm. Answering this question is hard because we usually do not observe the quantity (and quality) of a founder's input to developing the nascent firm, and if we do it is likely to be non-random. To exploit variation between nascent firms with respect to founder death provides an opportunity to overcome these estimation problems. My empirical strategy is to exploit the random presence of founders created through variation in the death event in order to identify the causal effect of founders. The basic regression model explains, for each founder, the performance of his start-up in the following manner,

$$\text{Start-up performance} = \beta(\text{founder characteristics}) + \gamma(\text{start-up characteristics}) + \lambda d + \epsilon \tag{1}$$

where d is an indicator variable that equals 1 if the founder dies and equal to 0 if the founder stays alive, and the other right hand side variables are evaluated at the start-up date. My main interest is to estimate λ, which I interpret as the economic magnitude of how much start-ups rely on their founder. The performance variables used are defined in

[7] Panel B treats each founder as an independent observation. Instead treating each firm as an independent observation gives the same overall picture. Two firms had two dead founders (neither firm survived more than four years of operations, and neither founder held a majority position). No firms had more than two dead founders.

[8] Several papers have demonstrated a positive relation between founder wealth and start-up size, e.g., Ando (1995), Holtz-Eakin et al. (1994b) and Hvide & Møen (2007). This relation is usually interpreted as evidence of liquidity constraints being binding.

Section 2.4.

There are two main issues with interpreting λ in (1) as a causal effect. The first is reverse causality; it is possible that bad performance of the start-up could increase the stress level of the founder and increase his death probability. The health literature documents that increased death probability is associated with "bad" stress, i.e., a combination of high work demand and limited ability to cope with it, rather than high work demand by itself.[9] This suggests that a possible effect from performance to death probability should primarily be for founders where the firm performs badly. Thus reverse causality should, if present, should bias our estimate of λ downwards. An indirect way of assessing the importance of reverse causality is to investigate whether entrepreneurs have a higher death probability compared to non-entrepreneurs with the same socioeconomic characteristics. My (unreported) analysis of this question suggested that entrepreneurs have a somewhat *lower* death probability.[10]

The second issue with interpreting λ as a causal effect is that omitted variables could make the residual in (1) correlated with the death probability. It could then appear as death is driving performance while it would in fact be the omitted variable. An obvious candidate for omitted variable is the health status of the founder, since this variable could affect both the founder's probability of dying and firm performance through reduced productivity of the founder. It is useful to consider two possible scenarios here. The most

[9]For example, Kivimäki et al. (2002) finds that after controlling for age and gender, individuals with high job strain (a combination of high demands at work and low job control) had a 2.2-fold cardiovascular mortality risk over a 25 year period compared to individuals with low job strain. Gardner & Oswald (2004) reports similar findings taking mortality as dependent variable.

[10]I sampled 50,000 persons that were alive in 1995 from the population at large, and then ran a probit regression where the dependent variable was whether the person dies before the end of 2006 or not. The right hand side variables were age, gender, income and wealth in 1995, in addition to a dummy if that person were a founder. The regression suggested that founders had about 1.5 percentage points lower probability of dying, an effect that was highly statistically significant I also ran a specification where I included an interaction term between death and the ownership share of that individual, to investigate whether founders with a larger ownership stake had a higher death probability. This term was positive but close to zero and highly insignificant. Including municipality fixed effects and squared sociodemographic terms did not change the results.

straightforward one is that founder ill health occurs unexpectedly after the start-up date. Estimates of λ would then combine two effects: pre-death loss in founder productivity due to illness and post-death effects of founder absence (replacing the founder, possibly with less productive people, or reducing the scale of the firm). This scenario is less of a worry, as both effects would be a causal effects going from founder presence to firm performance, where the identifying assumption would be that illness is unanticipated at the start-up date.

The second scenario is that founder ill health is anticipated (or present) at the start-up date, and that the founder adjusts the start-up characteristics in order to dampen the effects of illness. Possible adjustments to the firm could be having a lower initial capitalization or by recruiting additional founders as back-up, adjustments that quite possibly also could dampen the effects of founder death. Since I do not have access to the health record of the founders, I cannot separate "sudden" from "anticipated" deaths, and hence cannot fully account for the possibility that the founder adjusts the initial firm characteristics in view of ill health. If such conscious adjustments were the case, however, I would expect firms where the founder dies to be different along observable characteristics at the start-up date than firms where the founder stays alive.

To investigate whether firms where the founder dies are different at the start-up date than firms where the founder stays alive, I regress the firm variables initial equity, number of founders, number of employees, and assets on the founder variables.[11] The founder variables are age, gender, education level, previous income, and previous wealth. The results, reported in the following table, does not suggest the presence of systematic differences between firms where the founder dies and firms where the founder stays alive. Given the many undoubtable strains with starting up a company, a plausible explanation is that persons that expects to be ill would not start up a firm at all. This would make omitted

[11] While the first two variables are evaluated at the start-up date, the latter two variables are evaluated at the end of the first year of operations.

variable bias when estimating λ less of a problem.

Table 2: Comparing firms, first year

	λ	R^2	N
Dependent variable			
(1) Log equity	0.045	0.16	12,610
	(0.057)		
(2) Number of founders	-0.058	0.05	12,569
	(0.116)		
(3) Log employees	0.015	0.10	12,610
	(0.064)		
(4) Log assets	0.057	0.15	12,610
	(0.082)		
(5) IT	0.016	0.11	12,607
	(0.39)		

Each row is a separate regression where the dependent variable is given in the first column. Founder variables (age, gender, previous income, and previous wealth), firm variables (log equity, number of founders, two-digit industry), and start-up year are included as controls. The estimation method is ordinary least squares in (1)-(4) and probit in (5). In (5), the marginal effect is reported. Robust standard errors clustered at firm level in parenthesis. *** Significant at the 1 % level ** Significant at the 5 % level * Significant at the 10 % level.

The specification in (1) is cross-sectional. The data includes information on death year, and therefore gives scope for tests that explores changes in firm performance after a founder dies. Aggregate statistics from the US Department of Health suggest that the most common cause of death for persons in the 45-65 age bracket (containing two-thirds of the dead founders) is cancer (35 percent) and heart decease (20 percent).[12] Cancer in particular is typically associated with a preceding period of illness that could affect the founder's productivity well before the death event. The changes in firm performance from the death event can therefore be hard to track down, even if there are large cross-sectional effects of founder death. I therefore initially focus on the cross-sectional, between-firm,

[12]The other leading causes of death in this age bracket are accidents (7 percent), chronic lower respiratory diseases (4 percent), and diabetes (4 percent).

specification in (1), and then in Section 3.5 analyze within-firm changes in a window around the year of death.

2.4 Performance measures

I measure firm performance by three different measures. The first measure is business survival. A firm is defined to survive t years of operations if it reports a (negative or positive) profit and has at least NOK 50,000 in sales in year $t+1$. Survival provides a simple measure of performance but is rather crude; for example lack of survival could mean that the firm has been bought up or that the entrepreneur closes it down due to better opportunities in the labor market. The second measure is profitability, as measured by operating returns on assets (OROA). OROA is the standard performance measure in a large accounting and financial economics literature (see e.g. Bennedsen et al., 2007a, and the references therein) and defined as the ratio of earnings before interest and taxes (EBIT) to the total asset base used to generate them. Unlike returns on equity or returns to capital employed, OROA compares firm profitability relative to total assets. In contrast to net income-based measures such as return on assets, OROA is not affected by capital structure or dividend policy differences across firms. As asset base when calculating OROA, I use the average of the assets at the end of year $t-1$ and at the end of year t. Neither survival nor profitability measure start-up size, indications of value potential and job creation. I therefore add sales, number of employees, and total assets as third measures of performance, evaluated at the end of the fourth and at the end of the sixth year of operations.

3 Basic results

I now turn to the main question; how much nascent firm are hit by the founder dying. I start out by comparing the performance of firms where the founders subsequently die with the firms where the founders stay alive. To avoid that outliers drive the results, I winsorize the yearly OROA values at the 5 percent level.

Since I can track all companies through their first four years of operations, I first evaluate firm performance over a four-year horizon. To accommodate possible trends, I also evaluate firm performance over a six-year horizon. A six-year horizon reduces the total sample by 20 percent, to about 10,000 founders, as firms started up later than 2001 are then excluded from the sample.

Table 3: Performance summary

	d=0		d=1	
Dependent variable	Mean	(St.dev)	Mean	(St.dev)
Panel A: Survival				
3-year survival	0.77	(0.42)	0.76	(0.43)
4-year survival	0.71	(0.46)	0.67	(0.47)
5-year survival	0.65	(0.48)	0.61	(0.49)
6-year survival	0.61	(0.49)	0.59	(0.49)
Panel B: end of 4th year:				
Number of employees	5.7	(10.1)	6.6	(14.4)
Assets	3,962	(13,576)	4,481	(19,330)
Sales	6,849	(15,461)	6,947	(11,189)
OROA, year 1-4	0.08	(0.36)	0.06	(0.38)
Panel C: end of 6th year:				
Number of employees	6.3	(11.7)	8,1	(18,8)
Assets	4,959	(19,599)	7,475	(37,704)
Sales	8,157	(18,990)	9,108	(18,941)
OROA, year 1-6	0.09	(0.34)	0.07	(0.35)
N	12,568		181	

A firm is defined to survive year t if it reports a profit and at least NOK 50,000 in sales in year $t+1$. OROA is computed using the average of assets at the end of year $t-1$ and at the end of year t. The number of OROA observations in Panel B is 34,767 for d=0 and 501 for d=1. The number of OROA observations in Panel C is 50,944 for d=0 and 735 for d=1. Krone values are expressed in 2002 kroners.

Panel A reports the mean survival rates of the start-ups where the founder subsequently dies (the third column) with start-ups where the founder stays alive (the first column). Panel B reports size and sales after four years, and profitability during the first four years, broken down on founder type. Panel C reports the same as Panel B but on a six-year horizon. This first cut of the data does not suggest that the founder dying has any strong negative effects on the firm. For example, the 6-year firm survival rate is 60 percent for dead founders and 61 percent for alive founders. The start-ups of the dead founders have on average an OROA of 6 percent, while the average OROA of the alive founders is 8 percent. Using a t-test, neither of the difference in survival rates nor in OROA are significant at the 10 percent level.

Founders that die are older, wealthier, and start up larger firms. In the following regressions, I investigate firm performance controlling for founder and firm characteristics at the start-up date. The controls include the founder variables age, gender, previous income, and previous wealth, and the firm variables size (log equity at the start-up date), two-digit industry dummies, and start-up year.

Table 4: Performance regressions

Dependent variable	λ	R^2	N
Panel A: After four years			
(1) 4-year survival	-0.051	0.02	11,685
	(0.039)		
(2) Log employees	0.040	0.11	9,776
	(0.069)		
(3) Log sales	0.062	0.17	9,776
	(0.106)		
(4) Log assets	-0.003	0.19	9,776
	(0.097)		
(5) OROA (year 1-4)	-0.017	0.03	34,479
	(0.023)		
Panel B: After six years			
(6) 6-year survival	-0.064	0.02	8,034
	(0.044)		
(7) Log employees	0.059	0.09	6,598
	(0.101)		
(8) Log sales	0.019	0.12	6,598
	(0.146)		
(9) Log assets	0.012	0.15	6,598
	(0.138)		
(10) OROA (year 1-6)	-0.020	0.03	49,853
	(0.021)		

The estimation method is probit in (1) and ordinary least squares in (2)-(5). The reported coefficient in (1) is the marginal effect evaluated at the mean of the other variables. Founder variables (age, gender, previous income, and previous wealth), firm variables (log equity, dummies for two-digit industry and for start-up year) are included but not reported. In the OROA regressions (5) and (10), firm age dummies are also included. Robust standard errors clustered at firm level in parenthesis. NOK 10 000 are added to previous income, previous wealth, assets and sales before taking logs.*** Significant at the 1 % level ** Significant at the 5 % level * Significant at the 10 % level

In the first four rows of Panel A, I regress measures of firm performance after four years on the explanatory variables, and in row (5), I use each individual-year as an independent observation. Across rows (1)-(5), neither the size or the significance level of the estimated coefficient suggest a clear effect of the founder dying. The only coefficient that is close to

being significant is on survival. The estimated coefficient on survival suggests that firms where the founder dies has about 5 percentage points lower 4-year survival probability. In row (5), the relation between founder death and yearly profitability is weakly negative and insignificant. The results in Panel B speak to firm performance after six years of operations. The results are very similar to in Panel A, in that the only coefficient that is close to significant is on 6-year survival probability. The magnitude of the coefficient on survival is close to coefficient on 4-year survival; firms where the founder dies has about 6 percentage points lower survival probability. Since the results suggest very weak negative effects of the founder dying it seems unlikely that reverse causality, as discussed in Section 3.2, has any strong effects.

With less than two hundred dead founders, one might ask whether the statistical tests have sufficient power to reject the null hypothesis of no difference between the two groups. To illustrate, say that the true 4-year survival rate for the alive group of founders is 10 percentage points higher than the performance of the dead founders. Using the estimated standard deviations from Table 3, a one-sided 10 percent level t-test on differences in survival rate has 95 percent power, meaning that the null hypothesis will be rejected at the 10 percent level with a 95 percent probability. The corresponding power of a test of a 10 percentage points difference in OROA is 100 percent.[13] Doing the same type of exercise, but now assuming that the true difference in survival rates is 5 percentage points, gives a test power of approximately 60 percent for survival and 95 percent for OROA. The joint power, i.e., the probability of rejecting both null hypothesis given that one of them were false would thus be higher than 95 percent. These calculations suggests that the lack of evidence of strong differences between the groups is not due to low power of the tests.

[13] To accommodate that within-firm observations of ROA are correlated, I also calculated the power of the test if the stated number of observations equals the number of firms rather than the number of founder-years. The power of the test is then 99 percent. The numbers are calculated using the sampsi command in Stata.

I have exposed these basic results to a variety of robustness checks, such as running the regressions using one sector industry codes, using sales growth and asset growth as dependent variables rather than sales and assets after 4 (6) years, using median regressions rather than ordinary least squares, including squared terms on the main explanatory variables such as wealth and income of the founder, and size of the firm, and excluded firms where a firm (rather than an individual) is the largest founder. The results were the same. I have also run the regressions on firm level rather than on founder level. In these regressions I kept only one yearly observation per firm and defined a death dummy that equals one if at least one of the founder of the firm dies. The estimated coefficients on the death dummy in these regressions were very similar to in Table 4.

4 Additional analysis

The basic analysis suggested that founder death has only a weak effect on the performance of the nascent firm. The current section considers two extensions of the basic analysis.

A possible reason for the weak results is that the analysis contains founders with a small ownership stake and that die "late" in the early stage of the firm's life. In Section 4.1, I redo the analysis but now on majority founders that die before six years of operations. A different reason for the weak results could be that omitted variable bias skews the estimated coefficients towards zero. To assess this possibility, Section 4.2 considers within-firm effects of founder death, by analyzing changes in performance in a two-year time window around the founder death event.

4.1 Majority founders

The following table contains summary statistics on majority founders (who own at least 50 percent of the initial equity) that die before the end of the sixth year of operations.

Table 6: Summary statistics, majority founders

	d=0		d=1	
Panel A: Founders	Mean	(St.dev.)	Mean	St.dev)
Age	40.7	(9.8)	54.4	(11.9)
Years of education	12.2	(2.5)	11.4	(2.6)
Fraction male	0.87	(0.33)	0.92	(0.27)
Previous income (NOK 1000)	359	(332)	375	(209)
Previous wealth (NOK 1000)	973	(5,158)	1,973	(5,919)
Ownership share	0.70	(0.22)	0.75	(0.23)
Firm age at death	.	.	2.1	(1.9)
N	5,400		64	
Panel B: Firms, first year				
Year	1999.5	(2.2)	1999.0	(2.1)
Equity (NOK 1000)	153	(534)	165	(161)
Number of founders	1.8	(1.4)	1.8	(0.88)
Assets (NOK 1000)	2,060	(8,938)	2,001	(2,695)
Number of employees	3.5	(6.6)	4.6	(9.7)
Leverage ratio (debt/assets)	0.85	(1.2)	0.81	(0.31)
IT	0.26	(0.44)	0.20	(0.41)
N	5,400		64	

The table depicts summary statistics of majority founders and the firms they start up, broken down on whether the founder dies or not. Previous income and previous wealth are calculated as means over five years prior to start-up year. No founders is the number of founders with at least 10 percent ownership share. Leverage ratio is defined as book value of debt divided by assets. IT is defined as fraction of IT start-ups (NACE 72). Krone values are expressed in 2002 kroners.

Panel A contains information about the founders and Panel B about the firms they form. Of the 5 400 majority entrepreneurs, 64 (1.2%) die before the end of the sixth year of operations. The majority founders that die are older than the majority founders that stay alive, are more wealthy, and start up larger companies. Turning to performance, we have the following summary statistics.

Table 7: Performance summary, majority founders

Dependent variable	d=0		d=1	
Panel A: survival	Mean	(St.dev)	Mean	(St.dev)
3-year survival	0.78	(0.41)	0.77	(0.43)
4-year survival	0.72	(0.45)	0.70	(0.46)
5-year survival	0.66	(0.47)	0.63	(0.49)
6-year survival	0.62	(0.49)	0.67	(0.48)
Panel B: end of 4th year:				
Number of employees	4.9	(7.3)	5.6	(6.8)
Assets (in NOK 1000)	3,287	(13,308)	2,656	(2,758)
Sales (in NOK 1000)	6,134	(14,648)	6,550	(6,872)
OROA, year 1-4	0.10	(0.35)	0.06	(0.32)
Panel C: end of 6th year:				
Number of employees	5.3	(8.6)	5.9	(7.3)
Assets	4,488	(24,319)	2,783	(3,170)
Sales	7,212	(17,455)	6,294	(6,735)
OROA, year 1-6	0.11	(0.33)	0.07	(0.29)
N	5397		64	

A firm is defined to survive year t if it reports a profit and at least NOK 50,000 in sales in year $t+1$. OROA is computed using the average of assets at the end of year $t-1$ and at the end of year t. The number of OROA observations in Panel B is 15,092 for d=0 and 170 for d=1. The number of OROA observations in Panel C is 22,163 for d=0 and 252 for d=1. Krone values are expressed in 2002 kroners.

Panel A reports the mean survival rates of the firms where the majority founder subsequently dies within six years of operations (the third column) with firms where the founder stays alive (the first column). Panel B reports size and sales after four years, and profitability during the first four years, broken down on founder type. Panel C reports the same variables as Panel B but on a six-year horizon.

The summary statistics suggest that even confining attention to majority founders (that die "early") the effects of a founder dying are weak. For example, the 6-year start-up survival rate is 60 percent for dead founders and 61 percent for alive founders. The firms of the dead founders have on average an OROA of 6 percent, while the average OROA of the alive founders is 8 percent. Using a t-test, neither of the difference in

survival rates nor in OROA are significant at the 10 percent level. Quite strikingly, the difference between the two groups of founders seems only marginally larger than in Table 3.[14]

In the following regressions, I investigate firm performance controlling for the founder and firm characteristics.

Table 8: Performance regressions, majority founders

Dependent variable	λ	R^2	N
Panel A: After four years			
(1) 4-year survival	-0.041	0.03	5,036
	(0.067)		
(2) Log employees	0.109	0.13	4,199
	(0.119)		
(3) Log sales	0.173	0.18	4,199
	(0.188)		
(4) Log assets	0.088	0.21	4,199
	(0.158)		
(5) OROA (year 1-4)	-0.015	0.05	14,915
	(0.030)		
Panel B: After six years			
(6) 6-year survival	0.017	0.03	3,448
	(0.076)		
(7) Log employees	0.065	0.11	2,874
	(0.163)		
(8) Log sales	0.057	0.13	2,874
	(0.254)		
(9) Log assets	0.086	0.17	2,874
	(0.184)		
(10) OROA (year 1-6)	-0.015	0.04	21,635
	(0.025)		

The estimation method is probit in (1) and ordinary least squares in (2)-(5). The reported coefficient in (1) is the marginal effect evaluated at the mean of the other variables. Founder variables (age, gender,

[14] One might again ask whether the statistical tests have sufficient power to reject the null hypothesis of no differences. If the true 4-year survival rate for the alive group of founders is 10 percentage points higher than the performance of the dead founders, and using the estimated standard deviations from Table 6, a one-sided 10 percent level t-test on differences in 4-year survival rate has 67 percent power, while the power of a corresponding test for OROA is 100 percent (for a 5 percent difference, the power of the tests are 34 percent and 88 percent). These calculations suggest that the lack of evidence of strong differences between the groups is not due to low power of the tests.

previous income, and previous wealth), firm variables (log equity, dummies for two-digit industry and for start-up year) are included but not reported. In the OROA regressions (5) and (10), firm age dummies are also included. Robust standard errors clustered at firm level in parenthesis. NOK 10 000 are added to previous income, previous wealth, assets and sales before taking logs. *** Significant at the 1 % level ** Significant at the 5 % level * Significant at the 10 % level

In the first four rows of Panel A, I regress measures of firm performance after four years on the explanatory variables, and in the last row I use each individual-year. As for the regressions in Table 4, neither the size or the significance level of the estimated coefficient suggest a clear effect of the founder dying. The only coefficient that suggests an economic effect of some limited magnitude is the coefficient on survival. This estimate suggest that firms where the founder dies has about 4 percentage points lower 4-year survival probability than a start-up where the founder stays alive. Given that the survival rate for firms where the founder stays alive is about 70 percent, the estimated difference does not appear large. Panel B shows that the results on 6-year performance are very similar to 4-year performance, except that here the firms with the dead founders perform slightly better with respect to survival. Both on a 4-year and on a 6-year horizon, the firms with the dead founders have about 1.5 percentage points lower yearly OROA.[15]

It is possible that the death event interacts in an interesting manner with other founder or firm characteristics than the founder's majority status. To investigate this possibility, I ran regressions as in Table 4 and in Table 8, but where a number of interaction terms between the death dummy and founder and firm characteristics were included. These results, reported in the Appendix, were quite weak, suggesting that the average effects of death captured by Table 4 and Table 8 give a rather accurate picture of the effects of

[15] As one would expect, confining attention to the dead founders that own 100 percent of the company at incorporation date gives stronger results. For this group of founders, counting 35 individuals, the predicted six-year survival rate is about 13 percent lower than the alive founders that are sole owners, and the predicted drop in OROA is about 3 percentage points yearly. For sales, assets, and number of employees, the estimates predicted no difference between the two groups.

founder death.

4.2 Time window around death

The analysis has so far been cross-sectional. In this section, I analyze changes in the firm performance in a 2-year window around the year of death.[16]

Table 9: Changes in firm around death event

	Mean_{t-1}	Mean_{t+1}	Change	Mean_t	N
Performance variable					
(1)Survive	0.874	0.875	0.001		103
	(0.334)	(0.333)			
(2)Sales (in NOK 1000)	7,382	9,788	2406**	8,267	91
	(12,031)	(21,967	(11,397)	(16,676)	
(3)Employees	6.374	7.538	1.165*	7.000	91
	(14.617)	(19.757)	(6.705)	(16.027)	
(4)Assets (in NOK 1000)	5,731	9,063	3331	6,252	91
	(28,605)	(56,018)	(27,543)	(32,703)	
(5)OROA	0.164	0.156	-0.008	0.128	68
	(0.241)	(0.268)	(0.294)	(0.241)	

The table reports firm performance in a two-year window around founder death ,where year t is the death year. A positive change in the third column means an increase from year $t-1$ to year $t+1$. Standard deviations in parenthesis. *** Significant at the 1 % level ** Significant at the 5 % level * Significant at the 10 % level.

The first column shows means for the firms one year prior to founder death (year $t-1$), and the second column shows mean for the firms one year after founder death (year $t+1$). The third column is the mean change in firm performance between the year before death and the year after death.

Table 10 does not suggest that founder death has a strong detrimental effect on the firm. For example, the first entry in row (1) reports the mean survival rate between year

[16]The sample size is reduced because we lose founders that die before the end of the first year (30 individuals) and founders that survive the first year but where the nascent firm is closed down before year $t+1$ (60 individuals). For the OROA calculations we in addition lose individuals that die in the second year of operations (23 individuals).

$t-1$ and year t. This number is the same as the survival rate between year t and year $t+1$. Moreover, the firms seem to experience a healthy growth from year $t-1$ to year $t+1$. For example, average sales increases by about 15 percent annually. This is a higher growth than the firms where the founders do not die experience from year 4 to year 6 (Table 3 and Table 6). The growth in sales is significant at the 5 percent level, and the growth in employees at the 10 percent level. On profitability, OROA drops from year $t-1$ to year $t+1$, but less than a percentage point. The difference is highly insignificant. To test these results for robustness, I extended to the window to including two year before and two years after the death event. The results with this smaller sample are very similar.[17]

One reason why the estimated within-firm effects of founder death are small or non-existing could be that founder death is preceded by illness that makes the firm underperform in the years prior to founder death. In that case, however, we would expect the firms to underperform both after four and after six years of operations, something the cross-sectional regressions suggested is not the case.

I also investigated whether founder death could have transitory effects in the year of death. The last column reports the mean firm characteristics in year t. Here, the average OROA is about 3 percentage points lower than in year $t-1$ and in year $t+1$. Although the difference is not statistically significant at conventional levels, it suggests that profitability might drop somewhat in the year of death. To investigate the possibility that death has transitory effects further, I went back to the sample of majority founders and ran a regression on OROA as in Table 8, but where I included a year-of-death dummy that equals one if the founder dies in that year. The estimated the drop in OROA in the year of death was about 7 percentage points. The estimate on the death coefficient was now slightly positive. These cross-sectional results therefore also suggest that the negative

[17] I have also estimated the change in industry-adjusted performance, where industry performance is defined as average OROA in that industry that year. This estimate and its standard error are almost identical to the one reported in Table 10. I have also used various other adjustments for firm characteristics. These adjustments did not change the qualitative features of the results in Table 10.

effect on profitability is transitory.

It is interesting to combine the finding of an apparent transitory negative effect on profitability of founder death with the lack of convincing negative effects on sales found both in the cross-sectional and in the within-firm analysis. Taken together, these findings suggest that founder death does not affect firm growth but could temporarily drive costs up. Thus founder death seems to incur a certain adjustment cost, but not of a serious magnitude.

5 Conclusion

While entrepreneurship is often considered central to economic performance and growth, we know little about what the most critical factors are for the performance of new firms. Using unique Norwegian data, I have analyzed the importance of the founder for firms in their nascency by exploiting variation in the occurrence of founder death.

The empirical results are quite striking. Both the cross-sectional and the within-firm analysis suggest that founder death has only a slight average negative effect on firm performance. For example, after controlling for founder and firm characteristics at the start-up date, the predicted excess 4-year survival rate for nascent firms where the founder stays alive is around 5 percentage points. Firms where the founder dies become less profitable, but only in a short time span around the founder death, which suggests that founder death incurs an adjustment cost rather than a permanent drop in profitability. For other variables such as sales or asset growth, I failed to find very visible effects of founder death. I initially conjectured that the effect of founder death would depend highly on whether the founder was a majority owner or not. This turned out to have limited validity, in that the empirical results were barely stronger for this group.

The surprising finding of the paper is that for these infant firms, once they are set

up the founder for most cases seems highly substitutable. This finding has two main implications. First, it seems that nascent firms are much less dependent on their founder than what one could expect. This is good news since firms where the founder is non-essential can be expected to have easier access to credit and be less exposed to bottlenecks due to limited capacity of the founder. Second, the findings have implications for how we view the entrepreneur. Although our results suggest that the founder's role as a jockey to infant firms seems rather unimportant, the results should not be interpreted as the founder being an unimportant figure for the firm. Rather, the results suggest that the founder's role as a creator and visionary prior to the start-up date is more important than the role as a jockey.

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7 Appendix: Founder and firm characteristics

To investigate further how the effect of founder death depends upon founder and firm characteristics, I include interaction terms in (1) in the following table. The table focuses on the six-year horizon.

Table 10: Founder and firm characteristics

Interaction	Panel A: Survival			Panel B: Sales			Panel C: OROA		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Founder variables:									
Previous wage	0.056		0.081	0.118		-0.031	-0.034		-0.031
	(0.083)		(0.086)	(0.336)		(0.382)	(0.037)		(0.040)
Previous wealth	-0.049		-0.050	0.013		0.013	0.010		0.006
	(0.035)		(0.035)	(0.115)		(0.124)	(0.017)		(0.017)
Majority	0.096		0.170	0.107		0.196	-0.053		-0.059
	(0.075)		(0.078)	(0.312)		(0.352)	(0.043)		(0.054)
Firm variables:									
Size		-0.021	-0.015		-0.046	-0.074		0.021	0.017
		(0.052)	0.054		(0.165)	(0.192)		(0.023)	(0.026)
Co-founders		0.065	0.013		0.040	0.292		-0.005	0.016
		(0.096)	(0.020)		(0.052)	(0.430)		(0.036)	(0.048)
Firm age at death		-0.028*	-0.030*		-0.026	-0.020		-0.006	-0.006
		(0.015)	(0.016)		(0.054)	(0.055)		(0.008)	(0.008)
IT		-0.059	-0.098		-0.268	-0.307		0.021	0.028
		(0.099)	(0.104)		(0.492)	(0.491)		(0.065)	(0.066)
R^2	0.02	0.02	0.02	0.08	0.11	0.13	0,02	0.02	0.03
N	8,034	8,134	8,034	6,598	6,670	6,598	49,853	50,380	49,853

The dependent variable is performa estimation method is probit in (1)-(3) and ordinary least squares in (4)-(9). The reported coefficients in (1)-(3) is the marginal effect evaluated at the mean of the other variables. Previous wage and previous wealth are evaluated as means five years prior to start-up date. Majority is a dummy that equals one if the founder has at least 50 percent ownership in the firm. Size is measured by log equity at the start-up date, and co-founders is a dummy equal to one if there is more than one founder. IT is a dummy that equals one if the firm is in the IT industry. Founder variables (age, gender, previous income, and previous wealth), firm variables (log equity, dummies for two-digit industry and for start-up year) are included as controls but not reported. In the OROA regressions (7)-(9), firm age dummies are also included. Robust standard errors clustered at firm level in parenthesis. NOK 10 000 are added to previous income, previous wealth, assets and sales before taking logs. *** Significant at the 1 % level ** Significant at the 5 % level * Significant at the 10 % level

Table 10 reports the estimation results for the interaction terms on founder variables, in column (1)-(3), on firm variables in columns (4)-(6), and on both founder and firm

variables in column (7)-(9). A negative coefficient indicates that increases in the variable gives a larger negative effect of founder death on performance.

The table does not suggest any strong interaction between founder variables and the effect of founder death. Losing a founder with higher human capital, as measured by previous wages, seems, somewhat surprisingly, to play little role on survival and growth. Losing a wealthier founder has a stronger effect on survival, but does not seem to affect growth or profitability. Consistent with the previous section, losing a majority founder has no negative effect on survival or growth, but possibly a negative effect on profitability.

Turning to the firm variables, the variable "firm age at death" records firm age when the founder dies. We would have expected the coefficient on this variable to have a positive sign, meaning that the negative effect of founder death is smaller when the firm age is higher, but there seems to be little evidence in support of this hypothesis. While this variable has an automatic negative effect on survival, the coefficient on sales and on profitability are also negative. One explanation for this somewhat surprising result could be that a higher firm age at the time of death is an indication of a longer sickness period of the founder. The variable "co-founders" is a dummy that equals one if there is more than one founder of the firm. As expected the coefficient on this variable is positive, meaning that sole founders dying has a stronger negative effect. The estimated effect of losing a founder in the IT industry quite sizeable in terms of survival and sales growth, but the standard errors are too large for the effects to be statistically significant. While Table 10 reports results for the 6-year horizon, the results for the 4-year horizon is similar.

The most prominent feature of Table 10 is that there are no founder or firm variables that seem to be particularly associated with strong effects of founder death. To the extent that interactions are present, founder death has more an effect on firms with only one founder, and perhaps on firms that are predominantly based on intangible assets and human capital.