

Steve Jobs or No Jobs?

Entrepreneurial Activity and Performance among Danish College Dropouts and Graduates

Preliminary Draft: please do not cite or circulate without authors' permission

Abstract

Are college dropouts successful entrepreneurs? Besides some anecdotal evidence on illustrious college dropouts who managed to become self-made billionaires, there is only limited empirical evidence to answer this question. This paper addresses this issue by investigating the relationship between college dropout and entrepreneurship activity as well as performance. Using information from the Danish labor market register, we identify college students, whether these students graduate, and if they registered a new venture. We find that a larger share of dropouts starts a business, but this reflects the endogeneity of the decision to exit from college. Dropouts' ventures perform no worse than those started by graduates.

"It is strange to call me a college drop out in all but the most literal sense. I went for three years and took enough courses to graduate." Bill Gates during a Reddit AMA session in February 2014.

1. Introduction

Some of today's most prominent successful entrepreneurs are college dropouts. Regularly highlighted in the popular press, this has become part of the conventional knowledge about entrepreneurship. The list of dropout-entrepreneurs is certainly impressive. It contains iconic figures like Steve Jobs, Bill Gates and Mark Zuckerberg whose life stories are written down in bestselling biographies and become box-office hits shown in movie theaters around the world. Based on these stories, some have argued that obtaining a college degree may not be very valuable for future entrepreneurs, or that formal education may even be detrimental as it crowds out entrepreneurial intentions and possibly reduces entrepreneurial performance. The strongest versions of this argument go so far as to recommend aspiring entrepreneurs to drop out of college.¹

This pessimistic view of the link between formal education and entrepreneurship resonates with early research on entrepreneurship that emphasized the importance of inborn and fixed (Gartner, 1988) personality traits such as the willingness to take risks, tolerance of ambiguity, need for achievement, locus of control, desire for autonomy, and many others, for the decision to become an entrepreneur (Cromie, 2000). Some of the traits that favor entrepreneurship (e.g., risk taking and the desire for autonomy) may also enhance the likelihood that an individual leaves college without graduating. More recent research has added cognitive ability, personal values and attitudes to the list of personal characteristics that help predict entrepreneurs. While some of these characteristics can be acquired, teaching, e.g., personal values is not the top priority of formal education (Parker, 2004). Hence, formal education could be of little value for aspiring entrepreneurs.

The above considerations would lead us to expect that college dropouts are equally, if not more, likely than graduates to become entrepreneurs. We would moreover expect their firms to perform no worse than those started by otherwise comparable entrepreneurs who completed their college degrees. In this perspective, the Zuckerbergs, Gates and Jobs of this world are extreme cases indicative of a more general phenomenon: successful dropout entrepreneurs.

There is, of course, a competing view of dropout entrepreneurs. According to this view, individuals do not complete their degrees because they lack the personal characteristics such as cognitive ability, effort, and stamina required to succeed in college. After dropping out, they find themselves disadvantaged in a labor market that values not only the human capital accumulated in college but also rewards formal degrees as signals of ability and motivation. If dropouts are more likely than graduates to start firms (which finds some support in literature reviews by Van der Sluis *et al.* (2008) and Dickson *et al.* (2008)), this is mostly because they lack good employment alternatives, i.e. have low opportunity costs of entrepreneurship. Chances are that, because of the same lacking characteristics that prevented them from completing college, their firms may not be successful, either. Dropout entrepreneurs are further disadvantaged, particularly in

¹ A case in point is Peter Thiel of Facebook and PayPal fame, who established a scholarship program for dropout-entrepreneurs (cf. Bernau, 2013).

their ability to mobilize resources (Shane, 2003) such as access to financial capital (Werner, 2011) and quality employees.

Despite anecdotal references there is only limited empirical research that explicitly addresses college dropout and entrepreneurship. More often the issue is part of a broader discussion on entrepreneurship and education (see for a review Van der Sluis *et al.* 2008) where dropping out is regarded as either: (i) an intermediate level of human capital accumulation, assuming a linear relation between years of education and entrepreneurship indicators; or (ii) a dummy variable that does not receive much attention in the subsequent analysis of the empirical results. The objective of this paper is to provide a more detailed evidence on the link between college dropouts and entrepreneurial activity and performance. We also begin to address the potential endogeneity of dropping out in the decision to become an entrepreneur.

To address the prevalence and performance of dropout-entrepreneurs in more detail, we utilize individual-level information from the Danish Integrated Database for Labor Market Research (IDA). IDA is well-suited for our analysis as it contains information on an individual's completed and ongoing education, providing detailed information on the education level and discipline. Due to the longitudinal dimension of the register we can on an annual basis identify individuals' educational progress, including as our main variables of interest graduation or the possible abandonment of a course of study, i.e. dropout. These data are matched with data for the population of new firm registrations in Denmark. This match allows us to measure in greater detail the link between dropping out and entrepreneurship. We are moreover able to take into account the timing of entry into entrepreneurship in relation to dropping out or graduating from college, where we are mainly interested in entrepreneurial activities that take place relatively close to the dropout decision. The results in this paper suggest that dropouts are more likely than graduates to become entrepreneurs. However, this finding is not robust to controlling for the endogeneity of the decision to exit from college through an instrumental variable approach. Our results do not indicate that the firms started by dropouts perform worse than those of graduating peers.

The remainder of the paper is structured as follows. After this introduction we will continue with a literature overview on existing studies that link entrepreneurship with college dropouts (Section 2) and with theoretical considerations (Section 3). In Section 4 we introduce the data for the econometric analysis. Section 5 present our findings. Section 6 concludes and provides suggestions for future research.

2. Prior literature on college dropouts and entrepreneurship

Education and entrepreneurship

Among entrepreneurship researchers it is a well-established research practice to investigate education as a key determinant of both entrepreneurship activities and entrepreneurial performance (see e.g. Evans and Leighton 1989; Bates 1990; Robinson and Sexton 1994; Gimeno *et al.* 1997; Davidsson and Honig 2003; Shane 2003; Colombo

and Grilli 2005; Van der Sluis et al. 2008; Dickson et al. 2008; Unger et al. 2011).² Only contingent on availability, virtually all existing empirical work at the individual or the team level includes a measure that proxies the education of the entrepreneur(s). Yet in many instances it merely functions as a control variable without receiving further attention.

Formal education is part of an overall measure of human capital (Becker 1964) and the most frequently used human capital measure in entrepreneurship research (Unger et al. 2011). It is linked to two features that may assist individuals in starting their career as an entrepreneur and improve their performance. On the one hand education is associated with the acquisition of skills, which in addition of professional skills includes the acquisition of competences e.g.: recognition of attractive entrepreneurial opportunities (Parker 2004; Shane 2003; Davidsson and Honig, 2003), planning and prediction, (Unger et al., 2011), and obtaining new knowledge and learning from experience (Unger et al., 2011; Weick, 1996; Nielsen and Sarasvathy, 2011). In addition, formal education also provides a signal to potential investors and other stakeholders that influence the possibilities of entrepreneurs to mobilize the necessary resources (Shane, 2003; Kim et al. 2006).

Despite the plausible effects of formal education, its true impact on entrepreneurship activity and entrepreneurial performance is not that straightforward. The more consistent findings have been obtained for the relation between education and entrepreneurial performance (Van der Sluis et al. 2008). On a broad range of performance indicators, e.g. economic performance (Gimeno et al. 1997) earnings (Robinson and Sexton 1994), growth in sales and profits (Davidsson and Honig 2003), employment growth (Colombo and Grilli 2005), innovation (Marvel and Lumpkin 2007), obtaining finance (Hsu 2007) entrepreneurial ambition (Cassar 2006) there appears to be a overall positive relation between level of education and performance.

In contrast, the relationship of formal education and the decision to enter into entrepreneurship, and also its effect on entrepreneurial persistence, are less clear. As confirmed by meta-analyses of education on entrepreneurship (e.g. Van der Sluis et al. 2008 and Dickson et al. 2008) there is no robust association between the level of education and the decision to start a new business. One finding of prior research, which is also relevant for the discussion in this paper, is that individuals who did not graduate from college were more likely to enter into entrepreneurship compared to other education levels. These observed entry patterns may be explicable in relation to alternative employment options (Gimeno et al. 1997). Individuals with a higher level of education might have the better skills to enter entrepreneurship but simultaneously are also more attractive employees, thereby facing higher opportunity cost. Consequently, the net entry into entrepreneurship might not vary from any level of education. Similar mechanisms are at play when focusing on entrepreneurial persistence (Gimeno et al. 1997; Cassar 2006). Even though more highly educated entrepreneurs in general outperform entrepreneurs with lower levels of education; the decision to discontinue the new venture is dependent on alternative employment options. Due to higher

² When searching for the keywords entrepreneurship and education there are many studies that deal with the impact of entrepreneurship education. In our discussion we would like to focus on education in general.

opportunity costs, highly educated entrepreneurs would be expected to have a different, probably lower, threshold compared to entrepreneurs with lower levels of education.

Investigating the role of dropouts

The discussion on the impact of college dropout on entrepreneurship activity and entrepreneurial performance forces us to think more closely about how to operationalize college dropout. Rather than directly focusing on the link between college dropouts and entrepreneurship, most extant research on education and entrepreneurship treats dropout as an intermediate level of human capital accumulation between obtaining a high school degree and graduating from college. When operationalizing this measure a common approach is to construct a variable for the years of education, thus assuming a linear relation between level of education and entrepreneurship activity and entrepreneurial performance. Alternatively, levels of education are measured by using a categorical variable. In some instances, this approach leads to a misspecification of the dropout effect as college dropouts will be included in an indicator for high school, e.g. when the categories indicate the highest completed level of education, or as dropouts are merged with college graduates, e.g. in an overall measure of tertiary-level education. A more prevailing categorical approach is to transform the years of education into categories that also includes a measure for college dropouts, i.e. 13 to 15 years of education (e.g. Evans and Leighton, 1990) although in most cases there is a preference in referring to this category as “some college education” (e.g. more recently Lofstrom et al., 2013).

3. Theoretical considerations

A major complicating factor in studying the link between college dropout and entrepreneurship, which has found little attention in the empirical work reviewed above, is that causality may run both ways. On the one hand, dropping out from college may help explain entrepreneurial activities and entrepreneurial performance. On the other hand, engaging in entrepreneurial activities may cause individuals to leave college without graduating. Which of these effects is more relevant cannot be conclusively settled using observational data. It seems plausible, however, that the direction of causality is related to the sequence of events. Specifically, in our empirical analysis, we will distinguish individuals who first left college (with or without degree) and then started a firm from those who first started a firm and subsequently left college. While we cannot rule out that in some cases causality differed from the temporal ordering of events, e.g. because a dropout decision was made in anticipation of subsequent entrepreneurship, we expect such cases to be exceptions rather than the rule. We moreover address the potential endogeneity of the dropout decision using instrumental variable techniques.

Besides timing, there is further variation in the group of dropout entrepreneurs. First there is a distinction in the discipline from which college students drop out so it seems useful to take account of the particular discipline of education. Furthermore, as illustrated by the quote by Bill Gates, college dropouts might decide to terminate their studies very early or nearly at the end of their studies. Based on the skill acquisition

argument this should also influence their decision to start up and the entrepreneurial performance of their new venture.³

College dropout and subsequent entrepreneurship activity

As noted in the previous section, formal education may affect entrepreneurial activities both through its effect on skill formation and through its value as a credible quality signal. Consistent with the inconclusive empirical results on this issue, education may have competing effects on entrepreneurial activities through both channels of influence. Skill acquisition may enhance individuals' ability to recognize entrepreneurial opportunities and qualify them to start their own ventures. At the same time, better educated people may also have more valuable skills for paid employment, which will reduce their likelihood to become entrepreneurs. It is not obvious which of these effects is more important. Likewise, the signaling effect of education will facilitate entrepreneurial resource mobilization, but also improve individuals' chances in the labor market and thus their opportunity costs of becoming an entrepreneur.

Similar considerations apply to how leaving college with versus without degree will affect the likelihood of subsequently becoming an entrepreneur. If dropping out is related to the (lack of) success in college, dropout entrepreneurs will generally command less skills than graduates. This will put them at an disadvantage in the labor market, suggesting an enhanced propensity of entering into entrepreneurship. This "push effect" might be compensated, however, by a reduced ability to start a firm because of lacking skills. In addition, dropouts cannot credibly signal their quality. While this may limit their ability to mobilize resources, it also restricts their chances in the labor market, lowering their opportunity costs of starting a firm. As we have no priors about the relative importance of the various effects, how dropping out rather than successfully finishing college is related to the subsequent likelihood to become an entrepreneur appears to be an empirical issue.

College dropout and subsequent entrepreneurial performance

Above we suggested that dropout entrepreneurs will command less entrepreneurial skills, while at the same time they are disadvantaged in mobilizing resources. Both is expected to have adverse effects on the performance of their ventures. However, there may be a counteracting second-order effect: As dropouts have worse prospects in the labor market, relatively more capable individuals may be pushed into entrepreneurship than is the case among graduates. (This argument is closely related to the idea noted in the introduction that college education may deter promising entrepreneurs from starting firms.) In addition, given their poorer outside options, we would expect dropouts to be more persistent in entrepreneurship than graduates.

Entrepreneurial activity/performance and subsequent dropout

The above considerations assumed that the dropout decision antecedes the decision to become an entrepreneur. In other cases, including the prominent examples referred to in the introduction, the order of events is reversed: recognition and pursuit of a business

³ Labor market returns of individuals that attended two years of college compared to four years of college have been found to be significantly lower (Kane and Rouse 1995).

opportunity “pulls” individuals into entrepreneurship. It may well be that among these “early” dropout entrepreneurs, it is predominantly those who pursue the most promising opportunities that never finish their college degrees. In retrospect, these individuals will then be college dropouts, but this may just be the reflection of their success as entrepreneurs. Below we will probe into this conjecture by analyzing the factors that predict whether “early” entrepreneurs still finish their college degrees.

4. Data

Datasets

To investigate the activities and performance of dropout-entrepreneurs in more detail, we match individual-level information from the Danish Integrated Database for Labor Market Research (IDA), which contains information on all labor market participants in Denmark, with data for the population of new firm registrations in Denmark (see Timmermans (2010) for a more detailed description of IDA). Based on this match we impose several restrictions when creating our bounded sample. First, we select only individuals who are registered as Danes.⁴ Second, these individuals must have enrolled only once in a college program (professional bachelor, academic bachelor, or direct master) at age 25 or younger in the time period 1994-2005. They must have exited college, irrespective whether this exit was as a graduate or not, no later than 2008. In identifying exit, we allow that the college student takes a year of leave from college or changes programs, but if the individual is absent from college for two consecutive years we will treat this as an exit without graduating, i.e. dropout. We remove “lingering” students, i.e. individual who are registered as being in college for more than eight years. In the dataset used for our primary analysis, we also remove students in health care-related study programs. Entrepreneurship is pervasive among successful graduates of these programs, whereas dropouts cannot enter into the typical entrepreneurial careers (i.e., become physicians). Including students from these programs would considerably bias our results. Given all these restrictions we end up with a sample of 188,402 individuals that have entered *and* exited college, where dropouts account for approximately 21 percent of the sample, i.e. 38,802 individuals. We also present results from robustness checks employing other restrictions to the dataset.

Indicators

Fields of education. In addition to whether an individual graduates or leaves college without obtaining a degree, we also know in what field of education they pursued their studies. The respective indicators distinguish between programs in social sciences (48,207 students), humanities (37,537 students), engineering (28,977 students), and natural sciences (18,370 students). The reference group includes all students enrolled in programs outside these fields, which includes programs for the training of educators and officers (55,311 students). Furthermore, we have information on the number of years the student was enrolled before leaving college (a maximum of eight years).

⁴ Individuals are registered as Danes if they are born in Denmark and have at least one parent that is Danish.

Entrepreneurship activity. One of the key variables of interest in our analyses is entry into entrepreneurship. To proxy entry into entrepreneurship we use the entrepreneurship database from Statistics Denmark. This database provides us with information on the registration year, which we will use as the year of entry. We identify all students in the sample who registered a firm between the time they started college and three years after exiting from college. We do not consider later startup activity because it may primarily reflect labor market experience accumulated after leaving college. During this 3-year period 3,289 individuals (1.75 percent) of the sample registered a firm. Given the temporal structure of the dataset, it is possible to identify those who registered a firm before leaving college (1,030 instances), those who registered a firm in the same time of leaving college (452) and those who register a firm after leaving college (1,807).

Performance of the new venture. We employ several different measures of entrepreneurial performance. In the descriptive analysis, we report differences in turnover and number of employees between firms started by dropouts versus graduates. Two alternative performance indicators are constructed for the econometric analysis. First, as an indicator of survival we identify whether the new venture is still active three years after registration. Second, a dummy variable is constructed to denote high-growth ventures, defined as firms that employed at least two-and-a-half full time equivalent and have a turnover of at least 2.5 million Danish Kroners three years after registration. This information is only available for firms started in 2001 or later, which forces us to work with a more restricted sample of students starting college in 2001 in the respective analyses. The restricted sample contains 111, 94 and 483 entrepreneurs founding a venture while in college, in the year when they are leaving college, and after leaving college, respectively.

Additional variables In addition to the above-mentioned variables we use a range of other variables including age, gender, year of starting college, years of leaving college, and parental education. Descriptive statistics and correlations are shown in Table 1.

Insert Table 1 around here

5. Results

Entry into entrepreneurship: descriptive findings

Some informative patterns in our data already derive from the descriptives. Table 2 distinguishes individuals who registered a venture prior to leaving college from those who registered a firm and left college in the same calendar year and those who registered a venture in subsequent years after they had left college. In all three stages the share of entrepreneurs is higher among dropouts than among graduates (non-reported tests show that these differences are significant). For both groups the number of firms started after leaving college exceeds the number of firms started before leaving college.

Table 2: Sequence of entering entrepreneurship, graduating, and leaving college

	Dropout	Graduate	Total
No entrepreneurship	37,950	147,163	185,113
%	97.80%	98.37%	98.25%
Entr. prior to leaving college	236	794	1030
%	0.61%	0.53%	0.55%
Entr. while leaving college	139	313	452
%	0.36%	0.21%	0.24%
Entr. after leaving college	477	1330	1807
%	1.23%	0.89%	0.96%
Total	38,802	149,600	188,402

Taking this analysis one step further and focusing only on individuals who have registered a business (our measure of entrepreneurs), we observe striking differences in first-year turnover (Table 3) and employment size (Table 4). The differences are particularly pronounced for firms started prior to leaving college. In terms of both turnover and number of employees, firms whose founders dropped out after registering are on average 2-3 times as large as those whose founders subsequently graduated. These differences suggest that firms started by founders who later dropped out from college may have been more substantial than those of subsequent graduates. A significant difference is also visible for the second column where registration occurs in the same year as leaving college, while we observe no significant difference between dropouts and graduates in the last column, i.e. for businesses registered after leaving college. For both groups, but particularly among firms started by (later) graduates, “later” firms are more sizeable than “earlier” ones.

Table 3: Average turnover, dropout and graduates prior to leaving, same year as leaving and after leaving college

	Prior	Same	After	Total
dropout	306733.64	372685.51	401309.89	370148.48
Std. dev.	1223988.3	810895.37	886552.91	981543.17
N	235	138	467	840
graduate	109847.66	156164.06	424615.12	286495.22
Std. dev.	344514.14	380805.59	1133042.90	881119.91
N	794	310	1308	2412
Total	154811.90	222860.40	418483.55	308103.07
Std. dev.	662882.51	558381.90	1073499.70	908707.10
N	1029	448	1775	3252
	pr=0.000	pr=0.000	pr=0.6564	

Table 4: Average number of employees, dropout and graduates prior to leaving, same year as leaving and after leaving college

	Prior	Same	After	Total
dropout	0.246	0.626	0.589	0.500
Std. dev.	0.870	2.940	1.835	1.876
N	236	139	477	852
graduate	0.110	0.220	0.511	0.343
Std. dev.	0.795	0.888	1.894	1.516
N	794	313	1330	2437
Total	0.141	0.345	0.531	0.383
Std. dev.	0.814	1.796	1.879	1.618
N	1030	452	1807	3289
	pr=0.0120	pr=0.0133	pr=0.2167	

College dropout and subsequent entrepreneurial activity

In exploring these patterns further, we first focus on the group of “late” entrepreneurs who started their ventures in years after they had left college. In particular, we study whether dropping out versus graduating from college is associated with the likelihood that a (former) student registered a new firm in the three years after leaving college. To this purpose we study the transition into entrepreneurship for the full population of Danish students using a Probit specification. Our key variable of interest is a binary variable indicating whether an individual successfully graduated or left college without completing their degree. We furthermore control for the number of college years completed before leaving college (with or without degree).

The graduation variable may to be related to the decision to become an entrepreneur. To test this conjecture, we use a 2SLS instrumental variable regression with parental educational attainment measures as instruments. We construct our instruments using information in the IDA database about the minimum number of months required to complete the highest educational degree possessed by each parent. This measure of educational attainment, which varies between 72 and 240 months, is included in linear and quadratic terms and separately for fathers and mothers.⁵ The instruments thus obtained are justified on the grounds that parental educational attainment is strongly associated with children’s dropout decisions, whereas it is exogenous to children’s entrepreneurial activities.

This 2 SLS regression confirms our suspicion, as the null hypothesis of exogeneity is squarely rejected ($p = .000$). At the same time, a partial F-value of 127.24 is obtained in the first stage, and the Sargan test ($p > .70$ for the null hypothesis of instruments being uncorrelated with the error term) indicates validity of the instruments.

⁵ In single cases, no educational attainments of a parent are recorded. In these case we assumed that parents had not been subject to more than the minimum level of schooling.

Table 5: Probit / IV model estimating probability of start-up after leaving college.

	Model 1: Probit	Model 2: 2SLS	
		First Stage	Second Stage
Graduate	-0.198*** (0.022)		0.056*** (0.013)
Years	0.055*** (0.006)	0.068*** (0.001)	-0.003*** (0.001)
Natural	0.229*** (0.034)	-0.089*** (0.003)	0.011*** (0.001)
Technical	0.284*** (0.028)	-0.030*** (0.003)	0.010*** (0.001)
Social	0.201*** (0.028)	-0.000 (0.002)	0.004*** (0.001)
Humanities	0.131*** (0.030)	-0.081*** (0.002)	0.007*** (0.001)
Female	-0.422*** (0.020)	0.068*** (0.002)	-0.015*** (0.001)
Age	0.069*** (0.005)	0.004*** (0.001)	0.002*** (0.000)
Mother edu.		-0.0006*** (0.0002)	
Father edu.		-0.0005*** (0.0002)	
Mother edu. (sq.)		0.000003*** (0.0000007)	
Father ed. (sq.)		0.000003*** (0.0000006)	
Constant	-3.645*** (0.163)	-0.003 (0.023)	-0.022*** (0.005)
Year dummies	YES	YES	YES
Pseudo R ²	0.06		
Log-likelihood	-10418.496		
Durbin score		23.917 (p = 0.000)	
Sargan score		1.837 (p = 0.607)	
F(4,185563)		141.162	
Observations	185589	185589	

Significance levels: * 0.10 **0.05 ***0.01

Results of the simple Probit model are reported as Model 1 in Table 5. They suggest that graduates are significantly less likely than dropouts to register a new firm in the first three years after leaving college. In both models, we moreover obtain a significant positive coefficient estimate for the variable measuring college years prior to leaving college. Female students are less likely and older students are more likely to start firms. Results from the 2 SLS using parental educational attainment variables as instruments (Model 2 in Table 5) do not confirm this result, however. To the contrary, they suggest

that graduates are significantly more likely than dropouts to engage in entrepreneurial activities.⁶

Table 6: Probit models for the probability of survival and high growth after three years for individuals starting up after leaving college

	Model 1: Survival	Model 2: Growth
Graduate	-0.317** (0.155)	-0.183 (0.264)
Years	0.066 (0.064)	0.133 (0.118)
Natural	0.036 (0.232)	0.379 (0.446)
Technical	0.230 (0.192)	0.209 (0.372)
Social	0.013 (0.200)	0.518 (0.390)
Humanities	0.001 (0.222)	-0.331 (0.517)
Female	0.032 (0.146)	-0.311 (0.315)
Age	0.109*** (0.039)	0.145** (0.070)
Sales	0.024*** (0.000)	0.048*** (0.000)
Constant	-2.740*** (1.015)	-4.922*** (1.814)
Year dummies	YES	YES
Pseudo R2	0.05	0.26
Log-likelihood	-306	-84
Observations	468	468

Significance levels: * 0.10 **0.05 ***0.01

⁶ Even though the 2 SLS regression does not account for the fact that our dependent variable is binary. We also estimated bivariate Probit models using the same instruments as the 2 SLS. Results from the bivariate Probit are more similar to those of the simple Probit, but are not robust to modifications of the model specification (cf. also the below discussion of robustness).

College dropout and subsequent entrepreneurial persistence / performance

A Probit specification is next employed to analyze how subsequent entrepreneurial persistence and performance varies according to whether a student graduated or left college without degree.⁷ Firms started by college graduates have a significantly lower likelihood of surviving for more than three years than those started by dropouts (Model 1 in Table 6). Based on marginal effects, graduating from college decreases the probability of surviving the first three years by 12.6 percentage points. The results moreover indicate that founders' college experience does not have a significant effect on firm survival. The same holds for gender, whereas higher founder age is associated with higher odds of firm survival.

Firm longevity may not necessarily measure performance. In the extreme case, it may just be due to a lack of outside options that prevents entrepreneurs from closing down underperforming ventures. To obtain deeper insights into the relationship between dropout and entrepreneurial performance, we therefore adopt firm size after three years as an alternative performance measure. Model 2 (Table 6) uses as its dependent variable an indicator variable that attains a value of one if a firm has at least 2.5 full-time employees and DKK 2.5 million in turnovers in its third year of operation. For this alternative performance indicator, no significant association with the type of exit from college is obtained.⁸ We also find that firms started by individuals who spent more time in college, as well as those by older founders, are more likely to have overcome the size threshold in their third year of existence. In contrast, female entrepreneurs tend to operate smaller firms after three years.

Entrepreneurship and college dropout

The next step of the econometric analysis turns to the "early" entrepreneurs who registered firms before leaving college.⁹ Model 1 (Table 7) investigates the factors associated with whether or not a college degree was eventually obtained by the respective individuals. Models 2 and 3 investigate the probability of survival and high growth. In addition to the college years, fields, and demographic controls, our key explanatory variable in this analysis measures firms' first-year sales. In line with a sizeable theoretical and empirical literature, first-year sales are taken as a measure of venture quality.

⁷ The null of exogeneity was not rejected at conventional levels for these analyses.

⁸ We experimented with restricted specifications excluding (i) the year dummies and (ii) year dummies and field indicators to improve the precision of coefficient estimates for the other variables. The coefficient of the graduation indicator remained insignificant in these specifications. Results are available from the authors.

⁹ Given the uncertainty about the direction of causality between dropping out and entrepreneurship, the group of entrepreneurs who started firms in the same year they left college is not included in the econometric analysis.

Table 7: Probit model for the likelihood of graduating, surviving and achieving high growth for individuals that started a firm while they were in college.

	Model 1 Graduation	Model 2 Survival	Model 3 Growth
Natural	-0.516** (0.218)	0.597 (0.536)	
Technical	0.041 (0.206)	0.550 (0.551)	0.168 (1.046)
Social	-0.189 (0.199)	0.861*** (0.511)	0.273 (0.864)
Humanities	-0.342 (0.219)	0.503 (0.541)	
Female	0.347** (0.165)	-0.127 (0.334)	-0.512 (0.778)
Age	0.010 (0.029)	0.045 (0.088)	0.090 (0.199)
Sales	-0.023** (0.000)	0.067** (0.000)	0.070*** (0.000)
Graduate		-0.067 (0.364)	-0.522 (0.688)
Years		-0.076 (0.100)	-0.076 (0.212)
Constant	0.110 (0.844)	-1.645 (2.092)	-3.366 (4.954)
Year dummies	YES	YES	YES
Pseudo R^2	0.06	0.08	0.21
Log-likelihood	-470	-67	-16
Observations	993	109	72

Significance levels: * 0.10 **0.05 ***0.01. Note: Observations in Model 3 are dropped because field membership perfectly predicted failure.

We find that founders who start with higher first-year turnover are less likely to subsequently obtain a college degree. In contrast, no systematic association between the number of first-year employees and degree completion is obtained in Model 1. (This also holds in an unreported model where the turnover measure is not included.) Age does not help predict degree completion, whereas female entrepreneurs are significantly more likely to graduate. Interestingly, in Models 2 and 3 none of our variables other than first-year sales helps explain the survival or growth of firms started prior to leaving college. (Note, however, the small number of observations available for these analyses.). Based on marginal effects, each increase in sales by 100,000 DKR in the first year: 1) decreases the probability of graduating by 0.6 percentage points; 2) increases the chance of survival by 2.6 percentage points and; 3) increases the chance of high growth by 0.7 percentage points.

Robustness check: alternative delinations of the sample

In the above analysis we excluded programs related to health care from the analysis, as professional self-employment is pervasive among graduates of these students whereas dropouts cannot enter the same professions. To rule out that our results are driven by the nature of our sample, we re-estimated for two more selective alternative samples.

For the first alternative sample, we excluded all students from the analysis who are enrolled in a professional bachelor program. Graduates from these programs do not normally enter a Master program but the respective programs are primarily designed to prepare students for a direct labor market entry. The second alternative sample only includes graduates from programs in the sciences, in engineering and in business. We would expect that innovative startups are predominantly started by graduates from these fields.

Table 8: Robustness checks: probability of start-up after leaving college.

	Observations	Probit	2SLS	Biprobit
Graduate (preferred sample)	185,589	-0.198*** (0.022)	0.056*** (0.013)	-0.392*** (0.111)
Graduate (no profess. bachelor)	34,848	-0.143*** (0.042)	0.038*** (0.151)	0.125 (0.247)
Graduate (science, eng., bus.)	32,280	-0.137*** (0.040)	0.084*** (0.283)	-0.023 (0.266)

Significance levels: * 0.10 **0.05 ***0.01

Table 8 reports the coefficients estimated for our main variable of interest, the indicator variable denoting students who successfully graduated from their program, for the alternative samples and estimation approaches. Compared to the preferred sample employed above, we find no qualitative differences in the results of the Probit and 2 SLS models. Regardless of how the sample is delineated, the Probit results suggest significantly lower entrepreneurship rates for graduates, while the opposite is true for the 2 SLS models. We also report results from bivariate Probit model using the same instruments as the 2 SLS. The bivariate Probit is an alternative approach to handle endogenous continuous regressors in models with binary dependent variables. As can be seen in Table 8, the results from the bivariate Probit models differ substantially between the alternative samples.¹⁰

Similar to the likelihood of entrepreneurship, we also re-estimate the performance of ventures started by “late” entrepreneurs for the two alternative samples. Results are included in Table 9. While the precision of these analyses is limited by the small numbers of entrepreneurial ventures started by the students contained in the smaller alternative samples, they suggest that the result for survival obtained for the full sample must be treated with caution. For both alternative samples, differences in the likelihood of 3-year survival are not significant between graduates and dropout.

¹⁰ We also experimented with specifications including additional control variables such as the completion of vocational training before taking up university studies. While the latter is generally predictive of entrepreneurial activities, its inclusion (or that of other controls) had little effect on our main results.

Table 9: Robustness checks: performance

	Observations	3-year survival	3-year growth
Graduate	468	-0.317**	-0.183
(preferred sample)		(0.155)	(0.264)
Graduate	90	0.163	N.A.
(no profess. bachelor)		(0.327)	
Graduate	178	0.266	0.198
(science, eng., bus.)		(0.233)	(0.457)

Significance levels: * 0.10 **0.05 ***0.01

6. Discussion and concluding remarks

Based on a number of prominent examples, entrepreneurs who dropped out from college have received substantial public attention. But how substantial is the phenomenon of the successful dropout entrepreneur? In this paper, we tried to find answers to this question based on information for the population of Danish college students. We found that when compared to individuals who complete their college degrees, dropouts are more likely to start firms, particularly among the minority who register their firms prior to leaving college. In this group of early startups, the firms of future dropouts enter bigger, and larger size at entry predicts both the odds of founder dropout and three-year rates of firm survival.

Looking at entrepreneurial activities in the first three years after leaving college, dropouts are more likely to start firms than graduates. However, the decision to leave college without completing one's degree may be driven by the intention to start a firm. When we begin to control for the potential endogeneity of dropping out, we no longer find a higher likelihood of entrepreneurship among dropouts (compared to graduates). If anything, our findings may even suggest a lower likelihood of dropouts to become entrepreneurs. No clear-cut patterns are obtained in the analysis of firm performance for these "late" entrepreneurs. In the full sample, their firms are more likely to survive for three or more years, but this is not reproduced in more selective subsamples of the Danish student population, and no significant differences in the likelihood of growth are observed. We moreover found that additional years spent in college significantly increase the likelihood of entrepreneurial activity, but not of venture survival or growth. Taken together, our results thus provide little support for the conjecture that successful dropout entrepreneurs are a pervasive phenomenon extending between the well-known examples who have received substantial attention in the media.

The substantial gender differences that we found in entrepreneurial outcomes also deserve attention. Female students in Denmark are more likely to graduate successfully, but they start fewer firms than their male peers. Their ventures are less likely to grow than those started by men. All this may be explicable in terms of higher risk aversion by female students, but if so, it is puzzling that the more cautious behavior does not translate into longer-lived ventures.

Before concluding we would like to highlight a number of caveats. The present study focuses on Denmark; consequently, it is an open question how valid our findings are for the institutional context of other countries. The Danish welfare system includes special employment schemes for the highly educated, which potentially influences entry into entrepreneurship activity that is necessity based. (GEM surveys consistently show that necessity based entrepreneurship is less frequent in Nordic economies.). Individuals that are more challenged on the labor market (e.g., dropouts compared to graduates) are less inclined to start into self-employment compared to individuals in countries that do not have access to these social benefits. Furthermore, the national context also heavily influences the overall perception of entrepreneurship.

The information in the Danish register is gathered using government records. Despite the ability to gather data on a large scale and obtain rather consistent longitudinal measures there are some limitations we encounter when investigating entrepreneurship. To measure entry into entrepreneurship we are constrained to firm registrations. This variable does not provide us with information on the motivation of starting up, e.g. necessity vs. opportunity based entrepreneurship. Furthermore, we are not able to identify nascent entrepreneurs who do not reach the point of registering a business. As a result, we have a selection issue, as poor performing nascent entrepreneurs might not reach the stage of registering a new venture. The problem that emerges from this selection problem in light of survival and performance has been illustrated by Yang and Aldrich (2012) comparing data of registered venture and nascent entrepreneurs from the PSEDII; however, there are currently no feasible ways to identify nascent entrepreneurs in the databases available to us.

Furthermore, in our attempt to investigate the impact of survival we are not able to exactly determine the cause or nature of the exit. We only observe that a firm dissolves but whether this is because of bankruptcy, liquidation, or voluntary closure (e.g. because of a wish to pursue new opportunities, selling the business) is not possible to assess.

We are likewise unable to identify the motives behind dropping out. Some students might drop out because they cannot keep up with the requirements of the program while others are dropping out because they do not like to be constrained by the education system. Consequently, the variation among dropouts might be higher compared to the variation among graduates.

All this suggests that further research on dropout entrepreneurs is required.

References:

- Bates, T. (1990). Entrepreneur human capital inputs and small business longevity. *The review of Economics and Statistics*, 551-559.
- Becker, G. S. (1964). *Human capital: A theoretical and empirical analysis, with special reference to education*. University of Chicago Press.
- Bernau, P. (2013). "Das schräge Superhirn aus dem Internet", Frankfurter Allgemeine Zeitung, January 31, 2013.
- Cassar, G. (2006). Entrepreneur opportunity costs and intended venture growth. *Journal of Business Venturing*, 21(5), 610-632.
- Colombo, M. G., & Grilli, L. (2005). Founders' human capital and the growth of new technology-based firms: A competence-based view. *Research policy*, 34(6), 795-816.
- Cromie, S. (2000). Assessing entrepreneurial inclinations: Some approaches and empirical evidence. *European Journal of Work and Organizational Psychology*, 9(1):7-30.
- Davidsson, P. & Honig, B. (2003). The role of social and human capital among nascent entrepreneurs. *Journal of Business Venturing*, 18(3):301-331.
- Dickson, P. H., Solomon, G. T., & Weaver, K. M. (2008). Entrepreneurial selection and success: does education matter?. *Journal of small business and enterprise development*, 15(2), 239-258.
- Evans, D. S., & Leighton, L. S. (1990). Small business formation by unemployed and employed workers. *Small business economics*, 2(4), 319-330.
- Gartner, W. B. (1988). "Who is an entrepreneur?" is the wrong question. *American Journal of Small Business*, 12(4):11-32.
- Gimeno, J., Folta, T. B., Cooper, A. C., & Woo, C. Y. (1997). Survival of the fittest? Entrepreneurial human capital and the persistence of underperforming firms. *Administrative science quarterly*, 750-783.
- Hsu, D. H. (2007). Experienced entrepreneurial founders, organizational capital, and venture capital funding. *Research Policy*, 36(5), 722-741.
- Lofstrom, M., Bates, T., & Parker, S. C. (2013). Why are some people more likely to become small-businesses owners than others: Entrepreneurship entry and industry-specific barriers. *Journal of Business Venturing*.
- Marvel, M. R., & Lumpkin, G. T. (2007). Technology entrepreneurs' human capital and its effects on innovation radicalness. *Entrepreneurship Theory and Practice*, 31(6), 807-828.
- Nielsen, K. & Sarasvathy, S. D. (2011) Passive and Active Learning from Entrepreneurship: An Empirical Study of Re-Entry and Survival. DRUID Working Paper No. 11-12.
- Parker, S. C. (2004). *The Economics of Self-Employment and Entrepreneurship*. Cambridge University Press.
- Robinson, P. B., & Sexton, E. A. (1994). The effect of education and experience on self-employment success. *Journal of business Venturing*, 9(2), 141-156.
- Shane, S. (2003). *A general theory of entrepreneurship: The individual-opportunity nexus*. Northampton, MA: Edward Elgar.
- Timmermans, B. (2010). The Danish integrated database for labor market research: towards demystification for the English speaking audience. *Aalborg: Aalborg University*.
- Unger, J. M., Rauch, A., Frese, M., & Rosenbusch, N. (2011). Human capital and entrepreneurial success: A meta-analytical review. *Journal of Business Venturing*, 26(3), 341-358.
- Van der Sluis, J., Van Praag, M., & Vijverberg, W. (2008). Education and entrepreneurship selection and performance: A review of the empirical literature. *Journal of Economic Surveys*, 22(5), 795-841.

- Weick, K. E. (1996). Drop your tools: An allegory for organizational studies. *Administrative Science Quarterly*, 301-313.
- Werner, A. (2011). Do credit constraints matter more for college dropout entrepreneurs?. *International Journal of Entrepreneurship and Innovation Management*, 14(2), 190-205.
- Yang, T., & Aldrich, H. E. (2012). Out of sight but not out of mind: Why failure to account for left truncation biases research on failure rates. *Journal of Business Venturing*, 27(4), 477-492.

Table 1: Descriptive statistics and correlation table

		N	Mean	S.E	1	2	3	4	5	6	7	8	9	10	11	12
1	Graduate Years in college	188,402	0.794	0.404												
2		188,402	2.855	1.518	0.194*											
3	Age	188,402	21.665	1.608	0.009*	-0.116*										
4	Gender	188,402	0.564	0.496	0.083*	0.009*	0.019*									
5	Natural	188,402	0.098	0.297	-0.041*	0.101*	-0.099*	-0.059*								
6	Technical	188,402	0.154	0.361	-0.012*	0.084*	-0.048*	-0.286*	-0.140*							
7	Social	188,402	0.256	0.436	0.011*	-0.177*	-0.143*	-0.080*	-0.193*	-0.250*						
8	Humanities	188,402	0.199	0.399	-0.039*	0.049*	-0.036*	0.107*	-0.164*	-0.212*	-0.293*					
9	Start-up Sales (1000 DKK)	188,402	0.017	0.131	-0.018*	0.034*	0.007*	-0.096*	0.015*	0.054*	0.008*	-0.018*				
10		3252	308.103	908.707	-0.040*	-0.003	0.059*	-0.039*	-0.020	-0.002	0.029	-0.006	.			
11	Employees	3289	0.383	1.618	-0.043*	-0.008	0.067*	-0.036*	-0.006	-0.022	0.033	0.003	.	0.473*		
12	Growth	688	0.455	0.498	-0.037	-0.025	0.120*	-0.030	0.011	0.068	-0.018	-0.039		0.154*	0.013	
13	Survival	688	0.065	0.247	-0.047	-0.021	0.081*	-0.082	-0.026	0.024	0.042	-0.039		0.407*	0.263*	0.290*

Appendix:

Table A1: Biprobit model for the probability of survival and high growth after three years for individuals starting up after leaving college

	Model A1: Survival	Model A2: Growth
Graduate	-0.209 (0.615)	-0.399 (0.942)
Years	0.045 (0.114)	0.097 (0.180)
Natural	0.046 (0.229)	0.387 (0.442)
Technical	0.230 (0.193)	0.216 (0.368)
Social	0.024 (0.202)	0.556 (0.387)
Humanities	0.008 (0.225)	-0.301 (0.510)
Female	0.025 (0.145)	-0.323 (0.310)
Age	0.117*** (0.040)	0.151** (0.071)
Sales	0.000*** (0.000)	0.000*** (0.000)
Constant	-2.851*** (0.924)	-5.453*** (1.701)
Year dummies	NO	NO
Log-likelihood	-515	-293
Observations	468	468

Significance levels: * 0.10 **0.05 ***0.01