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# Identifying the effect of college education on business and employment survival

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**Abstract** We use a multipronged identification strategy to estimate the effect of college education on business and employment survival. We account for the endogeneity of both education and business ownership with a competing risks duration model augmented with a college selection equation. We estimate the model jointly on the self-employed and salaried employees in the National Longitudinal Survey of Youth 1979. Unlike most previous studies, we find that college does not increase business survival. By contrast, a college degree significantly increases employment survival. Cognitive skills have a positive impact on survival for both the self-employed and employees. These findings suggest that college benefits the self-employed less than salaried, perhaps by generating skills more useful in employment than self-employment, or because of differences in the value of signaling.

A. Asoni: The views presented here are my own and do not necessarily reflect those of CRA or any CRA employee.

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## 1 Introduction

Estimating the effect of college on labor market outcomes is an important but methodologically challenging question. Those who attend college differ, on average, from those who do not in terms of skills and other characteristics, which makes isolating the effect of education itself problematic. A sophisticated economic literature has developed to address confounding factors such as unobserved heterogeneity and the endogeneity of occupational choices. Broadly speaking, researchers have concluded that obtaining a college degree increases earnings even when accounting for various biases (for example, Angrist and Krueger 1991; Card 1995, 1999 and 2001; Harmon et al. 2003; Webbink 2005; Heckman et al. 2006; Oreopoulos and Salvanes 2011). In addition, college appears to benefit health (Kenkel 1991; Lleras-Muney 2005), marital outcomes (Becker 1994; Chiappori et al. 2009) and life satisfaction (Oreopoulos and Salvanes 2011).

Less is known about the causal effect of a college degree on the self-employed. College-educated business owners are found to be more successful in most,

though not all, studies (for example, Van der Sluis et al. 2008; Unger et al. 2011; Mayer-Haug et al. 2013; De Wit and van Winden 1989; Evans and Leighton 1989 and 1990). This holds for various definitions of success, including the earnings of the owner, firm growth and business survival. Van Praag et al. (2009), however, point out that this literature has long remained methodologically unsophisticated compared to the literature investigating the effect of college on employment. Block et al. (2012) investigate the link between education and entrepreneurial outcomes and report severe endogeneity problems. Considerable resources are spent every year on education, and budget-constrained local and national governments could benefit from a better understanding of how various educational policies affect their business community. A well-identified answer to this question would help researchers and public officials design effective cost and benefit analyses of the resources spent on education.

Identifying the value of a college degree for business activity poses methodological challenges similar to those posed by the measurement of the effect of college for salaried employees. In addition, selection into self-employment itself must be accounted for. Numerous studies, for example, report a positive association between a college degree and business survival, but rarely in a well-identified framework. This paper proposes an empirical strategy that addresses the main empirical identification challenges to the estimation of the effect of college on business and employment survival. Survival is defined as the probability of avoiding non-employment.

There are multiple, potentially severe, biases that have to be considered. These include unobserved heterogeneity in skills, and the simultaneous endogeneity of education and the choice to become self-employed. Studies have taken some but not all of these issues into account when estimating the effect of education on entrepreneurial earnings and business survival, often by using instruments or fixed effect models (including Parker and Van Praag 2006; Fossen and Büttner 2013; Van Praag et al. 2013; Åstebro et al. 2013). To our knowledge, this is the first study that estimates the effect of college on business survival taking into account all main biases identified in the literature.

Dealing with many biases at once requires a multipronged identification strategy. We rely on a combination of instrumental variables for college attainment and controls for cognitive skills to account for unobserved heterogeneity and selection into college. In addition, a competing risks duration model with unobserved heterogeneity is employed to control for selection into entrepreneurship. We estimate our model on the National Longitudinal Survey of Youth 1979, a large representative American panel dataset with a rich set of questions on business activity (henceforth, NLSY79).

The effect of college education on the self-employed is interesting both in itself and in comparison with salaried employees. In addition to skill formation, the advantages of college include peer effects and networks (for example, Sacerdote 2001; Zimmerman 2003; De Giorgi et al. 2010; Falck et al. 2012), and the signaling role of education used by employers to screen for ability (Spence 1973; Heckman et al. 2006; Backes-Gellner and Werner 2007; Arcidiacono et al. 2010). The impact of college education on the labor market outcomes of the self-employed may indirectly help shed some light on the relative importance of skills, signaling, and other benefits of college. An advantage of our methodology is that we can directly compare the effect of college on the self-employed and salaried employees with the same identification strategy in the same dataset. In particular, because in our framework occupational choice is endogenous, any difference between the self-employed and salaried workers is due to a treatment effect, rather than selection.

We find that college does not affect business success after controlling for skills, the endogeneity of education, and occupational choices. By contrast, obtaining a college degree has a significant positive effect on employment survival of salaried workers. This may suggest that self-employed and salaried workers rely on partially different sets of skills for success. Another possible explanation may be that the benefits of college in terms of personal networks and signaling are relatively larger for salaried employees. While it may still be valuable to signal ability to financiers or clients, the signaling function of a higher degree is presumably smaller when employing oneself. While a college degree only benefits the employment survival of salaried employees, cognitive skills are found to significantly benefit both the self-employed and employees. We investigate men and women separately and find similar results for both genders.

Section 2 describes the previous literature. Section 3 discusses the problems associated with correctly

estimating the effect of college education on business survival; we then describe our identification strategy and the model used in this paper. Section 4 discusses the data. Section 5 presents our results; we then discuss the limitations of our study (Sect. 6) and its policy implication (Sect. 7). Section 8 concludes.

## 2 Human capital and business dynamics in the literature

Numerous studies have investigated the importance of college education for the self-employed. Two recent meta-studies of this literature (Van der Sluis et al. 2008; Unger et al. 2011) point to a positive association between college education and various measures of business success. Davidsson and Gordon (2012) summarize a large number of longitudinal panel data studies on small business activity. Overall, the correlation between various measures of human capital and success is weak, though many studies are not causally identified. In this paper we focus on one measure of business success, namely business survival. Focusing on this outcome measure allows us to account for the dual endogeneity of education and business ownership within the framework of our model. The effect of college on business survival among the self-employed is compared with the effect of college on the risk of employment termination for salaried employees.

Van der Sluis et al. (2008) report that most of about thirty surveyed studies find that education improves business survival. Studies that report a positive link between education and business survival include Bruderl et al. (1992), Gimeno et al. (1997), Boden and Nucci (2000), Lin et al. (2000), Mengistae (2006), Millan et al. (2012), Oberschachtsiek (2012), Ganotakis (2012), Rauch and Rijsdijk (2013) and Lechmann and Schnabel (2014). By contrast Davidsson and Honig (2003), Van Praag (2003) and Blanchflower and Meyer (1994) find that a college degree is associated with higher failure rates. Few studies account for unobserved skills and selection. Moreover, studies have often not distinguished between exit from self-employment into employment and exit into non-employment. Transition from self-employment to employment may represent an upward or lateral career move. Only transition into non-employment can be plausibly defined as business failure, though this too may in some instances reflect voluntarily exit. We focus on transition to non-employment to measure business survival.

## 3 An empirical model of occupational and educational choices

### 3.1 Challenges to the estimation of the effect of college education on firm dynamics

Identifying the effect of education on business survival requires addressing several sources of bias. First, the strong link between ability and education causes an upward bias on the effect of schooling (Becker 1994). Second, even when the analysis includes measures of ability, there are still unobserved characteristics that simultaneously affect educational choices and labor market outcomes. For instance more entrepreneurial individuals can substitute college education with industry experience (for example, dropping out of college to start a business). This will translate into a negative bias for the measured effect of education, as the most talented entrepreneurs are less likely to complete their studies.

Third, even in a scenario in which college education is entirely exogenous—and the issues discussed above are not relevant—researchers still need to take into account the fact that college education itself affects the decision to become self-employed. College education might change the distribution of returns for employees and self-employed differently. For example, if market returns from a college degree are higher for employees than the self-employed, only the college-educated with most business talent will attempt to create firms. This will positively bias the measured effect of college education on entrepreneurial success. If the reverse is true, as it has recently been suggested (for example, Hartog et al. 2010; Van Praag et al. 2013), the bias will be negative.

The fourth and final issue to be considered is what Heckman and Singer (1984) refer to as "negative duration dependence" bias. Those who are most likely to transition from one state (self-employment) to another (non-employment) on average also tend to experience such transition sooner. In other words, the composition of the population of self-employed, in terms of unobserved heterogeneity, changes over time as people move from self-employment to employment or non-employment. For instance, individuals with

lower entrepreneurial talents are more likely to transition out of self-employment, and they will do so sooner rather than later. Ceteris paribus this implies that the average entrepreneurial talent in the pool of the self-employed is increasing over time. If, for example, those entrepreneurs are also the most educated entrepreneurs, this will bias the measured effect of education on survival.

### 3.2 Addressing the challenges

In order to cope with these issues, we rely on a multipronged empirical strategy. The NLSY79 includes accurate measures of cognitive skill, reducing an important element of unobserved ability bias. Most importantly, we apply a competing risks duration model with unobserved heterogeneity as developed by Ham and LaLonde (1996) and modified by Eberwein et al. (1997). The key to identification is analyzing the decision to create a firm and the subsequent decision to continue or terminate the firm simultaneously. This way we can use information about the individual elicited through the entry decision (starting a firm) to better account for the probability of exit (moving to non-employment). This model addresses the relationship between education and selection into entrepreneurship, and the relationship between unobserved entrepreneurial talent, selection into self-employment, and self-employment outcomes. It does so by imposing a flexible structure on the unobserved heterogeneity and estimating it jointly with the rest of the parameters of the model. Below we describe the details of this model.

To address the endogeneity of education to both ability and entrepreneurial talents, we augment this model with a selection equation into college. This approach is analogous to Eberwein et al. (1997). Identification comes in this case from two instruments for educational attainment. The first instrument is distance from college interacted with parental education. Distance from college at the time of high school graduation creates variation in the cost of obtaining a degree. One problem is that college-educated parents tend to live closer to universities. The solution proposed by Card (1995) is interacting distance from college with parental education. The instrument is a dummy variable that is equal to one if parents lack a college degree and the individual lives in a county where a college is located, and zero otherwise.

The second instrument is local unemployment rate at the time when the individual graduated from high school. During economic booms, high school graduates are more likely to join the labor force and discontinue their studies. When labor market demand is weaker, attending colleges becomes more attractive. The state of the labor market the year in which one graduates can be assumed to be largely random with respect to ones educational choices. Our instrument is defined as the deviation in the year of completion of high school degree from the average local unemployment rate over time.

### 3.3 Modeling occupational choice

#### *3.3.1 A competing risks model*

For expositional ease, let us start by assuming that education is exogenous and focus on occupational choice. We rely on a competing risks, multinomial choice model in a dynamic setting based on Ham and LaLonde (1996). At any given time, each individual is in one of three mutually exclusive states: self-employment ($s$), employment ($e$) or non-employment ($n$). At the end of each period, one of three things will happen: The individual stays in his current state, or moves to one of the other two states.

Consider someone who is employed at the beginning of the time period covered by the data. At the baseline, $t_B$, this person is employed. After $t_e$ periods, he starts a firm and manages it for $t_b$ periods. The business spell is followed by a non-employment spell of length $t_n$ that is right censored because we have reached the end of the time period covered by the data. We are interested only in the probability of moving out of a business spell, but we will look at the entire employment history for an unbiased estimate.

The transition probabilities across states depend on demographic as well as macroeconomic variables and unobserved characteristics. They can be written as follows: In any given period the probability $\lambda_{i,kj}$ that individual $i$ leaves state $k$ and enters state $j$ is

$$\lambda_{i,kj}(t|\theta_{i,kj}) = \frac{\exp(y_{i,kj}(t))}{1 + \sum_{s \neq k} \exp(y_{i,ks}(t))}$$

with

$$y_{i,kj}(t) = \beta_{kj} X_i(t) + \gamma_{kj} \mathrm{CO}_i + h_{kj}(t) + \theta_{i,kj}$$

where $X_i(t)$ is a vector of control variables containing race, age, age squared, marital status, number of kids and local unemployment rate, measured as log deviation from local average; industry dummies are also included to capture differences in the industrial structure of different industries that might influence transition rates. $CO_i$ is a dummy variable indicating whether the individual has a (4-year) college degree. $h_{kj}(t)$ is a function of duration; in particular $h_{kj}(t) = \delta_{1,kj}\log(t) + \delta_{2,kj}\log^2(t)$. We also consider an alternative specification that includes cognitive skills (measured by the AFQT) as well as a measure of non-cognitive ability (locus of control) among the controls. We hope that this will lead to better identification of the college effect.

The unobserved heterogeneity is captured by the scalar random variable $\theta_{i,kj}$. These unobserved factors are assumed to be fixed across spells of the same type and potentially different across spells of different types. There are six different $\lambda_{i,kj}(\cdot|\theta_{i,kj})$ since there are 3 states: $kj = es$, $en$, $se$, $sn$, $ne$ and $ns$. However we impose that the unobserved factor that influences, for example, exit rates from business spell is the same regardless of the exit route taken. Same thing is true for employment and non-employment spells. In other words, we impose $\theta_{es} = \theta_{en} = \theta_e$, $\theta_{se} = \theta_{sn} = \theta_s$, and $\theta_{ne} = \theta_{ns} = \theta_n$.

### 3.3.2 *Unobserved heterogeneity and occupational choice*

Unobserved heterogeneity is important in this model for several reasons. First, it helps us correct for the existence of negative duration dependence bias: For expositional ease assume there is no relationship between length of self-employment spell (duration) and probability of failing—that is start-ups and well-established firms have the same probability of going bankrupt ceteris paribus. Furthermore, assume that there are only two types of business owners: skilled and unskilled. Unskilled business owners are more likely to fail and move to non-employment (or employment). As the more unskilled business owners leave the self-employed group, only the best among them are left managing firms. This creates in the data a negative relationship between duration and exit probability where none exists.

In order to deal with this problem, we follow a standard approach in the labor literature and specify a distribution for the unobserved heterogeneity terms. The parameters of such distribution need to be estimated along with the rest of the coefficients in the model. By specifying a distribution of the unobserved terms, we can write down the average likelihood function and then estimate the *average* survival function, correcting for the negative duration dependence bias.

Second, the unobserved heterogeneity helps us deal with selection into self-employment *induced by education*. Even if college education was entirely exogenous and not related to underlying unobserved factors, there could still exist a systematic relationship between college education and the unobserved characteristics of those in the self-employment group. Consider the following example. Each individual has only two dimensions of skill: business talent and education. Business talent is not observed by the econometrician. Education is randomized in the population and, by construction, not correlated with business talent. However, more educated people earn higher wages in the "employed" sector, and this makes them less likely to start a business. As a consequence, only the most talented among the highly educated will self-select into entrepreneurship. This creates a positive correlation among businessmen between education and business talent. Another way to state it is that education changes the distribution of unobservables in the subpopulation of business owners. Note that one could devise an example with a negative correlation between education and business ownership. The model is not predicated on the relationship being positive. Indeed the sign of the relationship will be estimated together with the rest of the parameters of the model.

One way to resolve this problem is to allow the unobserved characteristics to be correlated across spells of different types. In particular, we allow the unobserved term in any spell preceding a business period to be correlated with the unobserved factor in the business spell. By analyzing the process of selection into self-employment, we learn what type of individuals education makes more likely to enter self-employment, and we can use this information when estimating the effect of education itself: Once we have learned how education changes the

distribution of unobservables in the self-employed population, we can use this information to average out the effect of the unobserved terms and estimate the average effect of education on business spells.

The third issue where unobserved factors play a role is with left-censored spells. The model we have described so far is conditional on the initial distribution of individuals across states. Instead of explicitly modeling such distribution, we allow the heterogeneity term of the first (left-censored) spell to be different from the heterogeneity term of the corresponding spell type in the rest of the employment history (as in Ham and LaLonde 1996). Consider an individual who at the baseline is employed. For this individual, the first, left-censored spell is an "employment spell." For all the other employment spells that this person will experience during his working life, the heterogeneity term will be $\theta_e$. For thee first left-censored spell, the heterogeneity term instead is $\theta_{el}$, with $\theta_e \neq \theta_{el}$ (where $l$ stands for "left censored"). We define analogously $\theta_{sl}$ and $\theta_{nl}$.

We assume that the distribution of the unobserved terms has a finite number of points. In particular for $k = e, s, n$:

$$\begin{aligned} \theta_{i,k} &= c_k\theta_1^* \quad \text{with probability } P_k \\ &= c_k\theta_2^* \quad \text{with probability } 1 - P_k \end{aligned}$$

where $c_k$, $\theta_1^*$, $\theta_2^*$ and the probability $P_k$ are estimated along with the rest of the parameters. For identification reasons, $c_n$ is normalized to 1. The loading factors $c_k$ describe the relationship between the unobserved factor in the non-employment spells with the others (and hence of any spell with all the others). If they are positive, then there is a positive relationship between unobserved factors and vice versa if negative.

### 3.3.3 The likelihood function

We can write the likelihood of any employment history using the aforementioned probabilities. In general, the probability of a spell of type $k$ of length $t_k$ that ended with transition in state $j$ as opposed to state $m$ is written as:

$$f_{kj}(t_k|\theta_{kj},\theta_{km}) = \lambda_{kj}(t_k|\theta_{kj}) \times \prod_{s=1}^{t_k-1}\left(1 - \lambda_{kj}(s|\theta_{kj}) - \lambda_{km}(s|\theta_{km})\right)$$

Analogously the contribution of a right-censored type-$k$ spell can be described as:

$$S_k(t_k|\theta_{kj},\theta_{km}) = \prod_{s=1}^{t_k-1}\left(1 - \lambda_{kj}(s|\theta_{kj}) - \lambda_{km}(s|\theta_{km})\right)$$

To write the contribution to the likelihood function of the employment history described at the beginning of this section, we need to integrate the probability of each spell over the distribution of the unobserved characteristics:

$$\int f_{eb}(t_e|\theta_{el})f_{bn}(t_b|\theta_b)S_n(t_n|\theta_n)dG(\Theta) \tag{1}$$

where $G(\Theta)$ is the joint cumulative distribution function for $\Theta = \{\theta_{el}, \theta_n, \theta_b\}$. Following this approach, we can write the likelihood function of the observed data.

### 3.3.4 The college choice

So far we have assumed that college education was exogenous. A well-established literature, however, suggests that this is not the case (for example, Becker 1994). In our case, college education can be related not only to "ability" in general but more specifically to "business talent." The framework described above can be easily modified to account for such endogeneity. We augment each individual's contribution to the likelihood function with a selection equation into college and rely on instrumental variables to achieve identification.

The selection equation simply describes the probability of getting a college degree at time $t_{sc}$. Such probability depends on a series of observables ($\hat{X}_{i,t}$), an unobserved term ($\theta_{i,sc}$) and a set of instruments ($Z_i$). Its formulation is similar to the rest of the model:

$$\lambda_{i,s}(t_{sc}|\theta_{i,sc}) = \left(1 + \exp(-y_{i,s}(t))\right)^{-1}$$

with

$$y_{i,s}(t) = \beta_s\hat{X}_{i,t} + \gamma_s Z_i + \theta_{i,s}$$

The set of controls contains variables also used in the description of transitions across working and non-working spells, such as race, age, intelligence, locus of control, marital status and parental background. The instrumental variables, as discussed above, are local

unemployment rate at the time of high school graduation and distance from college interacted with parental background.

The contribution to the likelihood function of someone who earned a college degree at time $t_{sc}$ and then had the employment history discussed above is:

$$\int \prod_{c=1}^{t_{sc}-1} \left[1 - \lambda_{i,sc}(c_{sc}|\theta_{sc})\right] \lambda_{i,s}(t_{sc}|\theta_{sc}) f_{eb}(t_e|\theta_{el}) \times f_{bn}(t_b|\theta_b) S_n(t_n|\theta_n) d\hat{G}(\hat{\Theta}) \quad (2)$$

where $\hat{G}(\hat{\Theta})$ is the joint cumulative distribution function for $\hat{\Theta} = \{\theta_{el}, \theta_n, \theta_b, \theta_{sc}\}$.

## 4 Data

We rely on the National Longitudinal Survey of Youth 1979 (NLSY79). The dataset includes 12,686 individuals chosen to reflect a representative sample of the US population. The NLSY79 contains detailed data on employment and business activity. We identify someone as being a business owner if they report being self-employed for most of a given year.[1] Education is measured by a dummy variable equal to one if the individual has a 4-year college degree and zero otherwise. Cognitive skills are measured by a test similar to the Armed Forces Qualification Test (AFQT), which is widely used in labor market studies. One measure of non-cognitive skills that we account for is "locus of control." This trait has been found to influence the choice to become self-employed (for example, Berlew 1975). Locus of control measures the extent to which one believes oneself, rather than external forces, to be in control of events affecting one's life (Rotter 1966).

Moving from self-employment to employment may not reflect failure but career advancement or change in preferences, which makes this transition unsuitable for studying business success. However, approximately one-third of individuals who leave self-employment move into non-employment. We define transition from self-employment into non-employment as business failure. This is especially clear for those who remain non-employed for at least 1 year.

[1] The Appendix contains a detailed description of how we constructed the employment status.

**Table 1** Comparison between men and women

| | All | Male | Female |
|---|---|---|---|
| Observations | 12,686 | 6394 | 6292 |
| College (%) | 23.5 | 23.4 | 23.7 |
| Minorities (%) | 19.3 | 19.5 | 19.2 |
| Married (%) | 59.2 | 57.0 | 61.4 |
| Ever owned a business (%) | 23.2 | 27.2 | 19.0 |
| Business owner (%) | 7.0 | 9.4 | 4.5 |

All percentages are calculated as averages of the period 1988–2004 to refer to an adult population. In 1988 the youngest individual was 24 years of age, and virtually, all the sample is out of school and either employed, self-employed or non-employed

Male and female patterns of self-employment differ in terms of industry and the role of education (Macpherson 1988; Simpson and Sproule 1998). For this reason, we analyze men and women separately. Since there are roughly twice as many self-employed males than self-employed females in the sample (Table 1), the precision of the estimates is lower for women.

### 4.1 College data

We construct distance from college using data from the National Center for Education Statistics (NCES) list of American 4-year colleges. There are 2966 colleges in the USA; for each college, we collect information on legal status (public or private), geographical location, number of graduate and undergraduate students and other characteristics. The distance between the geographically closest college at time of high school graduation is defined as distance to college.

## 5 Results

### 5.1 College education and business survival

Table 2 reports the main findings of this paper for the self-employed. Among men, before controlling for ability and selection, a college degree significantly reduces the probability of leaving a business spell into non-employment. Once we add cognitive skills and control for selection, we find that college has no statistically significant effect on business survival.

**Table 2** Human capital and business survival

| | I | II | III | IV | V |
|---|---|---|---|---|---|
| Panel A: Males | | | | | |
| College | −0.33 | | | 0.15 | −0.11 |
| | (0.04)** | | | (0.38) | (0.61) |
| Cognitive skills | | −3.78 | | −3.94 | −1.94 |
| | | (0.00)*** | | (0.00)*** | (0.00)*** |
| Internal locus of control | | | 0.51 | 0.35 | 0.77 |
| | | | (0.16) | (0.34) | (0.05)** |
| Panel B: Females | | | | | |
| College | −0.14 | | | 0.09 | −0.03 |
| | (0.45) | | | (0.65) | (0.90) |
| Cognitive skills | | −2.35 | | −2.49 | −1.01 |
| | | (0.00)*** | | (0.00)*** | (0.22) |
| Internal locus of control | | | 0.10 | −0.07 | 0.35 |
| | | | (0.83) | (0.88) | (0.47) |
| Model | No selec. | No selec. | No selec. | No selec. | Selec. |

*P* value in parenthesis. This table reports the coefficients of the variables on the leftmost column from the competing risks occupational model. Each regression also controls for marital status, number of kids, race, deviations of local unemployment rate from the mean, age, age squared and industry. Columns I–IV report results without correcting for endogeneity, while column V reports the coefficient obtained correcting for the endogeneity of college education and occupation

Cognitive skills, however, still have a large and statistically significant impact on survival. A one standard deviation increase in cognitive skills lengthens the average business spell by approximately thirteen percent among men.

For women the effect of college on failure is not significantly different from zero even before controls. While not statistically significant, the point estimate is negative which means that college makes failure less likely. Once we add controls for cognitive skills and take into account selection using the model, the effect size of college is reduced and is virtually zero.

### 5.2 College education and "employment" survival

Table 3 reports analogous results for the transition of employees into non-employment, which can be interpreted as losing one's job. Whereas a college degree has no significant effect on business survival, it increases "employee survival" for both men and women. The relationship remains statistically significant after controlling for ability and selection, though, as expected, the effect size is reduced for both men and women. Interestingly, the effect of college on losing employment appears to be somewhat larger for men than for women. Cognitive ability reduces the probability of losing one's job both with and without controls for selection. The effect size of cognitive skill of remaining employed is large and similar in magnitude for both men and women.

The comparison of results in Tables 2 and 3 suggests that college education helps employees avoid non-employment, but does not help the self-employed. One interpretation of this finding is that college may teach skills such as the ability to work in teams or within a predetermined hierarchy that are more valuable for corporate employees than the self-employed.

### 5.3 Testing the validity of the instruments

Table 4 reports the coefficients for the instrumental variables in the selection equation. The instruments seem to work as expected for males, even though the coefficient for proximity to college is estimated with a low degree of precision. The coefficient for proximity is also not significant for women and has the wrong sign. As a robustness check, we have used a

**Table 3** Human capital and employment survival

| | I | II | III | IV | V |
|---|---|---|---|---|---|
| Panel A: Males | | | | | |
| College | −0.90 | | | −0.52 | −0.55 |
| | (0.00)*** | | | (0.00)*** | (0.00)*** |
| Cognitive skills | | −4.04 | | −3.70 | −2.74 |
| | | (0.00)*** | | (0.00)*** | (0.00)*** |
| Internal locus of control | | | 0.05 | −0.05 | 0.16 |
| | | | (0.64) | (0.65) | (0.17) |
| Panel B: Females | | | | | |
| College | −0.52 | | | −0.27 | −0.27 |
| | (0.00)*** | | | (0.00)*** | (0.00)*** |
| Cognitive skills | | −3.84 | | −3.62 | −2.76 |
| | | (0.00)*** | | (0.00)*** | (0.00)*** |
| Internal locus of control | | | −0.01 | −0.17 | −0.02 |
| | | | (0.93) | (0.12) | (0.87) |
| Model | No selec. | No selec. | No selec. | No selec. | Selec. |

*P* value in parenthesis. This table reports the coefficients of the variables on the leftmost column from the competing risks occupational model. Each regression also controls for marital status, number of kids, race, deviations of local unemployment rate from the mean, age, age squared and industry. Columns I–IV report results without correcting for endogeneity, while column V reports the coefficient obtained correcting for the endogeneity of college education and occupation

**Table 4** Instrumental variables in the college selection equation

| | Males | Females |
|---|---|---|
| Distance | 0.09 | −0.09 |
| | (0.22) | (0.15) |
| Unemployment | 1.78 | 0.47 |
| | (0.00)*** | (0.04)** |

*P* value in parenthesis. This table reports the coefficients of the instrumental variables in the college selection equation. The equation also includes marital status, number of kids, race, age, age squared, a dummy for parental college education, a polynomial for duration, intelligence and self-confidence

specification where only the deviation from unemployment is used as an instrument. The results were qualitatively the same.

For our instruments to be valid, it is necessary that they influence self-employment dynamics only through their impact on education. Possible concerns are that areas near colleges display higher rates of self-employment, or families living close to colleges have higher personal wealth. Similarly, areas with higher relative unemployment at the time of high school graduation might have higher self-employment rates. This does not appear to be the case (Table 5).

## 6 Limitations and future research

Our results suggest that college education does not have a positive effect on business survival. There are, however, other important measures of success that we do not investigate. These include firm growth and the wealth and earnings of the founders. Public rather than private benefits include technological innovation, job creation, and increasing consumer welfare through higher quality and lower prices. College may turn out to have clear benefits when looking at outcome variables other than business survival. The biases and identification issues discussed in this paper apply generally and should be considered when studying any measure of business success.

We find that college does not affect business survival while improving employee survival. We have, however, not established the source of this difference, which is an interesting avenue for future research. Perhaps college teaches skills that are useful in a corporate setting, but

**Table 5** Validity of instrumental variables

| Panel A: Proximity to college | | | | |
|---|---|---|---|---|
| | Males | | Females | |
| | Wealth | SE rate | Wealth | SE rate |
| Close | $58,559 | 5.6 % | $57,260 | 2.5 % |
| | (954) | (0.1 %) | (897) | (0.01 %) |
| Far | $88,233 | 6.6 % | $88,531 | 2.9 % |
| | (1742) | (0.1 %) | (1747) | (0.01 %) |
| *P* value | 0.00*** | 0.00*** | 0.00*** | 0.00*** |

| Panel B: Local unemployment | | | |
|---|---|---|---|
| | Males | Females | |
| | SE rate | | SE rate |
| High unempl. | 5.2 % | | 2.2 % |
| | (0.1 %) | | (0.01 %) |
| Low unempl. | 6.2 % | | 2.9 % |
| | (0.1 %) | | (0.01 %) |
| *P* value | 0.00*** | | 0.00*** |

This table reports the results of the tests we run to verify the validity of the instruments

have no impact on the ability to run a business, such as teamwork and social skills. There are professions where a formal college education is very important or required, such as medicine or accounting. While this is also true for self-employed professionals, perhaps the relative importance of formal requirements is greater among salaried employees.

Another possibility is that college aids in developing a network of relationships that makes people successful as employees but less so as business owners. A related argument involves the role of peer effects on personal characteristics such as social skills and work ethic. Finally, college might have a signaling value that is stronger for employee, but less important when running a business.

Our analyses do not distinguish among college majors. A natural extension to this research would be to analyze whether different majors have different impacts on business survival. This extension would probably require a different set of instrumental variables to take into account the endogenous nature of college majors. Similarly, one could study the effect of postgraduate studies, for example MBAs. This would be of particular interest since many MBAs and business school programs are offering entrepreneurship classes.

Our results point to some differences between men and women. While we do not find stark gender differences among salaried employees, there are some gender differences for the self-employed. Our measures of human capital do not seem to affect women as much as men. We interpret this as evidence that men and women choose to start their own business for different reasons. However, it should also be taken into account that women are less likely to engage in self-employment, making the female sample of self-employed smaller and estimates less precise. Larger samples are required to investigate the source of potential gender differences for the role of human capital on self-employment.

Finally, we study the relationship between human capital and business survival using American data over the last quarter century. It would of course be interesting to apply a similar framework to other countries to establish whether our results are specific to the American economy and institutional environment, or apply more generally (Van Praag 2007).

## 7 Discussion of results and policy implications

We find that college education is not a significant determinant of business survival once cognitive skills and selection are considered. By contrast, college substantially increases employment survival among salaried employees. Cognitive skills are valuable for both groups, increasing both business survival and employment survival. Non-cognitive skills, in the form of internal locus of control, are, perhaps not surprisingly, only valuable for the business owners.

Notwithstanding the limitations discussed in the previous section, these results have strong policy implications. First and foremost, our results undermine the case for subsidizing college in order to foster small business activity. Other studies have also found limited success of education programs that specifically aim to teach entrepreneurship, though no definitive conclusion has been reached (Von Graevenitz et al. 2010; Martin et al. 2013; Marvel et al. 2014).

Policy makers as well as students themselves should be careful not to assume that college is a strong determinant of small business success. The fact that college-educated self-employed are, on average, more successful in part reflects other factors and not a

causal effect of formal education itself; a naïve analysis risks overestimating the benefits of college.

One implication of our results is that many potential business owners might be better off starting their companies early in their careers and learning on the job rather than investing in college education. In fact, our findings should not be interpreted as evidence of the unimportance of human capital, but rather that the human capital useful in small business activity is different than the human capital valuable for salaried employees. While the self-employed do not benefit to the same extent from formal higher education, they too benefit strongly from human capital in the form of general cognitive and non-cognitive skills. Furthermore, the benefits of an internal locus of control confirm the common finding that successful entrepreneurs tend to have a particular personality, including self-confidence and motivation (Brockhaus 1980; Mueller and Thomas 2001; Koellinger et al. 2007; Caliendo et al. 2014; Begley and Boyd 1987; Puri and Robinson 2013).

Rather than focusing on higher education, an educational policy geared to support entrepreneurial activities should focus on early childhood education and programs that demonstrably improve cognitive and non-cognitive skills (Heckman et al. 2010, 2013). The benefits of investing in early education have been recognized for employment policies, but may also become an important tool for entrepreneurship policy.

It should again be emphasized that the sample studied are mostly self-employed with small- or medium-sized firms. Founders of high-tech start-ups empirically constitute a small share of the self-employed in the USA and other countries and may differ from the typical small business owner. The entrepreneurship literature has recently been focusing on the differences between entrepreneurs and small business owners (for example, Hurst and Pugsley 2010; Sanandaji 2010). The sample size does not allow us to satisfactorily differentiate between these two different categories. Our findings do not extend to high-tech start-ups and skill-intensive entrepreneurs. There is little reason to assume that the effect of college is uniform across the two types of business owners. High-tech entrepreneurs, on average, tend to be far more educated (Henrekson and Sanandaji 2014), indirectly suggesting that formal education may be more important. This is an interesting question for future studies that include a sufficiently large sample size and ways to distinguish various types of business activity.

## 8 Conclusion

Studies that do not control for ability and selection generally find that the self-employed with a college degree have lower risk of business failure. We attempt to account for the endogeneity of both education and career choices. We use a multipronged strategy to account for a host of identification problems. A competing risks model is combined with instruments and controls for cognitive and non-cognitive abilities. Once selection and ability are controlled for, college no longer reduces the risk of moving from self-employment to non-employment. This indicates that previous studies may have overestimated the importance of college education for business survival by not sufficiently accounting for unobserved heterogeneity and endogeneity.

A growing literature argues that the self-employed should be treated as conceptually distinct from "Schumpeterian" entrepreneurs. Self-employed individuals such as plumbers, "mom-and-pop" shop owners and dentists generally do not engage in innovation and rarely grow their firms. Both Schumpeterian entrepreneurs and self-employed individuals are important for the economy, though in different roles. The empirical model considered in this study is general and can be applied to both innovative and non-innovative business owners. Since our estimation applies the model to data on the self-employed, our empirical results should be interpreted as the effect of college on the self-employed rather than on entrepreneurs.

We use the same model and dataset to study the effect of college on salaried employees. Interestingly, a college degree significantly reduces the likelihood of avoiding non-employment spells for employees, even after controlling for ability and selection. The fact that college helps employees but not the self-employed suggests that education affects the two groups in different ways. More research is required to understand what specific knowledge or skills are acquired during the college years that help people thrive in the corporate sector but do not affect their firms' success. Results are similar across men and women, even though estimates for women are less precise due to the smaller sample size. We also find that human capital in general seems to play a less important role for female business owners, suggesting perhaps that men and women start firms for different reasons.

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## Appendix 1

See Tables 1, 2, 3, 4 and 5.

## Appendix 2: Construction of yearly employment status

The discrete observation period is assumed to be a calendar year. Any construction of yearly employment and schooling status starting from weekly or monthly self-reported data is somewhat arbitrary since an individual can be in several alternatives in a given year. There is no unequivocal solution to this problem. We followed the classification method proposed by Keane and Wolpin (1997) who used the same dataset to estimate a life-cycle model.

Every individual is assigned to one of four mutually exclusive states (employment, self-employment, non-employment or school) in the following hierarchical way. First, we establish whether someone can be classified as employed, non-employed, self-employed or his/her status is missing for the year. (a) *Missing Values, Employed or Non-employed*: If the weekly working status is missing for more than 2/3 of the weeks in 1 year, then the yearly status is missing. When weekly status is available for more than two-thirds of the weeks, then an individual is considered working if he/she reports doing so for more than two-thirds of the non-missing weeks and averages at least 20 h of work per week. Otherwise the yearly status is coded as "non-employment."[2] (b) *Self-Employed*: If an individual reports working as self-employed for more than half of the working weeks, then he/she is considered self-employed for the year.

Second, we establish whether someone classified as "non-employed" is, in fact, in school. An individual is classified in school during the current calendar year if he/she is not already classified as employed or self-employed and one of the two following statements is true: (a) He/she reports one more year of education the following calendar year *and* reports attending school at least during 1 month in the current calendar year; or (b) he/she reports attending school for at least 4 months during current calendar year. The second part of this definition is meant to capture those individuals who spent most of their time in school but for whatever reason did not complete the grade. We decided to give priority to the employment information rather than the schooling attendance variable because the former seems to be more accurate. First, it is collected on a weekly basis rather than a monthly basis. Second, in order to be employed, someone needs to work for more than 20 h a week. Third, according to the rules of the NLSY79, it is enough to have attended school for just 1 day in order to be classified as in school for the entire month.

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[2] Keane and Wolpin (1997) do a similar exercise, but construct their employment variables looking at only 9 weeks during the year. They do so for computational reasons. We do not have the same limitations so working status uses all the information/

Footnote 2 continued
weeks available. Keane and Wolpin also do not consider summer quarters to avoid picking up students' summer jobs. We calculate the working status with and without summer weeks. The correlation across individuals between the two definitions ranges between .9 in 1979 and .97 in 2003.

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