

Bünstorf, Guido; Nielsen, Kristian; Timmermans, Bram

Working Paper

Steve Jobs or no jobs? Entrepreneurial activity and performance among Danish college dropouts and graduates

MAGKS Joint Discussion Paper Series in Economics, No. 28-2016

Provided in Cooperation with:

Faculty of Business Administration and Economics, University of Marburg

Suggested Citation: Bünstorf, Guido; Nielsen, Kristian; Timmermans, Bram (2016) : Steve Jobs or no jobs? Entrepreneurial activity and performance among Danish college dropouts and graduates, MAGKS Joint Discussion Paper Series in Economics, No. 28-2016, Philipps-University Marburg, School of Business and Economics, Marburg

This Version is available at:

<https://hdl.handle.net/10419/146635>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

MAGKS



**Joint Discussion Paper
Series in Economics**

by the Universities of
Aachen · Gießen · Göttingen
Kassel · Marburg · Siegen

ISSN 1867-3678

No. 28-2016

Guido Buenstorf, Kristian Nielsen and Bram Timmermans

**Steve Jobs or No Jobs?
Entrepreneurial activity and performance among Danish
college dropouts and graduates**

This paper can be downloaded from
<http://www.uni-marburg.de/fb02/makro/forschung/magkspapers>

Coordination: Bernd Hayo • Philipps-University Marburg
School of Business and Economics • Universitätsstraße 24, D-35032 Marburg
Tel: +49-6421-2823091, Fax: +49-6421-2823088, e-mail: hayo@wiwi.uni-marburg.de

Steve Jobs or No Jobs?

**Entrepreneurial activity and performance
among Danish college dropouts and graduates**

Guido Buenstorf

University of Kassel

Department of Economics and INCHER-Kassel

Nora-Platiel-Strasse 5; 34109 Kassel (Germany)

(+49) (561) 804-2506

buenstorf@uni-kassel.de

(Corresponding author)

Kristian Nielsen

Aalborg University

Fibigerstræde 11, 9220 Aalborg Øst (Denmark)

kn@business.aau.dk

Bram Timmermans

Norwegian School of Economics (NHH)

Helleveien 30, NO-5045 Bergen (Norway)

bram.timmermans@nhh.no

Small Business Economics (forthcoming)

Abstract

Are college dropouts successful entrepreneurs? Other than 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 or graduation 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. On average, becoming an entrepreneur does not allow dropouts to escape from their punishment in the labor market.

keywords: entrepreneurship, higher education, college dropouts, returns to entrepreneurship.

JEL: L26, I29

Steve Jobs or No Jobs?

Entrepreneurial activity and performance among Danish college dropouts and 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 impairs entrepreneurial performance. The strongest versions of this argument go so far as to recommend aspiring entrepreneurs to drop out of college. A case in point is Peter Thiel of Facebook and PayPal fame who established a scholarship program for dropout-entrepreneurs (Clynes, 2016).

This pessimistic view of the effects of formal education on entrepreneurship resonates with early research on entrepreneurship that emphasized the importance of inborn and fixed personality traits (Gartner 1988) 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 successful 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 that these dropouts perform no worse than otherwise comparable entrepreneurs who completed their college degrees. Entrepreneurship may even allow college dropouts to escape from the labor market disadvantage that they face as paid employees. 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 (Spence 1973). 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 performance as entrepreneurs may also be marginal. Dropout entrepreneurs are further disadvantaged, particularly in their ability to

mobilize resources (Shane 2003) such as access to financial capital (Werner 2011) and quality employees as these entrepreneurs cannot credibly signal ability to outside stakeholders.

Prior research for the U.S. suggests that student entrepreneurship is an important phenomenon. Recent science and engineering graduates are more likely to start firms than their professors, and their ventures often perform well (Åstebro et al. 2012). However, to what extent are student entrepreneurship and its success related to graduating rather than merely attending college? This question is difficult to answer because there is only limited empirical research that explicitly addresses college dropout and entrepreneurship. A notable exception is the study by Werner (2011) who investigates the ability of college dropouts to get bank finance. More often the issue is part of a broader discussion on entrepreneurship and education (for reviews see van der Sluis et al. 2008 and Åstebro 2012) 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.

Motivated by the current debate about higher education and entrepreneurship, the objective of this paper is to provide more detailed evidence on how college dropout is associated with entrepreneurial activity and performance. We also begin to address the potential endogeneity of dropping out in the decision to become an entrepreneur through an instrumental variable approach. 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 our main variable of interest, 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. Moreover, we are 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. To investigate performance effects related to dropping out and entrepreneurship we rely on two personal income variables from IDA (originating from tax records) that allow us to identify total wages and total profits, respectively, received in a given year. This enables us to compare the total income of dropouts and graduates irrespective of the decision to start a new venture.

Our data suggest that the majority of entrepreneurship activities take place after a student leaves college (with or without a degree). We find 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. Dropouts and entrepreneurs, with the exception of entrepreneurs at the upper end of the distribution, have lower incomes than graduates and wage earners. On average, becoming an entrepreneur does not allow dropouts to escape from their punishment in the labor market.

The remainder of the paper is structured as follows. After this introduction we will continue with theoretical considerations based on a discussion of related prior work (Section 2). In Section 3 we introduce the data for the econometric analysis. Section 4 presents our findings. Section 5 concludes and provides suggestions for future research.

2. Theoretical considerations

2.1. 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 (Evans and Leighton 1989; Bates 1990; Robinson and Sexton 1994; Gimeno et al. 1997; Davidsson and Honig 2003; Shane 2003; Colombo and Grilli 2005; Parker and Van Praag 2006; Van der Sluis et al. 2008; Dickson et al. 2008; Ucbasaran et al. 2008; Hartog et al. 2010; Unger et al. 2011; Block et al. 2011;

Åstebro 2012; Van Praag et al. 2013).¹ 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 to professional skills includes the acquisition of competences, e.g., recognition of attractive entrepreneurial opportunities (Shane 2003; Davidsson and Honig 2003; Parker 2004; Ucbasaran et al. 2008), planning and prediction, (Unger et al. 2011), and obtaining new knowledge and learning from experience (Weick 1996; Unger et al. 2011; Nielsen and Sarasvathy 2016). 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; Parker and Van Praag 2006; Werner 2011).

Despite the plausible effects of formal education, its true impact on entrepreneurship activity and entrepreneurial performance is not that straightforward; probably as education is not the only path for (potential) entrepreneurs to obtain human capital (Ucbasaran et al. 2008) but also due to endogeneity problems when linking education to entrepreneurship (Parker and Van Praag 2006; Van der Sluis et al. 2008; Block et al. 2011).² The more consistent findings concerning education have been obtained for its effect on entrepreneurial performance (Van der Sluis et al. 2008; Åstebro 2012). There appears to be an overall positive relation between level of education and a broad range of performance indicators, e.g. survival (Gimeno et al. 1997; Nielsen 2015), earnings (Robinson and Sexton 1994; Gimeno et al. 1997; Parker and Van Praag 2006; Hartog et al. 2010; Van Praag et al. 2013), growth in sales and profits (Davidsson and Honig 2003), employment growth (Colombo and Grilli 2005), innovation (Marvel and Lumpkin 2007), overcoming financial (Hsu 2007; Parker and Van Praag 2006; Werner 2011) and other organizational constraints (Van Praag et al. 2013), as well as entrepreneurial ambition (Cassar 2006). High-tech entrepreneurs who make use of their education in their startup activities tend to outperform those who do not, and also comparable paid workers (Braguinsky et al., 2012). Performance effects moreover appear to differ when distinguishing between necessity and opportunity entrepreneurs (Fossen and Büttner 2013).

In contrast to performance, the relationship of formal education and the decision to enter into entrepreneurship, and also its effect on entrepreneurial persistence, are less clear. Individuals with a higher level of education might have the better skills to enter entrepreneurship (Hartog et al. 2010; Van Praag et al. 2013) but simultaneously are also more attractive employees, thereby facing higher (perceived) opportunity cost and/or lower risk. Interestingly, some empirical evidence suggests that entrepreneurs have higher returns to education than wage earners (Hartog et al. 2010; Van Praag et al. 2013), while Taylor (1996) finds the diametrically opposite. Consequently, net entry into entrepreneurship might not vary across levels of education (Åstebro 2012). 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 opportunity costs, highly educated entrepreneurs would be expected to have a different, probably lower, threshold compared to entrepreneurs with lower levels of education. As confirmed by meta-analyses of education on entrepreneurship (e.g. Van der Sluis et al. 2008; Dickson et al. 2008) there is no robust association between the level of education and the decision to start a new business

¹ 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.

² Discussions have also addressed whether one can learn to become an entrepreneur or whether one is born with it, i.e. nature vs. nurture. Recent twin studies suggest that both nature and nurture matter (Nicolaou et al. 2010; Lindquist et al. 2015).

and those returns that exist, around four percent, might not be worth the risk for the higher educated (Åstebro 2012). Problems of endogeneity are among the reasons why these effects are not that clear (Parker and van Praag 2006; Van der Sluis et al. 2008; Åstebro 2012). A recent study that controls for this endogeneity using an instrumental variable approach finds a positive relation between years of education and entry into entrepreneurship (Block et al. 2011).

2.2. Student entrepreneurship

Academic entrepreneurship by university faculty and researchers has been in the focus of substantial prior research. In contrast, we know relatively little about the entrepreneurial activities of their students, or about how successful these activities are. Åstebro et al. (2012) employ data on U.S. scientists and engineers to compare academic and student entrepreneurship. The latter is defined as starting a firm within three years after graduation. It is found to be much more common than academic entrepreneurship, not just because there are more students than faculty but also because students are two to three times as likely to organize a firm as their professors. Student entrepreneurs earn more on average than their employed peers, with the income margin of entrepreneurship similar to that realized by faculty entrepreneurs (relative to employees comparable to them).

The study by Åstebro et al. (2012) only looks at entrepreneurial activities of successful graduates. The same is true for other recent work on student entrepreneurship, which is typically based on data for one or several individual universities (e.g., Lazear 2005; Lerner and Malmendier 2013; Colombo et al. 2015). Our analysis goes beyond the prior work in that we directly compare entrepreneurial activities and performance – in terms of personal income - of successful graduates to those of student entrepreneurs who exit from college without obtaining a degree.

2.3. College dropout and entrepreneurship

A major complicating factor in studying the link between college dropout and entrepreneurship is that the sequence of decisions may differ across individuals. Dropping out from college may be the reason why individuals consider entering into entrepreneurship. In other cases, engaging in entrepreneurial activities may cause individuals to leave college without graduating. Different theoretical considerations are relevant in these cases.³ As noted above, formal education may have competing effects on entrepreneurial activities through its influence on skill acquisition and its value as a quality signal. Similar considerations apply to how leaving college with versus without degree will affect the likelihood of subsequently becoming an entrepreneur, particular as those who attended college remain to be among the highest qualified individuals in an economy. If dropping out is related to the (lack of) success in college, dropout entrepreneurs will generally command fewer skills than graduates. This will put them at a 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 (Åstebro and Bernhardt 2005; Werner 2011), 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.

If dropout entrepreneurs command fewer entrepreneurial skills, while at the same time they are disadvantaged in mobilizing resources, adverse effects on the performance of their ventures are to be expected. However, there may be a counteracting second-order effect: As dropouts have worse

³ Our distinction is related to that between opportunity and necessity entrepreneurship (Reynolds et al. 2002; Block and Wagner 2010). “Opportunity” student entrepreneurs may decide to leave college without graduating to focus on their venture, while poor employment prospects may drive dropouts into “necessity” student entrepreneurship. Note, however, that Block and Wagner (2010) relate the distinction of opportunity versus necessity entrepreneurship to whether or not the prior employment spell was ended voluntarily. Extending a similar definition to student entrepreneurship would limit the group of necessity student entrepreneurs to those who were expelled from their university. Fossen and Büttner (2013) alternatively define necessity entrepreneurship as self-employment out of unemployment, which does not capture the situation of student entrepreneurs well.

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.

So far we have 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 opportunity “pulls” individuals into entrepreneurship. Among these “early” dropout entrepreneurs it may predominantly be 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 reflect their success as entrepreneurs. Descriptive statistics reported below support this, as dropouts have significantly larger sales in the founding year compared to graduates among the entrepreneurs that start a new venture while in college.

3. Data

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 about all labor market participants in Denmark (see Timmermans 2010), with data for the population of new firm registrations in Denmark. Based on this matching we impose several restrictions when creating our bounded sample.

3.1. The 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 1994-2004. They must have exited college, irrespective whether this exit was as a graduate or not, no later than 2007. 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 students who upon graduating directly enter another program (mainly Master programs), as well as “lingering” students, i.e. individuals 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 programs related to health care, law and architecture. Entrepreneurship is pervasive among successful graduates of these programs, whereas dropouts cannot enter into the typical entrepreneurial careers (i.e., become physicians, lawyers, or start architecture firms).⁵ Including students from these programs would considerably bias our results in favor of graduates.

These restrictions leave us with a sample of 109,941 individuals who have entered *and* exited college, where dropouts account for 30,594 individuals or approximately 28 percent of the sample. This number is substantial. A recent OECD report listed the dropout rate among students in Danish tertiary education to be 20 percent, although their definition of a dropout is an individual that never completes his or her degree (OECD 2013). The higher dropout rate in our sample can be explained by the following two factors: (i) the requirement that a dropout should be absent for two consecutive years compared to never return to college, and (ii) the removal of graduates continuing in the education system from our sample. Overall, the Danish dropout rate is among the lowest reported as only Japan has a lower reported drop-out rate of 10 percent. The Netherlands and Finland come close but dropout rates in other Scandinavian countries are substantially higher.

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

⁵ Confirming these reservations, in the health care-related programs far more firms are started by graduates than by dropouts, and almost exclusively these firms enter in the health care industry.

The 109,941 students in our full sample were enrolled in programs in natural sciences (6,304 students), engineering (20,731), business (7,103), other social sciences (6,682), humanities (15,297 students), teachers' training (22,347) and pedagogues' training (26,448) as well as miscellaneous other fields (5,029 students). However, this sample is further reduced in some of the analyses due to the available data for the performance analysis and the several robustness tests conducted (e.g., the instruments available for the entrepreneurial activity analysis).

3.2. Indicators

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 that identifies all new ventures in Denmark. Statistics Denmark sets requirement concerning minimal economic activity in these new ventures in the form of work and/or turnover, where the latter varies between industries. These requirements remove new firm registrations that are inactive. 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 business, including private limited liability companies as well as sole proprietorships, between the time they started college and three years after exiting from college (see Åstebro et al. 2012). We do not consider later startup activity because it may primarily reflect labor market experience accumulated after leaving college. As a result, new student ventures established in the period 1994-2010 are included in our sample dependent on the year of exit from college. In the regression analysis including instrumental variables, the sample is restricted to individuals enrolling college in 2001 and onwards as the two instruments are only available for the subsample of these individuals.

Performance: personal income. As a measure of performance we use personal income, the sum of total wages and profits received in a given year available in IDA from tax records. Personal income is available for dropouts and graduates irrespective on the decision to start a new venture, and the variable is reported in real income for the three years following exit from college using Statistics Denmark Net Price Index (2015=100). We use the natural logarithm of personal income to control for the skewed distribution. Furthermore, to correctly attribute the personal income in a given year to entrepreneurship or employment, we test whether the main occupation of the individual in a given year is in a firm that appears in the entrepreneurship database with the individual as the main founder (restricting the founding year to the year that the individual enters college and onwards). Due to data restrictions, this is not possible prior to 2001; consequently, the performance analysis is only available for individuals for whom we observe entrepreneurship or employment from 2001 onwards. Given that we look at performance up to three years after exiting college the individuals in our sample cannot have left college prior to 1998. In addition, since performance will only be followed to 2010, we only look at new ventures formed up to 2007 so that all ventures can be followed three years.

Dropout. Our key variable of interest, the type of exit from college, is measured with a binary variable, *dropout*, which takes a value of one for students who left the respective program for two consecutive years without obtaining the college degree.

Years of enrollment prior to leaving college. 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 performance of their venture.⁶ To reflect these differences, we construct three binary variables indicating students enrolled 1-2 years, 3-4 years and 5-8 years, respectively, before leaving college.

⁶ Labor market returns of individuals who attended two years of college compared to four years of college have been found to be significantly lower (Kane and Rouse 1995). This resonates with Braguinsky et al.'s (2012) finding that entrepreneurs who do not make use of their education earn less (see above). It is also supported by the results in Table 8.

Field of Study. As we expect variation along educational disciplines we include dummies for the educational disciplines: natural sciences, engineering, business, other social sciences, humanities, teachers' training, pedagogues' training and other fields.

Parental self-employment. This binary variable denotes students who have at least one parent who is self-employed.

Parental wealth. Besides the self-employment history of the parents we also include a variable representing the natural logarithm of the wealth of both parents.

Vocational training. It is not uncommon for Danish students to have completed vocational training prior to enrolling in college. The respective students are denoted by an indicator variable.

Other controls. In addition to the above-mentioned variables we use a range of other variables that can explain entry into entrepreneurship and/or difference in personal income like gender, age, the year of starting college, industry (ten categories), region (five categories), year, time (i.e. year 1, 2 or 3 after exiting college).

Instrument variables. To accommodate the potential endogeneity of college dropout and entry into entrepreneurship, we rely on two instruments. First, the grade average from high school available for students finishing high school in 2001 and onwards. Second, a dummy variable taking the value 1 if the individual has a sibling that graduated from college, and 0 if the individual has a sibling that enrolled college but did not graduate.

Descriptive statistics and correlations are shown in Table 1.

Table 1: Descriptive statistics and correlation table

Variable	Obs	Mean	Std. Dev.	Pearson correlation matrix																		
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1 Dropout	109,941	0.278	0.448	1.00																		
2 Years 3-4	109,941	0.450	0.498	-0.40	1.00																	
3 Years 5+	109,941	0.116	0.320	-0.08	-0.33	1.00																
4 Female	109,941	0.574	0.494	-0.17	0.10	-0.07	1.00															
5 Age	109,941	21.940	1.651	-0.09	0.00	-0.13	0.01	1.00														
6 Parent entrepreneur	109,941	0.139	0.346	0.00	0.00	0.00	0.00	0.00	1.00													
7 Parent wealth (ln)	109,941	9.534	6.068	-0.06	0.01	0.02	-0.04	-0.01	-0.01	1.00												
8 Vocational	109,941	0.117	0.322	-0.05	-0.05	-0.09	-0.10	0.35	0.01	0.03	1.00											
9 Sciences	109,941	0.057	0.232	0.16	-0.09	0.06	-0.06	-0.07	0.01	0.02	-0.03	1.00										
10 Engineering	109,941	0.189	0.391	-0.05	-0.02	0.09	-0.39	-0.09	0.02	0.07	0.21	-0.12	1.00									
11 Social Science	109,941	0.061	0.239	0.03	-0.08	-0.02	0.05	0.01	0.00	0.00	-0.04	-0.06	-0.12	1.00								
12 Business	109,941	0.065	0.246	0.22	-0.18	-0.06	-0.11	-0.12	0.02	0.00	-0.03	-0.06	-0.13	-0.07	1.00							
13 Humanities	109,941	0.139	0.346	0.20	-0.11	0.04	0.04	-0.08	0.00	-0.02	-0.10	-0.10	-0.19	-0.10	-0.11	1.00						
14 Pedagogical	109,941	0.241	0.427	-0.24	0.10	-0.13	0.32	0.24	-0.03	-0.05	0.03	-0.14	-0.27	-0.14	-0.15	-0.23	1.00					
15 Teachers	109,941	0.203	0.402	-0.10	0.28	0.03	0.08	-0.02	-0.01	-0.01	-0.10	-0.12	-0.24	-0.13	-0.13	-0.20	-0.28	1.00				
16 Sibling graduate	18,519	0.808	0.394	-0.04	0.04	0.01	-0.03	-0.01	0.02	0.10	-0.03	0.00	0.01	0.01	-0.01	0.00	-0.02	0.02	1.00			
17 Grades	37,115	8.136	0.912	-0.08	-0.01	0.14	-0.06	-0.23	0.02	0.10	-0.02	0.05	0.14	0.13	-0.01	0.19	-0.35	-0.07	0.03	1.00		
18 Income year 1 (ln)	64,241	11.927	0.737	-0.12	0.12	0.07	-0.08	0.06	-0.01	0.01	0.07	-0.05	0.10	-0.02	-0.04	-0.14	0.06	0.03	-0.01	-0.08	1.00	
19 Income year 2 (ln)	74,845	12.360	0.752	-0.26	0.16	0.06	-0.09	0.06	0.00	0.01	0.07	-0.09	0.17	-0.05	-0.10	-0.20	0.02	0.13	0.00	-0.06	0.50	1.00
20 Income year 3 (ln)	81,132	12.435	0.765	-0.25	0.15	0.07	-0.10	0.05	0.00	0.01	0.08	-0.08	0.18	-0.05	-0.08	-0.18	-0.01	0.12	0.01	-0.04	0.34	0.60

note: significant correlations are highlighted in bold

4. Results

4.1. Entry into entrepreneurship: descriptive findings

Some informative patterns in our data already derive from the descriptive statistics. As shown in Table 2, a total of 1,942 (or 1.77%) of the students exiting from college in the period 1994-2007 (enrolled 1994-2004) are observed as starting firms in the period 1994-2010. Of these, 1,204 are graduates who completed the program they are last observed in; 738 are dropouts. The share of entrepreneurs is larger among the dropouts (2.41%) than among the more sizable group of graduates (1.52%). Entrepreneurs are found across all fields of studies, albeit with substantial differences in their numbers as well as the prevalence of dropout entrepreneurs. Except for the catch-up category of “other fields”, the highest shares of student entrepreneurs are found in engineering, natural science as well as business. This holds for both graduates and dropouts.⁷ Students of social sciences and education are least likely to start up, particularly if they graduate successfully.

Table 2: *Entrepreneurship among dropouts and graduates, by fields of study (startup: 1994-2010)*

Field of study	Dropout	Graduate	Total
Natural Science	133	75	208
(% Entrepreneurs)	3.68%	2.79%	3.30%
Engineering	171	522	693
(% Entrepreneurs)	3.57%	3.27%	3.34%
Social Science	52	32	84
(% Entrepreneurs)	2.39%	0.71%	1.26%
Business	145	84	229
(% Entrepreneurs)	3.09%	3.48%	3.22%
Humanities	119	135	254
(% Entrepreneurs)	1.54%	1.78%	1.66%
Pedagogical	21	69	90
(% Entrepreneurs)	0.91%	0.29%	0.34%
Teachers	58	87	145
(% Entrepreneurs)	1.37%	0.48%	0.65%
Other Fields	39	200	239
(% Entrepreneurs)	3.69%	5.04%	4.75%
Total	738	1204	1942
(% Entrepreneurs)	2.41%	1.52%	1.77%

Table 3 lists the industries in which we observe graduate and dropout entrepreneurs entering. Given restricted data availability, numbers refer to startup in the period 2001-2010 (for individuals starting college in the period 2001-2004 and exiting college in the period 2001-2007); the same sample restriction is used in the instrumental variable regressions). The largest number of entries is in business services (133 startups), followed by ICT (72), building and construction (68) and sales and transportation (67). In general, sectors with more student entrepreneurs who graduated also attract larger numbers of dropout entrepreneurs. The most notable differences are in business services and ICT, where graduates account for the largest shares of entrants. Dropout entrepreneurs play the biggest role in sales and transportation.

⁷ Around 3% of the science and engineering graduates enter into entrepreneurship. This is about half of the fraction of start-up owners observed by Åstebro et al. (2012) for their comparable sample of U.S. science and engineering graduates.

Table 3: Entrepreneurship among dropouts and graduates, by industries entered (startup: 2001-2010)

Industry	Dropout	Graduate	Total
Industry, raw material, supply	<10	<10	13
Building and construction	30	38	68
Sales and transportation	39	28	67
Information and communication	24	48	72
Finance, insurance, real estate	<10	<10	<10
Real estate and leasing	<10	<10	10
Business services	31	102	133
Administration, teaching, health	<10	<10	22
Culture, leisure, other services	19	18	37
Unknown / Other	<10	<10	<10
Total	160	269	429

Due to anonymity restrictions on the register data, small numbers prevent us from analyzing the link between fields of study, dropout and industries in more detail. However, it is clear that some of the above patterns are driven by individual study fields. Entry into construction is dominated by students from engineering programs. This holds both for dropout entrepreneurs (24) and for graduates (32). With 41 graduate startups versus only six dropout startups, students exiting from engineering programs also contribute substantially to the difference between graduate and dropout founders in business services. In general, however, the overlap between the fields entered by both groups of founders is substantial. There are 80 study field-industry pairs (eight study fields and ten industries) in our data. We observe at least one entrepreneurial entry in 59 of the 80 study field-industry pairs. Of these, 39 study field-industry pairs (or 66.1% of all pairs with entry) have both graduates and dropouts entering, suggesting that both groups do not enter into fundamentally different fields.

We next turn to the sequence of the entrepreneurship and dropout events. Table 4 distinguishes individuals who registered a venture prior to leaving college from those who registered a firm and left college in the same calendar year, as well as 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. For both graduate and dropouts the number of firms started after leaving college is considerably larger than the number of firms started before leaving college. This suggests that exit from college mostly antecedes the entrepreneurial activities of both groups.

Table 4: Sequence of entering entrepreneurship, graduating, and leaving college (startup: 1994-2010)

	Dropout	Graduate	Total
No entrepreneurship	29,856	78,143	107,999
%	97.59%	98.48%	98.23%
Entr. prior to leaving college	159	372	531
%	0.52%	0.47%	0.48%
Entr. while leaving college	116	149	265
%	0.38%	0.19%	0.24%
Entr. after leaving college	463	683	1,146
%	1.51%	0.86%	1.04%
Total	30,347	79,347	109,941

Taking this analysis one step further and focusing only on individuals who have registered a business (our measure of entrepreneurs), the first notable result is that the firms started by Danish college students generally tend to be of very small size. This is also supported by notable differences between median values and means of sales and employees indicating a highly skewed distribution with a few large firms as expected. With sales of about 165,000 DKR and 0.105 employees on average (median values: 54,000 DKR and 0.000 employees, respectively), firms started “early” (i.e., before exiting from college) are even smaller than those started “late”.

Distinguishing between the startups of dropouts and (eventual) graduates, we observe striking differences in first-year turnover (Table 5) and employment size (Table 6). The differences are particularly pronounced for new ventures started before leaving college (first columns in Tables 5 and 6). In terms of both turnover and number of employees, firms whose founders dropped out after registering are on average 2-2.5 times as large as those whose founders subsequently graduated (about 246,000 vs. 130,000 DKR and 0.176 vs. 0.075 employees). These differences are significant at the 1% and 5% levels, respectively (see Tables 5 and 6, last row). They suggest that firms started by founders who later dropped out from college may have been more substantial than those of subsequent graduates. A possible explanation could be that some of these “early” dropout entrepreneurs have identified highly promising business opportunities, and that these extreme cases drive the differences in the means of both groups. This explanation would obviously resonate with the examples of prominent dropout entrepreneurs alluded to in the introduction. It would find further support if the standard deviation of entry sizes also was substantially larger for the group of dropout entrepreneurs. This is indeed the case in the “early” group, but the difference is less pronounced than the difference in means.

In contrast to these patterns for “early” entrepreneurial activities, no significant differences in entry sizes are observed for the second column where registration occurs in the same year as leaving college. The final column shows the patterns for “late” entrepreneurship, i.e. for businesses registered after leaving college. In this group, we find that graduates enter with larger sales (481,000 vs. 361,000 DKR; significant at the 10% level, see Table 5). The difference in employment levels points to the same direction (0.322 for graduates vs. 0.276 for dropouts) but is not significantly different from zero (see Table 6).

Table 5: Mean and median annual sales (DKR), dropout and graduates before leaving college, same year as leaving and after leaving college (startup: 1994-2010)

		Early	Same	Late
Dropout	Mean	2.464	2.939	3.613
	Std. dev.	4.754	6.238	7.052
	Median	0.606	1.027	1.660
	N	159	116	463
Graduate	Mean	1.298	2.168	4.811
	Std. dev.	3.567	4.914	12.987
	Median	0.488	0.693	1.814
	N	372	149	683
Total	Mean	1.647	2.507	4.326
	Std. dev.	3.991	5.537	10.988
	Median	0.535	0.793	1.721
	N	531	265	1,146
		pr=0.002	pr=0.262	pr=0.073

Sales in 100,000 DKR

Table 6: Mean and median number of employees, dropout and graduates before leaving college, same year as leaving and after leaving college (startup: 1994-2010)

		Early	Same	Late
Dropout	Mean	0.176	0.164	0.276
	Std. dev.	0.611	0.685	0.905
	Median	0.000	0.000	0.000
	N	159	116	463
Graduate	Mean	0.075	0.161	0.322
	Std. dev.	0.498	0.698	0.826
	Median	0.000	0.000	0.000
	N	372	149	683
Total	Mean	0.105	0.162	0.304
	Std. dev.	0.536	0.691	0.859
	Median	0.000	0.000	0.000
	N	531	265	1,146
		pr=0.047	pr=0.975	pr=0.377

These descriptive patterns indicate that entrepreneurial activities and performance of Danish college dropouts may differ systematically from those of their peers who successfully graduate. However, it is unclear to what extent the differences are due to differences in the characteristics of both groups, and whether they are biased by the potential endogeneity of the decision to exit college with or without a degree. In the remainder of this section, we explore these issues econometrically.

4.2. College dropout and entrepreneurial activity

For the econometric analysis of entry into entrepreneurship we 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. The focus on “late” entrepreneurs reflects that they are the most sizeable group among both dropout and graduate entrepreneurs. In addition, a substantial methodological challenge arises from the fact that the causality of dropping out and becoming an entrepreneur may differ across individuals. We cannot observe whether students first decide to drop out or to start up, but base our estimation approach on the (untestable) assumption that causality is generally reflected by the sequence of events. Specifically, we assume that among the students who first left college (with or without degree) and then started a firm, the dropout decision mostly anteceded the decision to become an entrepreneur. Based on this assumption we initially study the transition into entrepreneurship using a Probit specification (Model 1 in Table 7). Our key variable of interest is *Dropout*, a binary variable indicating whether an individual left college without completing their degree (rather than successfully graduating).

However, causality may not always correspond to the temporal ordering of events, e.g. because a dropout decision was made in anticipation of subsequent entrepreneurship. Endogeneity tests for our sample of Danish students corroborated that this is a relevant concern. We therefore follow the lead of prior studies linking education to entrepreneurship and address the potential endogeneity econometrically (Parker and Van Praag 2006; Van der Sloot et al. 2008; Block et al. 2011). To this purpose, we primarily use two-stage least squares (2SLS) estimators for the instrumental variables regression, which has been shown to be suitable for contexts in which both the dependent variable and the potentially endogenous regressor are binary (Angrist 2001).

It proved challenging to find suitable instruments for the potentially endogenous *Dropout* variable that predict graduation but not entrepreneurship. This requirement ruled out various seemingly attractive candidates (for instance, sudden shocks such as unexpected illnesses and death in the family). We finally settled on two instruments, each of which is based on a different rationale. As a first instrument we employ *Grades* measuring the high school grade average. This instrument captures poor study performance as a driver of dropout decisions. Second, following earlier work investigating the link between education and entrepreneurship (Parker and Van Praag 2006; Block et al. 2011), we also instrument dropping out with a variable related to family background. Specifically, for each student in the sample we retrieved information about potential siblings that graduated or dropped out from college, conditional on having enrolled. Here, the underlying rationale is the role model provided by successfully graduating brothers and sisters.

Data limitations for the instruments require us to estimate the 2SLS regressions on a restricted sample. On the one hand, information about grades is only available from 2001 and onwards, which forces us to restrict the sample to those individuals that started college in 2001. On the other hand, variation in the (non-) graduation of siblings presupposes that the respective student has siblings who enrolled in college. This requirement leads to an even more substantial reduction of the sample size. To limit the loss of observations, we therefore first estimate a 2SLS model using only the grade-based instrument (Model 2 in Table 7). Subsequently, we add the sibling-based instrument and re-estimate the model for the more strongly restricted sample (Model 3 in Table 7). The suitability of our instruments is indicated by partial F-values of 504.94 (Model 2) and 44.97 (Model 3) in the first-stage regression, as well as by the Sargan test for overidentification in Model 3 ($p > 0.34$). Higher grades and having a sibling who graduates demonstrate to have negative coefficients on the likelihood of dropping out. Coefficients for both instruments are not significantly different from zero when (individually or jointly) included in a Probit regression of entering entrepreneurship.

Results of the simple Probit model are included as Model 1 in Table 7. To facilitate interpretation and comparison to subsequent results, we report marginal effects (discrete effects for binary variables) at sample means, where the baseline probability of late startup is 0.6 %. Our findings in Model 1 suggest that dropouts are significantly more likely than graduates to register a new firm in the first three years after leaving college; the probability of startup is increased by 0.2 percentage points if the student is a dropout. Female students are less likely and older students are more likely to start firms. Positive effects are moreover obtained for parental entrepreneurship and students with prior vocational training. In contrast, conditional on parental entrepreneurship, student's entrepreneurial activity is not predicted by parental wealth.⁸

The 2SLS regressions show a less unequivocal pattern regarding the entrepreneurial activities of dropouts. In Model 2 (Table 7) only using college grades as an instrument, the coefficient of the dropout variable is reduced by about 18 % and loses significance (reflecting that the 2SLS estimate is less precise). In Model 3 (Table 7) using both college grades and graduating siblings as instruments the (insignificant) coefficient turns negative. Accordingly, when we control for the potential endogeneity of the dropout decision, we can no longer reject the Null hypothesis that there is no difference in the likelihood of graduates and dropouts to become entrepreneurs.⁹ Results for the other variables are similar to those obtained in Model 1.

⁸ To rule out that these results are driven by the nature of our sample, we re-estimated Model 1 for two more selective samples. First, we excluded all students 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 science, engineering and business. Results for both alternative samples (available from the authors) are very similar to those reported above.

⁹ Following Cameron and Trivedi (2009, ch. 6) we re-estimated Model 2 using a latent-variable model in the first stage to account for the binary character of the *Dropout* variable. Doing so also yielded a non-significant coefficient for *Dropout*. The same result was obtained using a bivariate Probit model as an alternative for Model 3. Detailed results are available from the authors.

Table 7: Probit / IV model estimating probability of start-up after leaving college.

	Model 1	Model 2		Model 3	
	Probit (mfx)	2SLS (first)	2SLS (second)	2SLS (first)	2SLS (second)
Dropout (d)	0.002*** (0.001)		0.002 (0.010)		-0.039 (0.034)
Years 3-4 (d)	0.000 (0.001)	-0.422*** (0.006)	0.004 (0.005)	-0.392*** (0.014)	-0.011 (0.015)
Years 5+ (d)	0.001* (0.001)	-0.383*** (0.012)	0.004 (0.005)	-0.351*** (0.026)	-0.021 (0.014)
Female (d)	-0.007*** (0.001)	-0.095*** (0.006)	-0.007*** (0.002)	-0.091*** (0.013)	-0.014** (0.005)
Age	0.001*** (0.000)	-0.012*** (0.002)	0.001*** (0.000)	-0.001 (0.004)	0.002* (0.001)
Parents eship (d)	0.002*** (0.001)	-0.004 (0.007)	0.003* (0.002)	0.000 (0.017)	0.005 (0.005)
Vocational (d)	0.004*** (0.001)	-0.066*** (0.016)	0.016*** (0.006)	-0.096*** (0.032)	0.040** (0.018)
Parents wealth	-0.000 (0.000)	-0.004*** (0.000)	-0.000 (0.000)	-0.002* (0.001)	-0.000 (0.000)
Natural Sciences (d)	-0.004*** (0.000)	0.352*** (0.020)	-0.014* (0.007)	0.336*** (0.045)	-0.015 (0.020)
Engineering (d)	-0.005*** (0.000)	0.179*** (0.018)	-0.017*** (0.006)	0.119*** (0.042)	-0.014 (0.016)
Social (d)	-0.006*** (0.000)	0.162*** (0.019)	-0.018*** (0.006)	0.118*** (0.043)	-0.018 (0.015)
Business (d)	-0.004*** (0.000)	0.295*** (0.021)	-0.005 (0.008)	0.281*** (0.049)	0.011 (0.022)
Humanities (d)	-0.006*** (0.000)	0.291*** (0.018)	-0.016** (0.007)	0.210*** (0.041)	-0.004 (0.017)
Pedagogical (d)	-0.011*** (0.001)	-0.021 (0.018)	-0.020*** (0.006)	-0.085** (0.040)	-0.026* (0.014)
Teachers (d)	-0.009*** (0.000)	0.211*** (0.018)	-0.020*** (0.006)	0.159*** (0.040)	-0.018 (0.016)
Grade		-0.069*** (0.003)		-0.065*** (0.007)	
Sibling				-0.360** (0.017)	
Constant		1.289*** (0.055)	-0.002 (0.013)	1.039*** (0.131)	0.002 (0.036)
Region dummies	Yes	Yes	Yes	Yes	Yes
College start year dummies	Yes	Yes	Yes	Yes	Yes
Log-likelihood	-5781.982				
Chi-squared	1104.50		103.12		37.08
F		569.73		84.90	
pseudo R2	0.091				
R2		0.327	0.009	0.307	0.009
Observations	109,145	23,632	23,632	4,215	4,215

Robust Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

4.3. College dropout and entrepreneurial performance

How does entrepreneurial performance vary according to whether a student graduates or leaves college without degree? To address this question, we adopt income as a performance measure (Hamilton, 2000) and compare the incomes of both dropout and graduate entrepreneurs to those of their peers in paid employment. Specifically, we estimate a set of Mincer-type earnings regressions analyzing incomes in the first three years after leaving college (with or without a degree).

Our baseline performance model uses a pooled OLS regression for the restricted sample of individuals observed with an income in the period 2001-2010. To observe three years of post-college income, we restrict the sample to individuals exiting college in the period 1998-2007 (Model 1 in Table 8). Consistent with many prior studies (see Åstebro, 2012, for a survey of the evidence), we find that entrepreneurs earn significantly less than individuals in paid employment. The unconditional expected mean income (all independent variables in Model 1 set to the mean value) is about 211,000 DKK (equivalent to about 31,500 USD) with entrepreneurs earning 65% less than employees (calculated as $\exp(-1.049)-1$). In comparison, Åstebro et al. (2012) find that recent graduates earn 7.2-8.7 % less in self-employment compared to paid employment (not taking into account the relationship between the degree obtained and the self-employment activity or the quality of the school where the degree was obtained). The larger magnitude of the entrepreneurship “punishment” found in our study could be due to several factors, most importantly the empirical context and the sample used. Åstebro et al. (2012) is based on U.S. data where the returns to education are often found to be greater in self-employment compared to employment, but this finding is less common when looking at European data (Åstebro et al., 2012; Van der Sluis et al., 2008). In addition, the sample used in Åstebro et al. consists only of science and engineering graduates before 2006 (i.e. before the financial crisis). Finally, self-employment status and income are self-reported, and self-employed individuals who are not employed full time in their own venture, or have zero annualized salaries, are excluded (Åstebro et al., 2012).

A similar negative effect on income can be seen when comparing dropouts relative to graduates, where dropouts are found to earn 17% less than graduates. The coefficient obtained for dropout entrepreneurs (the interaction effect) is negative but not significant. This suggests that the “punishment” for dropping out does not differ systematically between entrepreneurs and paid workers. Our results moreover indicate positive returns for having completed three or more college years (the estimated marginal effects are 12% and 14%, respectively, dependent on the number of additional years enrolled), as well as a significant gender pay gap among Danish college students entering the labor market where females are found to earn 11% less than males.

Model 2 replicates this analysis but restricts the sample to third-year observations to see whether the differences found in Model 1 are more than only transitory. This seems to be the case, as entrepreneurs are found to earn 72% less than employees three years after leaving college. The income punishment of dropping out of college increases to 22%. Model 3 uses a fixed-effects specification, which limits the sample to those individuals who switch into ($N = 105$) or out of entrepreneurship ($N = 251$) in the first three years after leaving college.¹⁰ In this specification, the income differential between entrepreneurship and paid employment is reproduced, although, the income differential is smaller with entrepreneurs earning 57% less than employees. Consistent with Models 1 and 2, the income differential between entrepreneurship and paid employment is not dependent on whether the student graduated or dropped out of college.

To this point, the estimates suggest that entrepreneurship does not allow dropouts to avoid the labor market disadvantages that they face compared to graduates.¹¹ As suggested above, this may be due to

¹⁰ To improve the precision of the estimates, all observations are included in the model but time-invariant variables will be dropped when running the fixed effects model.

¹¹ Note that the above results only capture income effects in the first three years after leaving college. A large number of individuals exit from entrepreneurship, both in our sample and more generally (cf., e.g., Åstebro and Thompson (2011, fn 10) for data on the U.S. and Canada). This suggests that even if entrepreneurship allowed dropouts to avoid their labor market disadvantage, this would in many cases only delay the punishment.

the fact that human capital and quality signals are valuable both in paid labor and in entrepreneurship. There is some indication, however, that this general conclusion does not fully capture the heterogeneity of outcomes in terms of income. In an unreported variant of Model 2 with absolute rather than logged incomes as the dependent variable, we obtained a marginally (at the 10% level) significant positive estimate for E^{dropout} . In this variant of the model, dropping out of college decreases income for employees by approximately 60,000 DKK (equivalent to about 9,000 USD), while the decrease for entrepreneurs is only around 16,000 DKK (2,400 USD). Apparently top earners among the dropout entrepreneurs do better than their employed peers, and this difference is dampened by the log transformation. This interpretation is consistent with results from quantile regressions of absolute or log transformed incomes showing a general income advantage for entrepreneurs at the 90th percentile. Results are available from the authors.

Models 4 and 5 (Table 8) distinguish between “early” and “late” entrepreneurship (see Section 4.1 above). In Model 4 including all income years, we find that both groups are punished relative to their peers in paid employment; early and late entrepreneurs earning 70% and 64% less than employees. If only third-year incomes are taken into account (Model 5), the income gap is smaller and not significant for the early entrepreneurs; it amounts to -45% for early entrepreneurs and -74% for late entrepreneurs, respectively. The negative and significant coefficients of the dropout variable in Models 4 and 5 are robust to the different model specification and identical to the coefficients found in Models 1 and 2. As a further indication of heterogeneous effects, point estimates for the income differences of graduate and dropout entrepreneurs vary substantially between Models 4 and 5, as well as between early and late entrepreneurs. However, none of the estimates is significant at conventional levels of significance.

Summing up, the analysis of incomes provides no evidence that dropout entrepreneurs generally outperform graduate entrepreneurs. The systematic income differential that we generally observe between graduates and dropouts is not compensated (except perhaps for the most successful dropout entrepreneurs) by an income premium of entrepreneurs relative to paid workers within the group of dropouts.

Table 8: OLS / fixed effects regressions estimating log incomes of wage earners and entrepreneurs.

	Model 1 OLS/pooled	Model 2 OLS/year3	Model 3 Fixed effects	Model 4 OLS/pooled	Model 5 OLS/year3
Entrepreneur (E)	-1.049*** (0.163)	-1.288*** (0.223)	-0.840*** (0.318)		
Entrepreneur (pre)				-1.217*** (0.458)	-0.594 (0.567)
Entrepreneur (post)				-1.012*** (0.172)	-1.361*** (0.239)
Dropout	-0.183*** (0.008)	-0.248*** (0.010)		-0.184*** (0.008)	-0.248*** (0.010)
E X Dropout	-0.127 (0.264)	-0.146 (0.374)	0.040 (0.320)		
Pre X Dropout				0.321 (0.600)	-0.648 (0.985)
Post X Dropout				-0.266 (0.300)	-0.107 (0.403)
Years 3-4	0.111*** (0.007)	0.058*** (0.009)		0.111*** (0.007)	0.058*** (0.009)
Years 5+	0.134*** (0.015)	0.080*** (0.020)		0.135*** (0.015)	0.080*** (0.020)
E X Years 3-4			0.250 (0.386)		
E X Years 5+			0.484 (0.338)		
Female	-0.120*** (0.005)	-0.124*** (0.006)		-0.120*** (0.005)	-0.124*** (0.006)
Age	0.166*** (0.016)	0.348*** (0.028)	0.096*** (0.022)	0.166*** (0.016)	0.348*** (0.028)
Age^2	-0.003*** (0.000)	-0.006*** (0.000)	0.003*** (0.000)	-0.003*** (0.000)	-0.006*** (0.000)
Parents eship	-0.006 (0.006)	-0.002 (0.008)		-0.006 (0.006)	-0.002 (0.007)
Vocational	0.088*** (0.006)	0.089*** (0.008)		0.088*** (0.006)	0.089*** (0.008)
Parents wealth	-0.002*** (0.000)	-0.002*** (0.000)		-0.002*** (0.000)	-0.002*** (0.000)
Natural Sciences	0.016 (0.020)	0.082*** (0.028)		0.016 (0.020)	0.082*** (0.028)
Engineering	0.351*** (0.017)	0.451*** (0.025)		0.351*** (0.017)	0.451*** (0.025)
Social	0.154*** (0.018)	0.153*** (0.025)		0.154*** (0.018)	0.153*** (0.026)
Business	0.148*** (0.019)	0.206*** (0.028)		0.148*** (0.019)	0.206*** (0.028)
Humanities	-0.071*** (0.018)	-0.014 (0.025)		-0.071*** (0.018)	-0.014 (0.025)
Pedagogical	0.225*** (0.016)	0.214*** (0.023)		0.225*** (0.016)	0.214*** (0.023)
Teachers	0.300*** (0.016)	0.375*** (0.023)		0.300*** (0.016)	0.375*** (0.023)
Constant	8.972*** (0.231)	6.773*** (0.402)	7.196*** (0.308)	8.966*** (0.230)	6.772*** (0.402)
Region dummies	Yes	Yes	Yes	Yes	Yes
College start year dummies	yes	Yes	No	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes
Year 1-3 dummies	Yes	No	Yes	Yes	No
Log-likelihood	-233062	-85655	-104018	-233047	-85641
R2	0.208	0.174	0.233	0.208	0.175
Observations	220,218	81,132	220,218	220,218	81,132

Robust Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

5. Concluding remarks

Based on a number of prominent examples, entrepreneurs who dropped out from college have received substantial public attention. Some observers have gone as far as to suggest that tertiary education is bad from the perspective of entrepreneurship. But how pronounced are the differences in entrepreneurship rates between college dropouts and their graduating peers, and how substantial is the phenomenon of the successful dropout entrepreneur? In this paper, we utilized information for the population of Danish college students to find answers to these questions, which is complicated by the fact that the decision to leave college without completing one's degree may be driven by the intention to start a firm. Controlling for this potential endogeneity of dropping out, we did not find significant differences in the likelihood of entrepreneurship among dropouts and graduates. In addition, except at the upper end of the income distribution, entrepreneurship does not allow college dropouts to compensate their disadvantages in the labor market.

Before concluding we would like to highlight some limitations of our analysis. The present study focuses on college dropouts, while we could not address the issue of dropping out from high school. This focus seems appropriate given the current discussion about the relationship between higher education and entrepreneurship. Studying the related issue of high-school dropouts is a desideratum for further research. In addition, our empirical context is Denmark, and it is an open question how valid our findings are for the institutional setup 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 who are more challenged on the labor market (e.g., dropouts compared to graduates) may be less inclined to enter 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. For instance, incomes of paid workers and entrepreneurs may not be perfectly comparable. As our primary interest is not in the income of entrepreneurs, but more specifically in the differences between graduate and dropout entrepreneurs, this does not seem to be a major limitation of the performance analysis.

With these caveats in mind, our results do not suggest that successful dropout entrepreneurs resembling the well-known examples who have received substantial attention in the media are a pervasive phenomenon. Both dropouts and entrepreneurs are disadvantaged in the Danish labor market. Compared to dropouts in paid employment, dropout entrepreneurs are not worse off, and in some particularly successful cases they may even earn more than their employed peers. However, gambling on such exceptional success and dropping out of college to pursue a career as an entrepreneur seems ill-advised. Even more so because failure rates of entrepreneurs are high, and failed dropout entrepreneurs will face an even stronger stigma when they return as wage earner to the labor market.

References:

- Angrist, J. D. (2001). Estimation of limited dependent variable models with dummy endogenous regressors. *Journal of Business & Economic Statistics*, 19(1), 2-16.
- Åstebro, T. (2012). The returns of entrepreneurship. In: Cumming, D. (ed.). *The Oxford handbook of entrepreneurial finance*. Oxford University Press, pp. 45-108.
- Åstebro, T., & Bernhardt, I. (2005). The winner's curse of human capital. *Small Business Economics*, 24(1), 63-78.
- Åstebro, T., & Thompson, P. (2011). Entrepreneurs, jacks of all trades or hobos? *Research Policy*, 40, 637-649.
- Åstebro, T., Bazzazian, N., & Braguinsky, S. (2012). Startups by recent university graduates and their faculty: Implications for university entrepreneurship policy. *Research Policy*, 41(4), 663-677.
- 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.
- Block, J. H., & Wagner, M. (2010). Necessity and opportunity entrepreneurs in Germany: Characteristics and earnings differentials. *Schmalenbach Business Review*, 62, 154-174.
- Block, J. H., Hoogerheide, L., & Thurik, R. (2011). Education and entrepreneurial choice: An instrumental variables analysis. *International Small Business Journal*, 0266242611400470.
- Braguinsky, S., Klepper, S., & Ohyama, A. (2012). High-tech entrepreneurship. *Journal of Law and Economics*, 55, 869-900.
- Cameron, A. C., & Trivedi, P. K. (2009). *Microeconometrics Using Stata*. College Station, TX: Stata Press.
- Cassar, G. (2006). Entrepreneur opportunity costs and intended venture growth. *Journal of Business Venturing*, 21(5), 610-632.
- Clynes, T. (2016). Peter Thiel's dropout army. *New York Times*, June 4.
- 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.
- Colombo, M. G., Piva, E. & Rossi, C. (2015). Student entrepreneurs from technology-based universities: the impact of course curriculum on entrepreneurial entry. Mimeo, Politecnico di Milano.
- 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.
- Elert, N., Andersson, F. W., & Wennberg, K. (2015). The impact of entrepreneurship education in high school on long-term entrepreneurial performance. *Journal of Economic Behavior & Organization*, 111, 209-223.
- Evans, D. S., & Leighton, L. S. (1990). Small business formation by unemployed and employed workers. *Small Business Economics*, 2(4), 319-330.
- Fossen, F. M., & Büttner, T. J. (2013). The returns to education for opportunity entrepreneurs, necessity entrepreneurs, and paid employees. *Economics of Education Review*, 37, 66-84.
- 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.
- Hamilton, B.H. (2000). Does entrepreneurship pay? An empirical analysis of the returns to self-employment. *Journal of Political Economy*, 108(3): 604-631..
- Hartog, J., Van Praag, M., & Van Der Sluis, J. (2010). If you are so smart, why aren't you an entrepreneur? Returns to cognitive and social ability: Entrepreneurs versus employees. *Journal of Economics & Management Strategy*, 19(4), 947-989.
- Hsu, D. H. (2007). Experienced entrepreneurial founders, organizational capital, and venture capital funding. *Research Policy*, 36(5), 722-741.
- Lazear, E.P. (2005). Entrepreneurship. *Journal of Labor Economics*, 23, 649-680.
- Lerner, J., & Malmendier, U. (2013). With a little help from my (random) friends: Success and failure in post-business school entrepreneurship. *Review of Financial Studies*, 26(10), 2411-52.

- Lindquist, M. J., Sol, J., & Van Praag, M. (2015). Why Do Entrepreneurial Parents Have Entrepreneurial Children?. *Journal of Labor Economics*, 33(2), 269-296.
- 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.
- Nicolaou, N., & Shane, S. (2010). Entrepreneurship and occupational choice: Genetic and environmental influences. *Journal of Economic Behavior & Organization*, 76(1), 3-14.
- Nielsen, K. (2015). Human capital and new venture performance: the industry choice and performance of academic entrepreneurs. *The Journal of Technology Transfer*, 40(3), 453-474.
- Nielsen, K. & Sarasvathy, S. D. (2016) Passive and Active Learning from Entrepreneurship: An Empirical Study of Re-Entry and Survival. *Academy of Management Discoveries*, forthcoming.
- OECD. (2013). Education at a Glance 2013; OECD Indicators. OECD Publishing.
- Parker, S. C. (2004). *The Economics of Self-Employment and Entrepreneurship*. Cambridge University Press.
- Parker, S. C., & Van Praag, C. M. (2006). Schooling, capital constraints, and entrepreneurial performance: The endogenous triangle. *Journal of Business & Economic Statistics*, 24(4), 416-431.
- Reynolds, P.D., Camp, S.M., Bygrave, W.D., Autio, E. & Hay, M. (2002). *Global Entrepreneurship Monitor: 2001 Executive Report*. Business Council for the United Nations.
- 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.
- Spence, M. (1973). Job Market Signaling. *The Quarterly Journal of Economics*, 355-374.
- Taylor, M. P. (1996). Earnings, independence or unemployment: why become self-employed?. *Oxford Bulletin of Economics and Statistics*, 58(2), 253-266.
- Timmermans, B. (2010). The Danish integrated database for labor market research: towards demystification for the English speaking audience. *Aalborg: Aalborg University*.
- Ucbasaran, D., Westhead, P., & Wright, M. (2008). Opportunity identification and pursuit: does an entrepreneur's human capital matter?. *Small Business Economics*, 30(2), 153-173.
- 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.
- Van Praag, C.M., van der Sluis, J. & van Witteloostuijn, A. (2013). The Higher Returns to Formal Education for Entrepreneurs versus Employees. *Small Business Economics*, 40, pp. 375-396
- 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.