Do elite colleges matter? The impact of elite college attendance on entrepreneurship decisions and career dynamics

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Abstract

We study the effects of attending an elite college on entrepreneurship decisions and career dynamics. We first document that having an elite college degree is positively correlated with entrepreneurship (i.e., owning an incorporated business) but not with other self-employment (i.e., owning an unincorporated business). We then develop an overlapping generations model which captures the self-selection in education and career choices based on heterogeneous ability and family wealth endowments. Our estimates show that different career paths (employee, entrepreneur, and other self-employed) demand different types of human capital (employee, incorporated, and unincorporated human capital) and elite colleges improve these three types of human capital more than ordinary colleges. Our counterfactual experiment finds that shutting down elite colleges reduces the number of entrepreneurs but has little impact on other self-employed individuals. Providing subsidies to elite colleges is more efficient than giving grants to non-elite colleges in encouraging entrepreneurship, improving intergenerational mobility, and increasing welfare.

JEL Classification: D15, I20, J24

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1 Introduction

Do elite colleges matter? Elite college dropouts such as Mark Zuckerberg and Bill Gates are often cited as "proof that one can have a successful career without a degree from an elite college. However, Jeff Bezos and Sundar Pichai are cited to demonstrate that elite college graduates have better chances at successful careers. The ongoing lawsuit by Students for Fair Admissions against Harvard University and recent admissions scandals involving elite colleges suggest that the general public believes that elite colleges matter.

The economics literature quantifies the impact of elite colleges in a more scientific manner. Dale and Krueger (2002) find that there is no earning differential between elite college graduates and ordinary college graduates after controlling for college selectivity.[1] This implies that the "elite college premium" is negative as elite colleges charge much higher tuition than ordinary colleges. Many studies debate these findings (e.g., Black and Smith, 2004, 2006, Dale and Krueger, 2014, Hoxby, 2009, 2018, Ge et al., 2018).[2] More recently, Zimmerman (2019) shows that attending an elite business-focused degree program in Chile significantly enhances the probability of attaining a top position in corporates for male students from expensive private high schools. Such differences are not found for female students or male students from other types of high schools.

In this paper, we analyze the effect of attending an elite college on lifetime income with a focus on the impact on entrepreneurship decisions and career dynamics. Our overlapping generations model unifies the seminal work of Keane and Wolpin (1997) highlighting life-cycle education and career choices and a series of works by Cagetti and De Nardi (2006, 2009) emphasizing entrepreneurship decisions. We allow for self-selection in education and career choices through the intergenerational transfer of wealth and multi-dimensional abilities. Our model allows us to evaluate (a) the contributions of different types of education (elite colleges, ordinary colleges, or no college) to different types of human capital and (b) the production technologies, riskiness of the income stream, and the human and physical capital requirements for different career choices (employment, entrepreneurship, and other self-employment). Our estimates show that our relatively simple model captures the diversity in education choices, the subsequent career dynamics (the switching from one career to another), and the intergenerational mobility observed in our panel dataset.

[1]Throughout this paper, the term "ordinary college" and "non-elite college" are used interchangeably.

[2]Black and Smith (2004) use a matching method to show that the often-used linear specification can lead to biased results. Black and Smith (2006) compare four different econometric methods and find that the effect of college quality is likely under-estimated by the literature. Hoxby (2009) shows that elite colleges have become more selective with time. With their resources, elite colleges enable their students to make massive human capital investments and to be more competitive. Dale and Krueger (2014) extend their earlier work by examining the returns to college for a more recent cohort and over a longer time horizon for the older cohort. They argue that college effects on wages are concentrated in certain sub-groups, such as African American and Hispanic students. Hoxby (2018) calculates the productivity of 6,700 undergraduate programs in the U.S. using their effect on students' lifetime outcomes ("value-added") divided by the lifetime cost of producing this effect. She finds that selective institutions are more productive than non-selective institutions. Ge et al. (2018) find that elite college attendance has significant marriage market benefits, especially for women.

We proceed in several steps. First, we show that the income profile (i.e., median, mean, and standard deviation) of entrepreneurs (individuals who own an incorporated business) is different from the income profiles of employees and other self-employed individuals (individuals who own an unincorporated business). With the help of a restricted access dataset from the Panel Study of Income Dynamics (PSID), we identify the college each respondent graduated from. We show that elite college graduates are more likely to becoming entrepreneurs but not other self-employed (Table 2). This suggests that it is important to distinguish between two types of self-employment, entrepreneurs who own an incorporated business and other self-employed individuals who own an unincorporated business, as pointed out by Levine and Rubinstein (2016).[3] We show that after conditioning on the career choice of an agent (employee, entrepreneur, or other self-employed) and other controls, elite college graduates have higher incomes (Table 3). These findings are important because the literature often focuses on devoted employees (i.e., economic agents who have never been self-employed) when evaluating the effect of elite college attendance. We highlight the impact of elite college attendance on entrepreneurship.

Next, we construct an overlapping generations model of education and career choices. Education and career choices are typically not random as they are affected by ability and wealth. For example, individuals with higher ability or from wealthy families are more likely to enroll in elite colleges and become an entrepreneur. Therefore, it is important to model the intergenerational transfer of wealth and abilities. Estimating such a model allows us to recover the potentially different human capital gains from different types of college attendance while controlling for the selection effect.[4]

Our life-cycle model captures both the education and career decisions, as well as the career dynamics. While career dynamics (transitions between being an employee, an entrepreneur, and other self-employed) are often overlooked in the literature, they are worthy of attention for many reasons. Although 80% or more of our sample subjects work as employees in a cross-sectional sense, the percentage of "devoted employees," i.e., economic agents who have never been self-employed during their career, is only 70%. In other words, almost one-third of subjects have some experience of being self-employed by owning either an incorporated or an unincorporated business. In addition, entrepreneurs tend to be successful salaried workers before they open their own business; this is not the case for other self-employed individuals. When estimating the model, we match both the income level of different career paths and career and income dynamics such as the different conditional probabilities of switching from one career to another and the correlations in the incomes of people switching from one career to

[3]Throughout this paper, the terms "other self-employed individuals and "unincorporated business owners are used interchangeably.

[4]In this paper, human capital is different from ability. Loosely speaking, human capital is equal to the sum of ability endowment, human capital gain from school and human capital gain from experience. We will provide details in later sections.

another.[5] Our structural model also delivers estimates of intergenerational linkages such as the conditional probability of a sons educational or career choice given the fathers choice. To our knowledge, this unified framework for studying educational choices, career dynamics, and intergenerational linkages is new to the literature. Our results provide new insights on the effect of elite college attendance on human capital accumulation. Agents born with higher employee ability, incorporated ability (i.e. ability to operate incorporated business), and financial capacities are more likely to enroll in elite colleges. Elite colleges provide higher human capital gains for employees, entrepreneurs, and other self-employed individuals compared to non-elite colleges. However, the elite college premium (lifetime income gain from elite colleges net of tuition) is still negative (-$26,000 in 2011 dollars), suggesting that the consumption value of elite colleges plays a role in explaining peoples willingness to attend elite colleges. We also provide evidence that the two types of businesses operate with very different human and physical capital requirements. Incorporated businesses make use of employee human capital and incorporated human capital, while unincorporated businesses mostly use unincorporated human capital. Moreover, incorporated businesses have an entry cost of $50,000 (again, in 2011 dollars) while the corresponding number for unincorporated businesses is not significantly different from zero. Our model predicts that individuals with high employee ability, high incorporated ability, and high family income sort into incorporated businesses; individuals with low employee ability and high unincorporated ability (i.e. ability to operate unincorporated business) sort into unincorporated businesses.[6] Family income does not affect the probability of owning an unincorporated business.

To investigate the policy implications of our model, we conduct a series of counterfactual experiments. To underscore the importance of elite colleges, we simulate the situation in their absence. When we exclude elite colleges from the model, the fraction of incorporated business owners drops from 5.5% of the labor force to 4.9% (an 11% decline), but the fraction of unincorporated business owners only drops from 11.9% to 11.8% (a 1% decline). Moreover, the conditional probability that a son of an employee father (an unincorporated business owner father) becomes an incorporated business owner drops from 17% (17.8%) to 15% (16%). These numbers suggest that elite colleges help create successful entrepreneurs and promote intergenerational mobility. We also compare subsidies to elite college students versus subsidies to non-elite college students. We find that subsidizing elite college students indirectly increases the number of entrepreneurs and their income, reduces the age of first entrepreneurship, and increases the duration of entrepreneurship. These effects are larger than those for non-elite college subsidies. In addition, elite college subsidies are more efficient in improving social welfare

[5]The distribution of entrepreneurial returns is known to be skewed and is difficult to match precisely. Hall and Woodward (2010) find that almost three-quarters of venture-backed entrepreneurs receive nothing at firm exit but a few earn more than a billion dollars. Kartashova (2014) finds that the private entrepreneurial premium is positive when data from more recent years are included. Our model matches several moments of the distribution of entrepreneurial returns observed in the data.

[6]Our findings are consistent with findings in the literature emphasizing that "human capital" or "ability" is multi-dimensional.

and reducing intergenerational income persistency, although the effect on income inequality is non-monotonic.

This paper proceeds as follows. Because the paper is built on a vast literature, we devote the next section to the literature review. The formal model is presented in Section 3, followed by a description of the data used for estimation in Section 4. We explain the identification and estimation strategies in Section 5. Estimation results and counterfactual experiment results are presented in Sections 6 and 7, respectively. Section 8 concludes the paper.

2 Literature Review

This paper builds on the insights of many authors. Because the literature on self-employment and education has been surveyed by several authors (Astebro et al., 2014, Kerr et al., 2018, Oreopoulos and Salvanes, 2011, Oreopoulos and Petronijevic, 2013, Van der Sluis et al., 2008), we highlight only a few contributions. Because entrepreneurship (incorporated business ownership) and other self-employment (unincorporated business ownership) play essential roles in our model, we begin with the literature on self-employment. Note that the literature on self-employment does not distinguish between entrepreneurs and other self-employed individuals. Several authors explore which individual characteristics, including income, wealth, and education, affect the probability an individual becomes self-employed (Blanchflower and Oswald, 1998, Dunn and Holtz-Eakin, 2000, Evans and Jovanovic, 1989, Evans and Leighton, 1989, Holtz-Eakin et al., 1994). Hurst and Lusardi (2004) find that the relationship between wealth and self-employment is almost flat except at the top 5% of the wealth distribution, where wealth and self-employment are positively correlated.

Evidence of a relationship between education and self-employment is mixed. Some studies do not find a significant effect (Dunn and Holtz-Eakin, 2000, Evans and Jovanovic, 1989), while others see a significant impact (Parker and Van Praag, 2006, Samaniego and Sun, ming). Blanchflower (2000) examines OECD data and finds "evidence that self-employment is more prevalent among groups at the two ends of the education distribution and especially so for the least educated." These results are consistent with the idea that several competing factors, such as the opportunity cost and financial constraints, affect the self-employment decision.

It is natural to explore the effect of family on self-employment. Nicolaou and Shane (2010) use data on identical (MZ) and fraternal (DZ) twins in the U.S. to confirm the existence of a genetic component to the intergenerational transfer of self-employment. Using Swedish adoption data, Lindquist et al. (2015) find that post-birth factors are more important than pre-birth factors by comparing individuals living with adopted parents to those living with their biological parents. Using Norwegian data, Hvide and Oyer (2018) find that most male self-employed individuals start a business in the same or a closely related industry as their fathers.

In addition to micro studies on self-employment, there is also literature on self-employment in the dynamic equilibrium tradition. Bassetto et al. (2015) and Cagetti and De Nardi (2006, 2009) find that introducing self-employed individuals into models significantly helps models match stylized facts such as the capital-output ratio and the income distribution of the U.S. In the life-cycle model built by De Nardi and Yang (2014), economic agents choose whether to be self-employed and whether to leave a bequest. Their model can produce the skewed income distribution and the bequest distribution observed in the data. Samaniego and Sun (ming) introduce endogenous education choices into the Cagetti and De Nardi framework. They find that the higher labor earnings of college graduates allow them to mitigate credit constraints and become self-employed. They compare the welfare implications of different counterfactuals such as an education subsidy and a relaxation of the credit constraints of self-employed. There are also dynamic equilibrium models of self-employment which do not contain a life-cycle structure. Kwark and Ma (2018) build a dynamic general equilibrium model with both aggregate and idiosyncratic shocks and a discrete choice of self-employment versus employment in each period. Their model can explain the cyclical behavior of the income distribution over the business cycle. Choi (2017) develops a dynamic occupation choice model as in Vereshchagina and Hopenhayn (2009). He shows that self-employed individuals with better outside options as paid workers tend to take more business risks and thus exhibit higher firm exit rates, more growth dispersion, and faster growth conditional on survival.

We contribute to the literature in several ways. First, instead of asking whether education level or family wealth affects the probability of becoming self-employed, we build a life-cycle model in which different agents have different abilities and monetary endowments inherited from their families and they make their education and career decisions accordingly. This allows us to separate the effect of education, particularly elite college education, on self-employment decisions from the effect of wealth and ability. Our model can generate the intergenerational persistency in education, career, and income observed in practice. Second, we distinguish between two types of self-employment, incorporated and unincorporated business ownership. These two types of businesses have different technologies and risks and require different levels of human capital and entry costs. Our structural model helps us understand the difference between these two types of self-employment and how people make career decisions between them. Third, our structural model allows us to conduct a series of counterfactual calculations and evaluate their effects on welfare, inequality, and intergenerational mobility. Our structural approach complements the vast literature based on reduced-form estimation. Our approach also complements the recent literature on empirical earning dynamics, such as Guvenen et al. (2015). They combine the employee income with the self-employed income as individual earning and then estimate an elaborate empirical process with administrative data. On the other hand, this paper model the career dynamics, i.e., the switching between employee and self-employed status as an endogenous decision. Also, through our life-cycle model, we naturally relate the career dynamics and education decisions. Thus, our model provides a microfoundation of the aggregate earning process used in that literature.

3 Model

3.1 Model Setup

Economic environment The economy is populated by single-individual dynasties. Each individual lives for at least 65 years and at most 100 years. Each period is 5 years. For the first four periods (20 years) of an individuals life, the individual is a part of his parent's household and does not make any economic decisions. At age 20, the young individual moves out of his parent's house and forms his own household and decides whether to enroll in college and if so, what type of college to attend. There are three levels of education attainment, high school, non-elite college, and elite college, which are denoted $e \in \{hs, nc, ec\}$, respectively.[7]

Individuals not in school choose between being an employee, owning an incorporated business (being entrepreneur), or owning an unincorporated business (being other self-employed), which are denoted $j \in \{em, ib, ub\}$, respectively. All individuals decide how much to consume (c) and save (k). In addition, those who own a business choose an investment level k_j. Workers must retire at 65 but self-employed individuals can work after 65 if they owned a business in the previous period.

At age 30, each individual has a child. Individuals are altruistic towards their offspring. A child's expected lifetime utility enters the parent's value function with weight $\omega \in [0, 1]$. When a child leaves home and begins his own household, the parent has the option of giving him a one-time gift of liquid assets, denoted R. This can be motivated by the observation that many parents help their children pay for college or finance their businesses.[8]

Human capital Each person is born with three types of ability ($A = \{A_{em}, A_{ib}, A_{ub}\}$). Worker ability ($A_{em}$) is the capacity to produce earnings out of labor. Self-employed abilities (including incorporated ability and unincorporated ability, A_{ib} and A_{ub}) capture the capacity to invest capital productively. We use A_{ib} to capture the non-routine cognitive skills required by incorporated businesses and A_{ub} to capture the manual skills that are required by unincorporated businesses.[9] The initial ability of a child is broadly defined to include things like genetics, family culture, motivation, and knowledge acquired from parents. We assume the three abilities are uncorrelated. Abilities are assumed to be log normally distributed and imperfectly

[7] We focus on whether individuals graduate from college instead of college enrollment and dropout decisions. College dropouts are treated as high school graduates in our model. We assume that each period is 5 years because it takes four to five years to get a college degree.

[8] Empirical studies confirm the existence of inter vivos transfers for college and other investments. See Hurd et al. (2011) and Haider and McGarry (2012).

[9] Levine and Rubinstein (2016) show that entrepreneurs engage in activities demanding a high degree of non-routine cognitive skills while other self-employed individuals perform tasks demanding relatively strong manual skills.

transferred from parent to child according to an AR(1) process according to[10]

$$\log A_j^c = \theta_j \log A_j^p + \psi_j \text{ for } j \in \{em, ib, ub\} \quad (1)$$

where A_j^c is the child's ability, A_j^p is the parent's ability, and $\psi_j \sim N(0, (\sigma_j^a)^2)$ for $j \in \{em, ib, ub\}$. The variance of ability A_j^c is $\sigma_j^2 = \frac{(\sigma_j^a)^2}{1-\theta_j^2}$.

In this model, ability is inherited but human capital can be enhanced. Employee human capital is built on the in-born employee ability, h_{em}, and it can be improved by attending college and through learning by doing. How much employee human capital a person has depends on his employee ability (A_j), education (e), and potential experience (x) according to

$$\log h_{em} = \log A_{em} + \mu_e^{em} + \gamma_1 x + \gamma_2 x^2 \quad (2)$$

where μ_e^{em} is the employee human capital gained through education. We allow human capital gains to differ by school type e and career type j. We normalize the human capital gains from high school $\mu_{hs}^j x \in \{em, ib, ub\}$ to zero. Potential experience x is determined by age and whether a person attended college.

The human capital of self-employed individuals (h_{ib} and h_{ub}) can also be increased by attending college. How much incorporated/unincorporated human capital a person has depends on his incorporated/unincorporated ability (A_{ib}/A_{ub}) and education (e) according to[11]

$$\log h_j = \log A_j + \mu_e^j \text{ for } j \in \{ib, ub\} \quad (3)$$

where μ_e^j is the incorporated/unincorporated human capital gained through education with the human capital gained from high school μ_{hs}^j again normalized to zero.

Elite and non-elite colleges charge different tuitions and provide different levels of financial aid. Net tuition is

$$T_e - f_e(k^p, A_{em}) \quad \text{for } e = nc, ec$$

where T_e is college tuition and f_e is financial aid. Financial aid is a function of education type (e), family assets (k^p), and employee ability (A_{em}).[12] Our formulation embeds both need-based

[10]There is increasing evidence that "employee ability" and "self-employed abilities" are indeed different and transferred between generations. See Kerr et al. (2018), Hartog et al. (2010), and Schoon and Duckworth (2012).

[11]We assume away learning by doing for incorporated/unincorporated human capital because we already have the diminishing return to investment ν that plays a similar role in capturing the hump shape in the life-cycle income profile. In addition, we assume that incorporated/unincorporated businesses make use of both employee human capital and incorporated/unincorporated human capital and employee human capital has learning by doing. The empirical evidence for the correlation between entrepreneur experience and performance is controversial. Toft-Kehler et al. (2014) and others propose that such a correlation depends on the type of entrepreneur. For more details, see Toft-Kehler et al. (2014) and the references therein.

[12]We assume that colleges have perfect information on a students employee ability but do not give financial aid based on incorporated ability or unincorporated ability because incorporated ability and unincorporated ability are difficult for universities to observe. Most studies find that financial aid is a function of SAT scores or IQ test scores, which in turn are good predictors of employee performance. See Schmidt and Hunter (2004, 1998, 2000).

and merit-based financial aid.

Modeling college attendance is non-trivial and choices differ significantly by author. While some emphasize the capacity constraint of colleges, others focus on the ability requirements imposed by colleges. Although all of these elements may be important in practice, we abstract away from these concerns to focus on the free choices of the economic agents. Interestingly, only agents with relatively high abilities enroll in elite colleges in our model; individuals with relatively low abilities are discouraged by the high tuition costs. We discuss this further in Section 6.4.

Technology In our model, entrepreneurs (incorporated business owners) and other self-employed individuals (unincorporated business owners) operate their own firms, so their production technologies are also their individual level income processes. Employees provide their labor to representative firms which then combine labor with capital to produce income.

The income for entrepreneurs is given by

$$I_{ub} = P_{ub}h_{ub}(h_{em})^{\rho_{ub}}(k_{ub})^{v_{ub}}e^{\epsilon_{ub}} - C_{ub}1\{j_{-1} \neq ub\} \tag{4}$$

The income of an entrepreneur depends on 1) the productivity of the incorporated business technology (P_{ib}), 2) his incorporated human capital (h_{ib}), 3) his employee human capital (h_{em}), 4) his physical capital investment in the incorporated business (k_{ib}), 5) an idiosyncratic productivity shock (ϵ_{ib}, $\epsilon_{ib} \sim N(0, \xi_{ib})$),[13] and 6) the fixed cost of opening an incorporated business ($C_{ib} \geq 0$) if he was not an incorporated business owner in the previous period ($j_{-1} \neq ib$). To capture the fact that business investment is risky, we assume that ϵ_{ib} is unknown to individuals before they make their career choices. The parameters ρ_{ib} and ν_{ib}, $0 \leq \rho_{ib}, \nu_{ib} \leq 1$ are the rates of return to employee human capital and physical capital, respectively. We assume that all self-employed individuals are one-person firms which only use the business owners human and physical capital for investment.[14]

The income of other self-employed individuals is similar

$$I_{ub} = P_{ub}h_{ub}(h_{em})^{\rho_{ub}}(k_{ub})^{v_{ub}}e^{\epsilon_{ub}} - C_{ub}1\{j_{-1} \neq ub\}. \tag{5}$$

P_{ub} is the productivity of the unincorporated business technology, h_{ub} is the unincorporated human capital, k_{ub} is the physical capital investment in the unincorporated business, ϵ_{ub} is

[13] We believe it is reasonable to assume that the productivity shocks of the two types of businesses follow normal distributions; in our PSID sample, the log of total income (the sum of labor income and business income) of incorporated business owners has a skewness of -0.049 and that of unincorporated business owners has a skewness of -1.16.

[14] According to Kochhar et al. (2015), only 24% of self-employed individuals had at least one paid employee in 2014. It would be difficult to model the decisions of hiring workers for entrepreneurs as the entrepreneurship decision affects the wage rate of salary workers through an equilibrium effect. The value of entrepreneurship and the value of workers would depend on how many people choose to become entrepreneurs in equilibrium, which makes it very difficult to solve in a heterogeneous agent model.

an idiosyncratic productivity shock to the unincorporated business with $\epsilon_{ub} \sim N(0, \xi_{ub})$, and $C_{ub} \geq 0$ is the fixed cost of opening an unincorporated business if he was not other self-employed in the previous period ($j_{-1} \neq ub$). As with entrepreneurs, the parameters ρ_{ub} and ν_{ub}, $0 \leq \rho_{ub}, \nu_{ub} \leq 1$ are the rates of return to employee human capital and physical capital, respectively.

Agents who do not operate their own firms earn their living as employees in the employee sector. The income process for employees is

$$I_{em} = wh_{em}e^{\epsilon_{em}} \tag{6}$$

where w is the market wage rate (per efficiency unit), h_{em} is the employees human capital, and ϵ_{em} an idiosyncratic productivity shock with $\epsilon_{em} \sim N(0, \xi_{em}^2)$. The labor of employees is aggregated to the market supply of labor L_{em}, so

$$L_{em} = \int_{h \in S^{em}} h_{em} e^{\epsilon_{em}} dh. \tag{7}$$

The employee sector production function F_{em} combines the aggregate capital K_{em} (which is explained further later) and L_{em} to produce goods according to

$$F_{em}(K, L) = P_{em} K_{em}^{\alpha} L_{em}^{1-\alpha}. \tag{8}$$

The production function F_{em} has constant returns to scale. Combining it with competitive input markets, the marginal product of aggregate labor determines the wage rate w.

Leverage Entrepreneurs and other self-employed individuals can borrow up to a λ proportion of their assets k, so

$$(k_j - k) \leq \lambda k \quad \text{for} \quad j \in \{ib, ub\} \tag{9}$$

where λ is the leverage ratio with $\lambda \in [0, 1]$. This formulation of borrowing constraints comes from Kiyotaki and Moore (1997). The maximum leverage ratio, defined as the ratio between the maximum amount of investment and equity, k_j/k, is $(1 + \lambda)$.

We assume there is no borrowing constraint for college students because many studies find that borrowing constraints do not bind for most U.S. college students (e.g., Heckman and Mosso, 2014,Cameron and Taber, 2004, Carneiro and Heckman, 2002, Cameron and Heckman, 2001). College students can get federal loans which cover their tuition and minimum living expenses and they can also borrow commercially.

However, individuals with outstanding loans at the beginning of the period are not allowed to borrow again unless they pay back all their loans. Therefore, anyone who takes out a student loan to go to college cannot borrow again to finance a business until he pays back his student loan. This provides a disincentive for students to go to an elite college if they want to be an entrepreneur but have limited financial resources.

Preferences Every individual has the utility function

$$u(c,d) = \frac{c^{1-\sigma}}{1-\sigma} + b_{ib}1\{d = ib\} + b_{ub}1\{d = ub\} \tag{10}$$

$$+ b_{nc}1\{d = nc\} + b_{ec}1\{d = ec\} \tag{11}$$

where $b_d \sim N(0, (\eta_d)^2)$ and $d \in \{ib, ub, nc, ec\}$ are shocks to the consumption value of entrepreneurship and college, respectively.[15] Households discount the future at the rate β.

A household's lifetime utility is given by

$$U = \sum_{t=1}^{17} \beta^{t-1}\zeta(t)u(t) + \beta^6 \omega U^c. \tag{12}$$

An individual can live for 17 periods (from age 20 to 100 with 1 period equal to 5 years). A child's utility U^c enters his parent's utility function when the parent is 50 years old (period 7) with weight ω. $\zeta(t)$ is the survival rate and we assume $\zeta(t) = 1$ before age 65, and $\zeta(t) < 1$ after 65.

3.2 The Individual Problem in Recursive Form

Before introducing the mathematical formulation of our model, it is instructive to provide a descriptive overview. Agents go through different stages of life, starting at age 20. Age 20 is the schooling stage, when agents make their education choices of whether to attend an elite college, a non-elite college, or no college. Given their educational achievement, agents are in their working stage between ages 25 and 65. On top of the standard consumption-saving decisions, individuals choose their career path, choosing between being an employee, entrepreneur, or other self-employed. At age 50, agents can make a one-time transfer to their offspring. Starting age 65, employees retire and face a chance of death. Conditional on surviving, self-employed individuals can choose between being an entrepreneur, being other self-employed, and retirement after 65.

Retirement stage Let W_j represent the expected life-time utility for different career choices: employees ($j = em$), entrepreneurs ($j = ib$), and other self-employed individuals ($j = ub$). Employees older than 65 retire and decide how much to consume (c) and save for the next period's capital (k'). The state variables are age t, education type e, abilities $A = \{A_{em}, A_{ib}, A_{ub}\}$, capital k, last period career type j_{-1}, and "consumption shocks for incorporated businesses b_{ib} and unincorporated businesses b_{ub}, which are the utility gains individuals would receive if they become incorporated and unincorporated business owners. We may also say that they are the

[15] Empirical studies support the view that there are consumption values to college and entrepreneurship. See Benz and Frey (2008), Astebro et al. (2014), Jacob et al. (2018), and Gong et al. (2018).

“consumption value of being business owners.

The value of being a retired employee is

$$W_{em}(\Omega) = \max_{c,k'} u(c, em) + \beta\zeta(t)EV(\Omega') \tag{13}$$
$$s.t. \quad c + k' = k(1 + r) + p(e), \quad c > 0$$

where $p(e)$ is the pension received by retired employees which is assumed to be a ϕ fraction of the employees average earnings before retirement. The capital rental rate is $r + \delta$, where r is the interest rate and δ is the capital depreciation rate; the net capital rental rate is r. The next periods state variables are $\Omega' = \{t + 1, e, A_{em}, A_{ib}, A_{ub}, k', em, b'_{ib}, b'_{ub}\}$. The expectation is taken over b'_{ib} and b'_{ub}.

The value function for an incorporated business owner is

$$W_{ib}(\Omega, \epsilon_{ib}) = \max_{c,k',k_{ib}} u(c, ib) + \beta\zeta(t)EV(\Omega') \tag{14}$$
$$s.t. \quad c + k' = (1 - \delta)k_{ib} + P_{ib}h_{ib}h_{em}^{\rho_{ib}}k_{ib}^{v_{ib}}e^{\epsilon_{ib}} - C_{ib}1\{j_{-1} \neq ib\} - (1 + r)(k_{ib} - k)$$
$$c > 0, \quad (k_{ib} - k) \leq \lambda k$$

where $\Omega' = \{t + 1, e, A_{em}, A_{ib}, A_{ub}, k', ib, b'_{ib}, b'_{ub}\}$.

The value function for an unincorporated business owner is

$$W_{ub}(\Omega, \epsilon_{ub}) = \max_{c,k',k_{ub}} u(c, ub) + \beta\zeta(t)EV(\Omega') \tag{15}$$
$$s.t. \quad c + k' = (1 - \delta)k_{ub} + P_{ub}h_{ub}h_{em}^{\rho_{ub}}k_{ub}^{v_{ub}}e^{\epsilon_{ub}} - C_{ub}1\{j_{-1} \neq ub\} - (1 + r)(k_{ub} - k)$$
$$c > 0, \quad (k_{ub} - k) \leq \lambda k$$

where $\Omega' = \{t + 1, e, A_{em}, A_{ib}, A_{ub}, k', ub, b'_{ib}, b'_{ub}\}$.

When agents reach retirement age, they are only allowed to choose their career paths if they were self-employed in the last period; otherwise, they must retire.

$$V(\Omega) = \begin{cases} \max\{W_{em}(\Omega), EW_{ib}(\Omega, \epsilon_{ib}), EW_{ub}(\Omega, \epsilon_{ub})\} & \text{if } j_{-1} \in \{ib, ub\} \\ W_{em}(\Omega) & \text{if } j_{-1} = em \end{cases}$$

The expectations are taken over ϵ_{ib} and ϵ_{ub} because individuals do not observe productivity shocks when they make their career choices.

Working stage without intergenerational transfers During working stages without intergenerational transfers, the maximization problem of self-employed individuals is the same as it is in stages after age 65; for employees, the forward-looking maximization problem in the working stage is different from (13) as employees are paid a salary during these stages. The salary changes over time as employees accumulate experience and experience different productivity shocks in each period. Formally, it is

$$W_{em}(\Omega, \epsilon_{em}) = \max_{c,k'} u(c, em) + \beta EV(\Omega') \tag{16}$$
$$\text{s.t.} \quad c + k' = k(1+r) + wh_{em}e^{\epsilon_{em}}, \quad c > 0$$

where $\Omega' = \{t+1, e, A_{em}, A_{ib}, A_{ub}, k', em, b'_{ib}, b'_{ub}\}$.

An agent can freely change his career at the beginning of each period but he does not observe the productivity shocks $\epsilon_{em}, \epsilon_{ib}$, and ϵ_{ub}.

$$V(\Omega) = \max\{EW_{em}(\Omega, \epsilon_{em}), EW_{ib}(\Omega, \epsilon_{ib}), EW_{ub}(\Omega, \epsilon_{ub})\} \tag{17}$$

Working stage with intergenerational transfer At age 50, parents can give a one-time transfer to their offspring. The value function of an "employee parent" is

$$W_{em}(\Omega, \epsilon_{em}) = \max_{c,k',R} u(c, em) + \beta EV(\Omega') + \omega EJ(\Phi | A_{em}, A_{ib}, A_{ub}) \tag{18}$$
$$s.t. \quad c + k' + R = k(1+r) + wh_{em}e^{\epsilon_{em}}, \quad c > 0$$

where $J(.)$ is the value function of the child and $\Phi = \{\tilde{A_{em}}, \tilde{A_{ib}}, \tilde{A_{ub}}, R, k', b_{nc}, b_{ec}\}$. The expectation is taken over the child's abilities ($\tilde{A_{em}}$, $\tilde{A_{ib}}$, and $\tilde{A_{ub}}$) and shocks to the consumption value of college (b_{nc} and b_{ec}). The child's abilities are correlated with the parent's abilities but are not observed by parents at the time of the transfer.

Similarly, the value function of an "entrepreneur parent" at age 50 is

$$W_{ib}(\Omega, \epsilon_{ib}) = \max_{c,k',k_{ib},R} u(c, ib) + \beta V(\Omega') + \omega EJ(\Phi | A_{em}, A_{ib}, A_{ub}) \tag{19}$$
$$s.t. \quad c + k' + R = (1-\delta)k_{ib} + P_{ib}h_{ib}h_{em}^{\rho_{ib}}k_{ib}^{v_{ib}}e^{\epsilon_{ib}} - C_{ib}1\{j_{-1} \neq ib\} - (1+r)(k_{ib} - k)$$
$$c > 0, \quad (k_{ib} - k) \leq \lambda k$$

The value function of an "other self-employed parent" at age 50 is

$$W_{ub}(\Omega, \epsilon_{ub}) = \max_{c,k',k_{ub},R} u(c, ub) + \beta V(\Omega') + \omega EJ(\Phi | A_{em}, A_{ib}, A_{ub}) \tag{20}$$
$$s.t. \quad c + k' + R = (1-\delta)k_{ub} + P_{ub}h_{ub}h_{em}^{\rho_{ub}}k_{ub}^{v_{ub}}e^{\epsilon_{ub}} - C_{ub}1\{j_{-1} \neq ub\} - (1+r)(k_{ub} - k)$$
$$c > 0, \quad (k_{ub} - k) \leq \lambda k$$

Schooling stage We now define the value function of the offspring, $J(.)$. At age 20 ($t = 1$), an agent decides whether to attend an elite college, a non-elite college, or work.

$$J(\Phi) = \max\{H_{hs}(\Phi), H_{nc}(\Phi), H_{ec}(\Phi)\} \tag{21}$$

The value function of high school graduates who do not attend college is

$$H_{hs}(\Phi) = EV(1, hs, A_{em}, A_{ib}, A_{ub}, k, em, b_{ib}, b_{ub}) \tag{22}$$

where the expectation is taken over b_{ib} and b_{ub} because we assume individuals do not observe their consumption shocks to career choices when they make their schooling decision.

The value functions of individuals attending non-elite or elite colleges take the form

$$H_e(\Phi) = \max_{c,k'} u(c, e) + \beta EV(\Omega') \quad \text{where } e \in \{nc, ec\} \tag{23}$$

$$s.t. \quad c + k' = (1 + r)(R - T_e + f_e(k^p, A_{em})), \quad c > 0$$

where T_e is college tuition, f_e is financial aid, and $\Omega' = \{2, e, A_{em}, A_{ib}, A_{ub}, k', em, b'_{ib}, b'_{ub}\}$.

3.3 Equilibrium

In equilibrium, the wage w and interest rate r in the non-self-employed sector are such that

- each agent's consumption, investment, capital use, education choice, and occupation choice are optimal,
- the capital market clears (i.e., the total capital from all agents' savings equals the capital demand by both self-employed and non-self-employed individuals) so that

$$\int_{h \in S_{em}} k dh = \int_{h \in S_{ib}} b_{ib} dh + \int_{h \in S_{ub}} b_{ub} dh + K_{em} \tag{24}$$

  where h is the household index, S_{em}, S_{ib}, and S_{ub} are the sets of households who choose to be employees, entrepreneurs, and other self-employed, respectively, and $b_j = k_j - k$ for $j \in \{ib, ub\}$ denotes the amount of borrowing by entrepreneurs and other self-employed individuals, and

- the labor market clears (i.e., the total labor in efficient labor units supplied by employees equals the labor demanded by the non-self-employed sector) so that

$$L_{em} = \int_{h \in S^{em}} h_{em} e^{\epsilon_{em}} dh. \tag{25}$$

4 Data

4.1 Data Source

Our main data source is the Panel Study of Income Dynamics (PSID), which is a longitudinal project that began in 1968 with a nationally representative sample of over 18,000 individuals living in 5,000 families in the United States. The PSID tracks these individuals and their descendants, even after they form new families, so we can track the education and life-cycle career choices of parents and children. We restrict our sample to white males aged 25-60 with a father identified in the PSID. This results in 8,058 individuals with 305,296 individual-year observations. We also obtain restricted access data on school identifiers, which can be linked to the Integrated Post-secondary Education Data System (IPEDS) to provide rich information on the quality of the colleges that respondents attended.

4.2 Summary Statistics

Because we focus on the impact of elite college attendance on career dynamics and intergenerational mobility, it is important to identify which colleges are considered to be elite. We follow Black and Smith (2006) in using factor analysis to construct the college quality index

$$\begin{aligned}\text{Index} = 0.096 * \text{faculty-student ratio} + 0.137 * \text{rejection rate} + 0.257 * \text{retention rate}\\ + 0.245 * \text{faculty salary (in millions)} + 0.385 * \text{mean of reading and math SAT (in 100s)}.\end{aligned}$$

The top 100 universities according to this index are defined as elite.[16] Elite colleges include 15 flagship public universities. Therefore, not every state has an elite flagship public university according to our definition. Students living in states without a flagship public university must pay out-of-state tuition (which is much higher than in-state tuition) to go to an elite flagship public university. 41% of students surveyed in the PSID attending an elite flagship public university pay out-of-state tuition. Appendix Table A1 shows the list of elite colleges. Appendix Table A2 provides summary statistics of elite and non-elite colleges. Elite colleges have higher faculty-student ratios, higher rejection rates, higher retention rates, higher faculty salaries, and higher SAT scores. They also charge higher in-state and out-of-state tuition. We define an individual as having an "elite college ("non-elite college) education if he/she graduates from an elite college (non-elite college) and not simply if he/she attended an elite college (non-elite college). That is, education is defined by whether the individual receives a college degree.[17]

We now present some summary statistics on career dynamics. Table 1 shows that 18.2% of individuals in our sample do not work as employees.[18] Among them, 21% are entrepreneurs (i.e., own an incorporated business) and 69% are other self-employed (i.e., own an unincorporated business). Among entrepreneurs, 17% work in the construction industry, followed by the retail trade (13%) and financial services (11%).[19] The top 3 industries among other self-employed individuals are the same (accounting for 19%, 14%, and 10% of all such individuals, respectively).

Table 1 shows that employees and non-employees are quite different in their age, education,

[16]We cross-check our ranking with other rankings, such as the U.S. News Top 100 Colleges. Our list is comparable to theirs. In addition, our list does not change much over time. The current list is based on 2016 data.

[17]From now on, "elite/non-elite college attendance (go to an elite/non-elite college)" and "elite/non-elite college completion (receive an elite/non-elite college degree)" are used interchangeably.

[18]In the PSID data, 86% of individuals who own a business spent some time on their business, suggesting that the majority of them still play a managing role in their business.

[19]Medical, dental, and health services only account for 6%.

and income level.[20] Employees are younger, have fewer years of schooling, and are less likely to be college graduates. Furthermore, the income distribution of employees has a lower mean, median, and variance. The two types of non-employees have very different socioeconomic status. Entrepreneurs have 0.9 more years of schooling on average, are 17% more likely to be college graduates, and earn 74% more than other self-employed individuals. The education level of other self-employed individuals resembles the education level of employees and the mean and median of their income distribution are even lower than the mean and median of employees income distribution. We see significant differences in the summary statistics in social economic status between employees and non-employees, mainly driven by entrepreneurs, with other self-employed individuals looking very similar to employees. These findings are consistent with other studies such as Hamilton (2000), Levine and Rubinstein (2016), and Moskowitz and Vissing-Jørgensen (2002), and suggest that it is important to distinguish between different types of self-employment.

Table 8 shows the intergenerational relationships in education and career choices. Individuals whose fathers have an elite college degree are 14.4 percent points (ppt) more likely to graduate from an elite college compared with those whose fathers have a non-elite college degree and 23.0 ppt more likely than those whose fathers have a high school degree. There is a strong intergenerational correlation in education choice. The bottom panel shows a similar intergenerational persistency in career choice. A son whose father ever owned an incorporated business has the highest probability of ever owning an incorporated business, 9.5 ppt higher than a son whose father ever owned an unincorporated business but never own an incorporated business and 12.1 ppt higher than those with a devoted employee father.

To further elucidate the relationship between elite college attendance, career choices, and income, we run some simple regressions. Table 2 shows that graduating from an elite college is associated with a 2.0 ppt increase in the probability of being an entrepreneur compared with high school graduates after controlling for father's education and career; graduating from a non-elite college increases the likelihood by 1.7 ppt and graduating from graduate school has no significant effect. However, a college degree (either elite or non-elite) has no effect on the likelihood of being other self-employed. Table 3 shows that having an elite college degree is associated with a higher income for employees, entrepreneurs, and other self-employed individuals, while a non-elite college degree is only associated with higher incomes for employees and other self-employed individuals.

One possible channel through which elite college attendance could affect lifetime income is through better access to graduate schools. Using the PSID, we find that the marginal impact of graduate school on the likelihood of being an entrepreneur is much smaller than that of having attended an elite college, as shown in Table 2. This may be related to the fact that professional jobs (such as dentist, physician, accountant, or lawyer) account for less than 10% of entrepreneurs. Likewise, although attending graduate school increases an entrepreneur's

[20] Income includes labor income and business income for employees and entrepreneurs.

income, its impact on income is much smaller than that of elite college attendance, as shown in Table 3. Hence, we focus on the choice between elite and non-elite college attendance and abstract away from graduate school attendance.

One caveat is that those with more ability or from richer families are more likely both to enroll at an elite college and to be entrepreneurs even without going to an elite college. As a result, the positive correlation between elite college attendance and entrepreneurship is subject to a selection problem. This is why we need a structural model with endogenous education and career choices to identify the real effect of elite college attendance.

5 Identification and Estimation

In this section, we explain how we identify and estimate the model parameters. We fix a few parameters in our model and estimate the rest of the parameters using the simulated method of moments (SMM). Appendix Table A3 shows the fixed parameters, including the discount rate, survival rate, utility function parameter, pension, budget constraint, college tuition, and college financial aid. These parameter values are relatively standard in the literature. For instance, the discount rate is set to 0.821 because each period is five years, which is equivalent to a 0.95 annual discount rate. The capital depreciation rate is assumed to be 0.266 for five years, which is equivalent to a 6% annual depreciation rate. The survival rate is less than 1 after age 65 and calibrated using survival data from the Health and Retirement Study from 2011; the details are shown in Appendix Table A4. We assume that a pension is 40% of average earnings before retirement and the utility function parameter σ is set to 1.5, both of which come from Cagetti and De Nardi (2006).

For the budget constraint parameter, we follow Robb and Robinson (2014), who use the Kauffman Firm Survey to characterize the capital availability of start-up firms.[21] They show that the total equity of start-up firms accounts for 45% of their total capital,[22] so we set our collateral constraint parameter λ to 1.22.[23]

We calculate the average tuition at elite and non-elite colleges using the Integrated Post-secondary Education Data System (IPEDS) data. On average, elite colleges charge \$33,046 (in 2011 dollars) and non-elite colleges charge \$12,761. Unfortunately, the PSID does not have information on the financial aid received by respondents. Instead, we use the estimates of Fu (2014) to calibrate financial aid. Fu (2014) uses NLSY97 data to estimate the financial aid received by students at elite and non-elite colleges using a student's test scores and family

[21] The Kauffman Firm Survey is a longitudinal survey of new businesses in the United States. This survey collects annual information on 4,928 firms that started in 2004.

[22] Total equity includes owner equity, insider equity, and outsider equity and total debt includes owner debt, insider debt, and outsider debt. Total capital is the sum of total equity and total debt.

[23] Recall that our collateral constraint is $k_j \leq (1+\lambda)k$. When it holds with equality, capital/equity = $k_j/k = (1+\lambda)$. When we set $k/k_j = 0.45$, λ is approximately 1.22.

wealth.[24] Our financial aid formula is

$$\begin{aligned}\text{Financial aid of non-elite college} &= 13901 - 32.5 * \text{family wealth in thousands}\\ &\quad - 7432 * \text{employee ability below 1/3} + 6875 * \text{employee ability above 2/3}\\ \text{Financial aid of elite college} &= 20224 - 32.5 * \text{family wealth in thousands}\\ &\quad - 7432 * \text{employee ability below 1/3} + 6875 * \text{employee ability above 2/3}.\end{aligned}$$

Students from poorer families and with higher worker abilities receive more financial aid when they attend colleges. On average, elite colleges charge higher tuition on the one hand and provide more generous financial aid than non-elite colleges on the other hand.

Appendix Table A5 shows the parameters that remain to be estimated and the moments used to identify these parameters. We first discuss the identification of the ability distribution, the return to education, and the consumption shocks for different types of colleges. In general, our strategy for controlling for selection in education and career choices is to explicitly model the selection based on individual time invariant characteristics (abilities) and then fit the model's predictions to panel data.

We first track the same individual over time and calculate changes in their income when they stay in the same career and when they switch careers. The standard deviation of employee ability (σ_{em}) and the standard deviation of productivity shocks for employees (ξ_{em}) are jointly identified from the income variation of employees and the income correlation between two periods for individuals who are employees in both periods. If the dispersion of employee ability is large relative to the dispersion of productivity shocks, more employee income variation is driven by employee ability variation and we should observe high income correlation between two adjacent periods for employees.[25]

The income variation for entrepreneurs and other self-employed individuals can be decomposed into three parts: employee ability variation and the contribution of employee ability to entrepreneur income (ρ_{ib}/ρ_{ub}), incorporated/unincorporated ability variation (σ_{ib}/σ_{ub}), and the dispersion of productivity shocks (ξ_{ib}/ξ_{ub}). To identify the σ's, ρ's, and ξ's, we use the income variation and the income correlation between two periods for individuals who are entrepreneurs/other self-employed in both periods along with the income correlation between two periods for individuals who switch between being employees and entrepreneurs/other self-

[24] School identifier is restricted access data in the NLSY97 and is available only to researchers within the U.S., so we rely on the estimates from Fu (2014). Fu (2014) uses a slightly different definition of elite colleges from us; she defines the top 30 private universities, top 20 liberal art colleges, and top 30 public universities as elite. Our selection of the top 100 elite colleges is based on Black and Smith (2006). The difference between our list and the list used by Fu (2014) is very small.

[25] The correlation between earnings in paid employment is not exactly equal to the correlation between employee ability. However, as we use observational earnings data to estimate the structural parameters, we also use observed changes in earnings following entry or exit to estimate the returns to paid employment while controlling for selection on individual time invariant effects. Please see Keane and Wolpin (1997) for a similar identification strategy.

employed. If the σ's are large, we should observe a strong income correlation between two adjacent periods for individuals who remain in the same career. If the ρ's are large, we should observe that individuals who have high earnings as employees also have high incomes when self-employed.

Once we recover the ability distribution, we can identify the standard deviations of the consumption shocks to the value of non-elite and elite colleges (η_{nc} and η_{ec}) and the human capital gains from non-elite and elite college attendance (μ_e^j for $e \in \{nc, ec\}$ and $j \in \{em, ib, ub\}$) with the following equations. The first set of equations are education decision.

$$Pr(\chi \in \Pi) = Pr(e = ec)$$
$$Pr(\chi \in \Psi) = Pr(e = nc)$$

where $\chi = \{A_{em}, A_{ib}, A_{ub}, b_{nc}, b_{ec}\}$. Π is the set of students with χ who choose to go to an elite college and Ψ is the set of students who choose to go to a non-elite college.

The second set of equations are for the average human capital after college for employees, entrepreneurs, and other self-employed individuals with either an elite or a non-elite college degree.

$$E[\log A_{em}|\chi \in \Pi] + \mu_{ec}^{em} = E[\log h_{ec}^{em}]$$
$$E[\log A_{ib}|\chi \in \Pi] + \mu_{ec}^{ib} + \rho_{ib}(E[\log A_{ib}|\chi \in \Pi] + \mu_{ec}^{ib}) = E[\log h_{ec}^{ib}]$$
$$E[\log A_{ub}|\chi \in \Pi] + \mu_{ec}^{ub} + \rho_{ub}(E[\log A_{ub}|\chi \in \Pi] + \mu_{ec}^{ub}) = E[\log h_{ec}^{ub}]$$
$$E[\log A_{em}|\chi \in \Psi] + \mu_{nc}^{em} = E[\log h_{nc}^{em}]$$
$$E[\log A_{ib}|\chi \in \Psi] + \mu_{nc}^{ib} + \rho_{ib}(E[\log A_{ib}|\chi \in \Psi] + \mu_{nc}^{ib}) = E[\log h_{nc}^{ib}]$$
$$E[\log A_{ub}|\chi \in \Psi] + \mu_{nc}^{ub} + \rho_{ub}(E[\log A_{ub}|\chi \in \Psi] + \mu_{nc}^{ub}) = E[\log h_{nc}^{ub}]$$

where h_e^j denotes the average human capital of individuals with $e \in \{nc, ec\}$ education and $j \in \{em, ib, ub\}$ career type when they finish college. Using the panel data, we run income regressions and get individual fixed effects, which are equivalent to h_e^j because h_e^j does not change after an individual finishes his education. We have eight equations and eight unknowns ($\eta_{nc}, \eta_{ec}, \mu_{ec}^{em}, \mu_{ec}^{ib}, \mu_{ec}^{ub}, \mu_{nc}^{em}, \mu_{nc}^{ib}, \mu_{nc}^{ub}$), so we can identify the effects of non-elite and elite college attendance on employee, incorporated, and unincorporated human capital.

The identification of the other parameters is standard. The average incomes of employees, entrepreneurs, and other self-employed individuals are used to identify the technologies of the non-self-employed sector, incorporated businesses, and unincorporated businesses (P_{em}, P_{ib}, P_{ub}). The life-cycle income profiles of employees, entrepreneurs, and other self-employed individuals identifies the return to potential experience for employees (α_1, α_2) and the diminishing returns to investment for entrepreneurs and other self-employed individuals (ν_{ib}, ν_{ub}). The standard deviations of consumption shocks for entrepreneurs and for other self-employed individuals (η_{ib}, η_{ub}) are identified by the fraction of incorporated and unincorporated business owners. The costs of opening incorporated/unincorporated business (C_{ib}/C_{ub}) are pinned down by the transition rates between being employed and being an entrepreneur/other self-employed. If C_{ib}/C_{ub} is high, fewer employees will open incorporated/unincorporated businesses. Intergenerational correlations in education and careers identify the intergenerational transfer in employee, incorporated, and unincorporated abilities ($\theta_{em}, \theta_{ib}, \theta_{ub}$). Parental monetary transfers as a proportion of parental wealth identify a parent's weight on offspring's welfare. The output elasticity of capital in the non-self-employed production function is identified by the interest rate.

The estimation is conducted by SMM. A weighted squared deviation between sample aggregate statistics and their simulated analogs is minimized with respect to the model's parameters. The weights are the inverse values of the estimated variances of the sample statistics. The estimation proceeds in two steps. First, we solve the overlapping generations model by iterating until we reach a steady state with the parent generation having the same distribution of initial wealth, employee ability, incorporated ability, and unincorporated ability as the offspring generation. We make an initial guess of the joint distribution of initial wealth and abilities (including employee ability, incorporated ability, and unincorporated ability) for the parent generation and then simulate 5,000 individuals by drawing their initial wealth and abilities from the distribution and their idiosyncratic shocks to the non-pecuniary utility of education and career choices and the productivity shocks to career choices according to the parameters. The model predicts education and career decisions and their income and wealth over the life cycles. The model also predicts childrens abilities and the monetary transfers from parents to children. This provides us with a relationship between the intergenerational transfer of wealth and the intergenerational transfer of abilities. With the distribution of initial wealth and abilities of the offspring generation, we simulate the life-cycle decisions of the children and predict the intergenerational transfer of money and abilities for the grandchildren generation. We continue to iterate until the joint distribution of initial wealth and abilities converges.

The second step of the estimation is to compute the simulated moments and compare them to the sample aggregate statistics, which include

- education choice,
- career choice by education and age,
- average income by education, career, and age,
- variance of income by career,
- correlation between incomes in period t and $t + 1$ by career type,
- career transitions in period t and $t + 1$,

- intergenerational mobility in education and career and parental monetary transfers as a fraction of parental wealth, and
- the interest rate.

6 Estimation Results

6.1 Parameter Estimates and Model Fit

Table 4 shows parameter estimates with standard errors in parentheses. In general, the model fits education choices, career choices by education and age, and income by education, age, and career, as shown in Appendix Figures A1 to A4.

In addition, Table 5 shows that our model fits well the career transitions between two adjacent periods. For example, 87.0% of employees in our data remain to be employees in the next period, with the model predicting 87.1%. Our data show that 53.0% (52.0%) of incorporated (unincorporated) business owners are still in business five years later, while the model predicts 56.6% (54.1%). The model also predicts low transition rates between unincorporated and incorporated business ownership. The 5-year transition rate from unincorporated to incorporated business ownership is 9.3% in the data and 6.2% in the model. The 5-year transition rate from incorporated to unincorporated business ownership is 12.7% in the data and 12.0% in the model.

The model also fits the income correlation between period t and $t + 5$ for stayers and switchers (between career types), as shown in Table 6. For stayers (those who remain in the same career over the 5-year period), the income correlations are 0.71, 0.70, and 0.41 for employees, entrepreneurs, and other self-employed individuals, respectively. The model predicts 0.70, 0.72, and 0.50. For people who move from being an employee to owning an incorporated (unincorporated) business, the income correlation is 0.60 (0.49) in the data and 0.55 (0.42) in the model.

Our model also explains a large share of the intergenerational persistency in education and careers, as shown in Table 8. The data show that 78% of the offspring of high school graduates are also high school graduates, while the model predicts 71%. Similarly, the persistency in receiving a non-elite college degree is 39% in the data and 32% in the model and the persistency in receiving an elite college degree is 22% in the data and 18% in the model. In terms of the intergenerational persistency in careers, 63% of individuals in our data whose fathers are devoted employees (i.e. employees throughout their lifetime) are also devoted employees; the model predicts 64%. Similarly, the persistency in entrepreneurship (those who own an incorporated business at some point) is 25% in the data and 28% in the model and the persistency in other self-employment (those who own an unincorporated business at some point but never own an incorporated business) is 31% in the data and 26% in the model.

We also provide the fit for some untargeted moments. Table 7 shows that our model fits the income transitions for stayers and switchers. The average employee income in period t for those who remain employees in period $t+5$ is 54,582 in the data and 53,260 in the model. The average employee income in period t for those who become entrepreneurs in period $t+5$ is 75,482 in the data and 73,382 in the model, suggesting that entrepreneurs have much higher salaried earnings as employees before they become entrepreneurs. The average employee income in period t for those who own unincorporated businesses in period $t+5$ is 54,745 in the data and 52,269 in the model, suggesting that unincorporated business owners have similar earnings as employees before they open an unincorporated business to those who remain employees. For entrepreneurs, stayers have the highest income while those with the lowest income become other self-employed. For unincorporated business owners in period t, stayers have a medium income while those with the lowest income become employees.

Table 9 shows that our model sheds light on the intergenerational income elasticity (IIE) between fathers and sons. We calculate IIE by regressing the average income of sons between 30 and 50 years old (as a proxy for their permanent income) on the average income of fathers in the same age range.[26] IIE is 0.39 in the data and 0.41 in the model. The model predicts that the income persistence is highest for families in which both the father and son are employees, followed by families in which either the father or the son is an employee; families in which both the father and son are self-employed have the lowest income persistence because income variation is larger for non-employees (entrepreneurs and other self-employed individuals) than for employees. These results suggest that it is important to take career dynamics into consideration when we study intergenerational income elasticity.

6.2 Elite-College Premium

Our estimates contribute to the discussion on the importance of elite-college. First, as we mentioned before, there is a potential self-selection bias issue: more capable people may self-select into elite colleges, driving up the average earning of elite college graduates. In our model, although we do not impose any ability restriction for entrance to elite colleges, high ability individuals self-select into elite colleges. Our structural approach can address this selection issue. More specifically, our model identifies the underlying distribution of abilities. Table 10 shows how people with different combinations of abilities are sorted into different education and career paths. Elite college graduates have higher employee ability (0.291) compared to non-elite college graduates (0.092).[27] High school graduates have the lowest employee ability (-0.065). There is weak positive sorting in incorporated ability and no selection according to unincorporated ability. Elite college graduates have slightly more incorporated ability (0.010) than non-elite college graduates (0.004) or high school graduates (0.002). Recall that agents must first pay back student loans before receiving business loans. Therefore, some individuals with high incorporated ability may skip college and instead work after high school to accumulate assets to start a business.

[26] Haider and Solon (2006) find that the income earned around the age of 40 is the best proxy for permanent income.

[27] Abilities are normalized to have a mean of zero.

On the other hand, even taking the self-selection issue into account, we still find that elite college improve employee, incorporated, and unincorporated human capital much more than non-elite colleges do. Table 4 shows that elite college attendance leads to an increase in employee/incorporated/unincorporated human capital by 50%/56%/43%, while non-elite college attendance leads to a 31%/28%/28% increase.

To provide a summary statistic on the elite college issue, we also calculate the elite-college premium, which is defined as the difference between the discounted present value (DPV) of lifetime income (including tuition) at age 20 for an individual who chooses to attend an elite college and the DPV of lifetime income if the individual went to a non-elite college. The calculation does not include the consumption value of college. We find that the elite college premium is negative and equivalent to -26,106 U.S. dollars at age 20. Although elite colleges provide larger returns for employees, entrepreneurs, and other self-employed individuals, these returns are not large enough to cover the expensive tuition. Therefore, only those who receive high consumption value to elite college attendance enroll.[28]

6.3 Incorporated vs. Unincorporated Businesses

This paper has repeatedly emphasized that one of the contributions of elite colleges to lifetime income is through its change to the likelihood of being self-employed. The previous section reports that elite colleges improve employee, incorporated, and unincorporated human capital much more than ordinary colleges do. Thus, it is essential to deepen our understanding of incorporated and unincorporated businesses. Incorporated businesses use a combination of employee human capital and incorporated human capital, while unincorporated businesses mostly use unincorporated human capital. Table 4 shows that the contribution of employee human capital is 0.1 for incorporated business; the corresponding number for unincorporated business is only 0.02. Table 10 shows that individuals with high employee ability but low entrepreneur ability choose to become employees, those with high employee ability and high incorporated ability own incorporated businesses, and those with low employee ability but high unincorporated ability become unincorporated business owners. Our model's predictions are in line with the results of Levine and Rubinstein (2016), Levine and Rubinstein (2016), and Salgado (2017) that incorporated business owners tend to be successful salaried employees before becoming entrepreneurs and unincorporated business owners tend to earn less as salaried employees than comparable salaried employees that never become self-employed.

Besides, our model undercovers some parameter values that are not directly observable by econometricians. For instance, we find that the cost of opening an incorporated business is $50,000 (in 2011 dollars), while it is virtually zero for unincorporated businesses. This captures the fact that there are direct costs of incorporation, such as annual fees and the preparation of

[28] Jacob et al. (2018) show that elite colleges provide more consumption amenities than non-elite colleges, but we abstract away from consumption amenities here. Instead, we assume that each individual randomly draws a consumption value for elite college attendance and another consumption value for non-elite college attendance. We leave it to future research to provide an integrated approach to the issue of college consumption value.

more elaborate financial statements, and indirect agency costs associated with the separation of ownership and control. Therefore, incorporated businesses require more wealth to start, and older people are more likely to own an incorporated business than younger people. The first and the second differences explain why the transitions between the two types of businesses are rare, as shown in Table 5, a result that is also consistent with the findings of Levine and Rubinstein (2016).

6.4 Effect of Ability and Family Income on Education and Career Decisions

This paper highlights the relationship among abilities (employee ability, incorporated ability, and unincorporated ability, respectively) and family income on education and career decisions. To build up the intuitions behind the model, we provide visualization in this section. We divide individuals' family incomes into three groups: the bottom 1/3, the middle 1/3, and the top 1/3. Abilities are standardized and range from +2 to -2 standard deviations.

Figure 1 shows how employee ability and family income jointly affect decisions about college attendance and self-employment. The upper-left panel shows that individuals with higher family income are more likely to enroll in elite colleges, but this relationship is reversed for those with high ability. The chance that an individual with low employee ability (below 0.67 standard deviations) graduates from an elite college mostly depends on family income and not the individuals employee ability. The likelihood that an individual with high employee ability (above 0.67 standard deviations) graduates from an elite college is 15% for the top family income group and 20% – 25% for the bottom and middle family income groups. This increase in probability is because individuals with high ability from poor families receive more financial aid than individuals with the same ability but from rich families, as financial aid is both merit based and need based. The upper-right panel shows that the likelihood of graduating from a non-elite college increases with employee ability and is highest for the top family income group. The lower-left panel shows that the chance of becoming an entrepreneur increases with family income; the lower-right panel shows that the chance of owning an unincorporated business does not vary by family income. These relationships are a result of entrepreneurship being more capital intensive than other self-employment because entrepreneurship has a large entry cost. More importantly, we find that the chance of becoming an entrepreneur increases with employee ability but the chance of being other self-employed declines with employee ability. This is consistent with Table 10, which also finds positive sorting in employee ability for entrepreneurs and negative sorting in employee ability for other self-employed individuals.

Figure 3 demonstrates the joint effects of incorporated ability and family income on education and career choices. The upper-left and upper-right panels show that individuals from high income families are more likely to attend elite colleges and non-elite colleges, respectively; we find no obvious sorting behavior in terms of incorporated ability in either graph. The upper-left panel shows that positive sorting in incorporated ability only exists for the bottom and middle family income groups. An individual with high incorporated ability from a wealthy family may skip elite college and directly start an incorporated business, while an individual with similar ability from a poor family may want to go to an elite college to increase his employee earnings and to accumulate enough physical capital, in order to start a business. The bottom two panels show that incorporated ability increases the likelihood of being an entrepreneur but reduces the likelihood of being other self-employed. This implies that an individual with high incorporated ability is more likely to own an incorporated business and less likely to own an unincorporated business, suggesting a substitution effect between the two types of self-employment. In addition, conditional on incorporated ability, family income is positively associated with the likelihood of being an entrepreneur but has no impact on the likelihood of being other self-employed.

Figure 2 presents the interaction between unincorporated ability and family wealth for education and career choices. The upper-left panel shows that the probability of having an elite college degree is much higher for individuals from the top family income group. However, we do not find strong sorting behavior in unincorporated ability for all three family income groups. The upper-right panel shows the fraction of non-elite college graduates; there is positive sorting in unincorporated ability for the high family income group but not for the other two groups. The lower-left panel shows that the likelihood of being an entrepreneur declines with unincorporated ability, while the lower-right panel shows that the likelihood of being other self-employed increases with unincorporated ability in a concave manner. This again suggests that two types of self-employment are substitutes. In addition, conditional on unincorporated ability, family income is positively associated with the likelihood of being an entrepreneur but has no impact on the likelihood of being other self-employed. Family income also increases the chance of being an entrepreneur but has no impact on other self-employment, which is consistent with the other findings.

7 Counterfactual Analysis

7.1 Shutting Down Elite Colleges

Based on our estimated model and parameter values, we provide a counterfactual analysis of several scenarios in this section.[29] First, to analyze the impact of elite colleges on the economy, we consider a situation in which elite colleges are shut down. Table 11 presents the results. Without elite colleges, the number of entrepreneurs declines by 0.6 ppt (10.9%), while the number of other self-employed slightly declines by 0.1 ppt (0.8%). This suggests that elite colleges have a larger impact on the number of entrepreneurs than on the number of other self-employed individuals. Shutting down elite colleges also reduces the income of employees, entrepreneurs, and other self-employed individuals by 4%, 10%, and 6% respectively. Elite colleges have a larger impact on the income of entrepreneurs than the income of other self-employed individuals.

[29] Wolpin (2013) explains why counterfactual analysis based on structural models are easier to interpret.

Elite colleges also play an important role in the transition into entrepreneurship. Shutting down elite colleges has a larger impact on the transition from employment to entrepreneurship (9% drop) than on the transition from employment to other self-employment (1% drop). The average age of starting an incorporated business increases from 37.9 to 38.1 but the average age of starting an unincorporated business declines from 33.9 to 32.6, suggesting that the effects of elite colleges on the two types of businesses are quite different.

Shutting down elite colleges has two effects on the transition out of entrepreneurship. On the one hand, individuals cannot go to elite colleges to acquire more human capital, which reduces the chance that they can stay in business. On the other hand, without elite colleges, only individuals who are born with relatively high incorporated ability become entrepreneurs and they tend to stay in business longer than the others. Therefore, the net effect is ambiguous. The empirical results show that shutting down elite colleges does not change the probability of remaining an entrepreneur and the average duration of entrepreneurship increases by 0.4 years, suggesting the second channel dominates the first. Similarly, shutting down elite colleges increases the probability of remaining an unincorporated business owner and the duration of unincorporated business ownership.

7.2 Providing Subsidies to Elite College and Non-Elite College Students

Entrepreneurs are subsidized in many ways in different countries and not all subsidies are successful (Lerner, 2009 and Lerner and Schoar, 2010). Based on our structural model, we analyze the implications of two policies: subsidies to elite and non-elite college students. We consider a subsidy rate from 0 to 1. When the subsidy rate reaches 1, the subsidy covers all tuition. In both experiments, we use a labor income tax to finance the subsidy so that the government is budget balanced. The results are shown in Figures 4 and 5 and the details are in Appendix Tables A6 and A7.

Figure 4 shows the impact on the fractions of non-elite college graduates, elite college graduates, entrepreneurship, and other self-employment for the two experiments. Providing elite college subsidies leads to a huge increase in the number of elite college graduates and a drop in the number of non-elite college graduates. However, providing non-elite college subsidies leads to a big increase in the number of non-elite college graduates but does not have a large impact on the number of elite college graduates. A 100% subsidy to elite college students increases the fraction of elite college graduates by 45.4 ppt and reduces the fraction of non-elite college graduates by 5.7 ppt; the same subsidy rate for non-elite college students increases the fraction of non-elite college graduates by 16.8 ppt and only slightly reduces the fraction of elite college graduates by 0.1 ppt. This suggests that elite college subsidies encourage non-elite college students to go to elite colleges, while non-elite college subsidies mostly attract high school graduates to go to non-elite colleges.

Elite college subsidies have a larger impact on the number of entrepreneurs and other self-employed individuals than non-elite college subsidies do. In addition, the effect of elite-college subsidies on entrepreneurship is larger than its effect on other self-employment. A 100% subsidy to elite college students increases the fraction of entrepreneurs by 5.2 ppt and the fraction of other self-employed individuals by 2.1 ppt; the same subsidy rate for non-elite college students only increases the fraction of entrepreneurs by 0.8 ppt and the fraction of other self-employed individuals by 0.6 ppt.

Figure 5 shows the effects of subsidies on entrepreneur income and dynamics and the aggregate effects on society, such as intergenerational income elasticity, welfare, and the income Gini coefficient. Elite college subsidies are more efficient in improving entrepreneur income, reducing the age of starting entrepreneurship, and increasing the duration of entrepreneurship. A 100% subsidy to elite college students increases entrepreneur income by 51.0%, reduces the age of starting entrepreneurship by 0.95 years, and increases the average duration of entrepreneurship by 0.75 years. However, the same rate of subsidy to non-elite college students only increases entrepreneur income by 7.3%, reduces the age of starting entrepreneurship by 0.12 years, and increases the average duration of entrepreneurship by 0.06 years.

In terms of aggregate effects, low levels of subsidy rates do not have a big impact on intergenerational income elasticity for either type of subsidy. Elite college subsidies have a larger effect on intergenerational income elasticity at higher subsidy rates (greater than 30%). A 100% subsidy to elite college and non-elite college students reduces intergenerational income elasticity by 9.3 ppt and 4.1 ppt, respectively. In addition, both types of subsidies improve social welfare and social welfare is optimized at the 100% subsidy rate in both cases. A 100% subsidy to elite college students improves social welfare by 88%, while a 100% subsidy to non-elite college students improves social welfare by 36%. Figure 5 demonstrates that elite college subsidies provide larger welfare gains than non-elite college subsidies do at all levels of subsidies. However, elite college subsidies increase the income Gini coefficient, while non-elite college subsidies reduce the income Gini coefficient. A 100% subsidy to elite college students increases the Gini coefficient by 0.9 ppt, while a 100% subsidy to non-elite college students reduces the Gini coefficient by 0.004 ppt.

The optimality of full subsidy may seem counter-intuitive. In the literature, tuitions are often used as a screening mechanism to select the “right students (Fu, 2014). There are elements in our model, which contribute to the full subsidy results. First, there are a high fixed cost and financial constraints to start an incorporated business. In addition, while we impose no borrowing constraint on college students, those who have tuition loans are not allowed to borrow business loans until the tuition loans are paid off. This realistic constraint can distort the incentive to become an entrepreneur and therefore the incentive to go to colleges. A decrease in tuition may reduce such distortion and improve social welfare.

Overall, elite college subsidies are more efficient in increasing the number of entrepreneurs, improving the income of entrepreneurs, reducing the age of starting entrepreneurship, and increasing the duration of entrepreneurship than subsidies to non-elite college students. In terms of aggregate effects, elite college subsidies lead to a larger reduction in intergenerational income persistency and a larger increase in social welfare than non-elite college subsidies. However, elite college subsidies increase income inequality, while non-elite college subsidies reduce income inequality.

One caveat of this counterfactual experiment is that we do not model the supply side decisions in the education market (i.e., the decisions of elite and non-elite colleges). It is possible that if more students enrolled in colleges, the costs of elite college would increase and colleges would adjust tuition. In addition, education quality could decline. To capture the equilibrium response of elite and non-elite colleges, we would need a model of the education market and more information on the costs of college. Adding supply side decisions to our current model, which already has much heterogeneity across agents, would compromise tractability; we leave this to future research.

8 Conclusion

In this paper, we study whether elite colleges matter and how they matter. We analyze the effect of elite college attendance on entrepreneurship decisions and career dynamics. We construct and estimate an overlapping generations model which allows elite college and non-elite college attendance to lead to different human capital accumulation. Our model also allows for different career paths (employee, entrepreneur, other self-employed) which require different types of human capital. We use a restricted access panel dataset to estimate the model and find that elite colleges contribute more to different kinds of human capital than non-elite colleges do, which in turn increases the chance that elite college graduates become entrepreneurs relative to non-elite college graduates. However, the elite college premium is negative, meaning that the tuition for elite colleges is too high to justify the benefits. This result agrees with the recent literature on the consumption value of college.

Our counterfactual analysis reveals that shutting down elite colleges would significantly decrease the number of entrepreneurs but not the number of other self-employed individuals. It would also significantly reduce the chance of transitioning from being an employee to being an entrepreneur. We contrast subsidies to elite college students with subsidies to non-elite college students and find that subsidizing elite college students has many merits. Relative to non-elite college subsidies, elite college subsidies are more efficient in increasing the number of entrepreneurs, improving the income of entrepreneurs, reducing the age of starting entrepreneurship, increasing the duration of entrepreneurship, reducing intergenerational income persistency and bringing a larger increase in social welfare. The only drawback is that elite college subsidies increase income inequality while ordinary college subsidies reduce income inequality. Overall, our paper suggests that elite colleges are important engines for producing successful entrepreneurs but that high tuition and borrowing constraints prevent some would-be entrepreneurs from attending an elite college.

There are some limitations to our analysis. We consider three types of skills in this paper (employee human capital, incorporated human capital, and unincorporated human capital) to differentiate the different skill requirements for employees, entrepreneurs, and other self-employed individuals. Some studies question whether entrepreneurial human capital is one skill or a set of skills. For instance, Lazear (2004, 2005) stress that entrepreneurs have many skills but may not be excellent in any one area. This idea is further developed by Ding (2011), Hayward et al. (2006), and Holm et al. (2013). In our setup, we allow incorporated/unincorporated business owners to use both employee and incorporated/unincorporated human capital. Future work could consider more types of skills.

We also ignore potentially relevant elements for tractability. For instance, Dyrda and Pugsley (2018) study how tax reforms change the composition of incorporated businesses between C-corporations and S-corporations. Unfortunately, the PSID data do not distinguish between these two kinds of corporations. Future work could further explore how tax policies affect career choices. Lazear (2016) explores a model with different career paths with errors in individuals estimates of performance. His theory suggests that overconfidence should be more prevalent in occupations where estimates of ability are noisier such as entrepreneurship. Dillon and Stanton (2017) also consider the initial uncertainty in entrepreneur earnings and gradual learning about the entrepreneurial earnings process. As we attempt to integrate the insights from the human capital and the entrepreneur literatures, we abstract from signal extraction considerations to keep the model simple. Future work should explore the issues of uncertainty and learning in entrepreneurship, how they affect parameter estimation, and their policy implications.

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Table 1: Summary Statistics by Career

	All	Employee	Non-employee	Entrepreneur	Other self-employed
Age	35.9	35.41	38.1	39.59	37.44
Years of schooling	14.34	14.28	14.57	15.12	14.32
College degree	39.67%	38.66%	44.24%	57.23%	38.44%
Income(median)	51,645	51,343	54,010	72,996	48,093
Income(mean)	63,288	60,314	76,689	117,360	58,542
Income(std)	67,632	56,618	102,585	149,760	64,426
Observations	22,563	18,465	4,098	1,265	2,833
Proportion	100%	81.8%	18.2%	5.6%	12.6%

Non-employee includes both entrepreneurs and other self-employed individuals.

Table 2: Regression on Career Choice

	(1) Entrepreneur	(2) Other self-employed
Non-elite college	0.0171***	0.00130
	(5.39)	(0.30)
Elite college	0.0201***	0.0150
	(3.39)	(1.85)
Graduate school	0.00463	-0.00327
	(1.28)	(-0.66)
Father has non-elite college degree	0.00863**	0.00720
	(2.98)	(1.82)
Father has elite college degree	0.0295***	0.0215**
	(5.56)	(2.96)
Father ever runs unincorporated business	0.0146***	0.0519***
	(5.42)	(14.03)
Father ever runs incorporated business	0.0402***	0.0322***
	(14.19)	(8.32)
Constant	0.0248***	0.0739***
	(13.31)	(29.04)
N	38009	38009

We use a linear probability model. The dependent variable for the first column is whether the respondent owns an incorporated business and the dependent variable for the second column is whether the respondent owns an unincorporated business. The sample includes all white males with a high school or higher degree.

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Regression on Log Total Income

	(1) Employee	(2) Entrepreneur	(3) Other self-employed
Non-elite college	0.345***	0.103	0.371***
	(25.74)	(1.62)	(7.10)
Elite college	0.615***	0.386***	0.369***
	(24.21)	(3.51)	(3.95)
Graduate school	0.0727***	0.051***	0.153**
	(4.77)	(0.76)	(2.60)
Father has non-elite college degree	0.104***	0.0947	0.166***
	(8.51)	(1.68)	(3.54)
Father has elite college degree	0.0448	0.172*	0.264**
	(1.94)	(2.04)	(3.20)
Father ever runs unincorporated business	-0.123***	-0.0344	-0.0969*
	(-10.87)	(-0.55)	(-2.16)
Father ever runs incorporated business	-0.0400***	-0.00395	-0.0352
	(-3.35)	(-0.07)	(-0.73)
Constant	10.31***	10.61***	10.22***
	(1355.83)	(212.39)	(290.20)
N	32,316	1,892	3,589

We use a linear probability model. The dependent variable for all three columns is total income which includes labor income and business income and is pre-tax and pre-transfer. The sample includes all white males with high school or higher degree.

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Parameter Estimates

	Employee	Entrepreneur	Other self-employed
Productivity	2186 (532)	2.1 (0.5)	20.0 (8.1)
Return to non-elite college	0.31 (0.11)	0.28 (0.09)	0.28 (0.07)
Return to elite college	0.50 (0.19)	0.56 (0.16)	0.43 (0.17)
Return to potential experience	0.32 (0.08)	-	-
Return to experience squared	-0.032 (0.01)	-	-
Return to capital	-	0.75 (0.22)	0.58 (0.20)
Contribution of EM human capital to EN	-	0.20 (0.06)	0.02 (0.01)
Std of productivity shock	0.75 (0.20)	0.75 (0.29)	0.58 (0.18)
Fixed cost	-	60000 (22500)	0.00 (0.00)
Std of consumption shock	-	0.0005 (0.0002)	0.0009 (0.0003)
Std of ability	0.34 (0.12)	0.36 (0.16)	0.35 (0.14)
Intergenerational ability transfer	0.61 (0.17)	0.32 (0.10)	0.29 (0.06)
Std of consumption shock for college	0.010 (0.003)/0.0010 (0.002) (NC/EC)		
Weight on offspring's welfare	0.004 (0.001)		
Output elasticity of capita	0.246 (0.082)		

Standard errors in parentheses.

EM: employee, EN: entrepreneur, IB: incorporated business owner, UB: unincorporated business owner, NC: non-elite college, EC: elite college.

Table 5: Career Transition from Period t to $t + 1$

Data	Employees	Entrepreneurs	Other self-employed
Employees	87.0%	34.3%	38.7%
Entrepreneurs	3.3%	53.0%	9.3%
Other self-employed	9.8%	12.7%	52.0%
Model	**Employees**	**Entrepreneurs**	**Other self-employed**
Employees	87.1%	31.4%	39.7%
Entrepreneurs	3.5%	56.6%	6.2%
Other self-employed	9.4%	12.0%	54.1%

One period is five years. Period t in columns and period $t + 1$ in rows.

Table 6: Income correlation between period t and $t + 1$

Data	Employees	Entrepreneurs	Other self-employed
Employees	0.710	0.530	0.567
Entrepreneurs	0.602	0.697	0.483
Other self-employed	0.493	0.090	0.410
Model	**Employees**	**Entrepreneurs**	**Other self-employed**
Employees	0.704	0.622	0.371
Entrepreneurs	0.549	0.723	0.399
Other self-employed	0.421	0.190	0.501

One period is five years. Period t in columns and period $t + 1$ in rows.

Table 7: Income in period t by career type in periods t and $t + 1$

Data	Employees	Entrepreneurs	Other self-employed
Employees	54,582	109,868	55,017
Entrepreneurs	75,482	123,262	88,547
Other self-employed	54,745	87,824	59,587
Model	**Employees**	**Entrepreneurs**	**Other self-employed**
Employees	53,260	113,727	54,123
Entrepreneurs	73,382	120,773	80,038
Other self-employed	52,269	81,805	62,637

One period is five years. Period t in columns and period $t + 1$ in rows.

Table 8: Intergenerational Mobility

		Education choice						
Data	HS	NC	EC	Model	HS	NC	EC
HS	77.5%	51.3%	41.5%	HS	70.0%	59.1%	49.3%
NC	20.0%	38.5%	36.9%	NC	25.5%	31.7%	32.5%
EC	2.7%	10.2%	21.5%	EC	4.6%	9.2%	18.3%
		Career choice					
Data	EM	IB	UB	Model	EM	IB	UB
EM	62.7%	49.6%	54.9%	EM	64.3%	50.7%	55.8%
IB	14.1%	24.6%	14.5%	IB	17.0%	27.7%	17.8%
UB	23.2%	25.8%	30.6%	UB	18.7%	21.6%	26.4%

Fathers in columns and sons in rows.
HS: high school graduates, NC: non-elite college graduates, EC: elite college graduates, EM: employees, IB: entrepreneurs, UB: other self-employed.

Table 9: Intergenerational Income Elasticity

	Data	Model
Whole sample	0.39	0.41
Both father and son are devoted employees	0.51	0.55
Father has worked as non-employee; son is devoted employee	0.32	0.39
Father is devoted employee; son has worked as non-employee	0.39	0.39
Both father and son have worked as non-employee	0.31	0.33

Intergenerational income elasticity is calculated by regressing son's average income between ages 30 and 50 on father's average income during the same age range.
Non-employees include both self-employed individuals and entrepreneurs.

Table 10: Average Ability by Education and Career

	Employee	Entrepreneur	Other self-employed	Total
Employee ability				
High school	-0.158	-0.043	-0.184	-0.065
Non-elite college	0.041	0.104	0.018	0.092
Elite college	0.188	0.333	0.145	0.291
Incorporated ability				
High school	-0.023	0.513	-0.020	0.002
Non-elite college	-0.028	0.450	-0.014	0.004
Elite college	-0.038	0.337	-0.033	0.010
Unincorporated ability				
High school	-0.045	-0.056	0.333	0.000
Non-elite college	-0.037	-0.069	0.312	0.000
Elite college	-0.046	-0.018	0.251	-0.006

Average ability is normalized to be zero.

Table 11: Counterfactual: Effect of Shutting Down Elite Colleges on Entrepreneurship

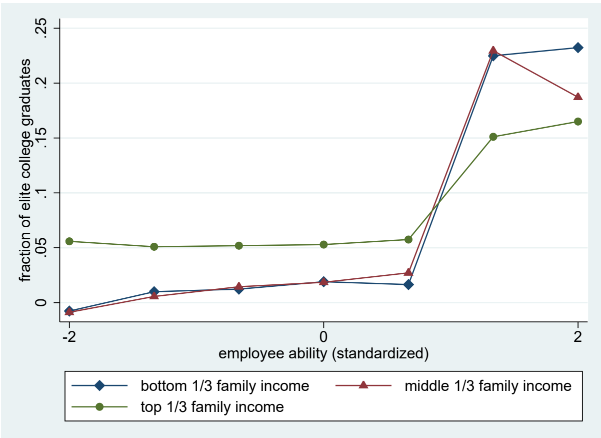
	Data	Model	No elite college
Fraction of EM	0.818	0.827	0.833
Fraction of IB	0.056	0.055	0.049
Fraction of UB	0.126	0.119	0.118
Average income of EM	60,314	59,896	57,406
Average income of IB	117,360	104,816	94,768
Average income of UB	58,542	59,026	55,341
Transition from EM to EM	0.870	0.871	0.875
Transition from EM to IB	0.033	0.035	0.032
Transition from EM to UB	0.098	0.094	0.093
Transition from IB to EM	0.343	0.314	0.316
Transition from IB to IB	0.530	0.566	0.566
Transition from IB to UB	0.127	0.120	0.118
Transition from UB to EM	0.387	0.397	0.393
Transition from UB to IB	0.093	0.062	0.058
Transition from UB to UB	0.520	0.541	0.549
Average age of starting IB	35.11	37.88	38.06
Average age of starting UB	32.43	33.86	32.56
Average duration of IB	7.65	10.26	10.67
Average duration of UB	6.31	7.89	7.94

EM: employees, IB: entrepreneurs, UB: other self-employed.

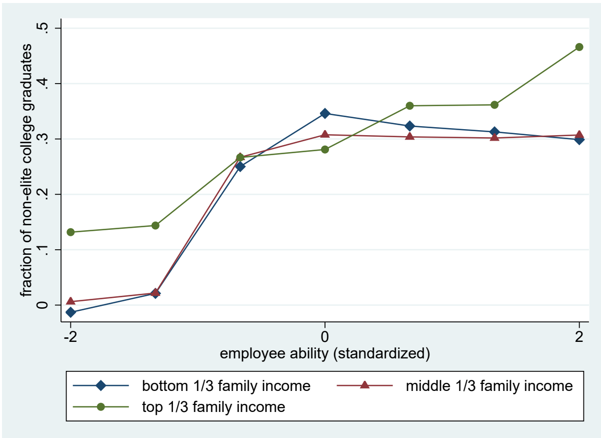
Table 12: Counterfactual: Effect of Shutting Down Elite Colleges on Intergenerational Mobility

	Data	Model	No elite college
Fraction of EM if father is EM	0.627	0.643	0.661
Fraction of IB if father is EM	0.141	0.170	0.151
Fraction of UB if father is EM	0.232	0.187	0.188
Fraction of EM if father is IB	0.496	0.507	0.520
Fraction of IB if father is IB	0.246	0.277	0.250
Fraction of UB if father is IB	0.258	0.216	0.230
Fraction of EM if father is UB	0.549	0.558	0.580
Fraction of IB if father is UB	0.145	0.178	0.161
Fraction of UB if father is UB	0.306	0.264	0.259
Intergenerational income elasticity	0.390	0.410	0.394

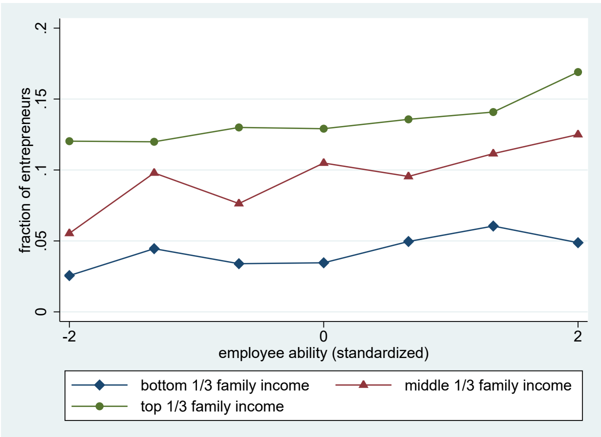
EM: employees, IB: entrepreneurs, UB: other self-employed.



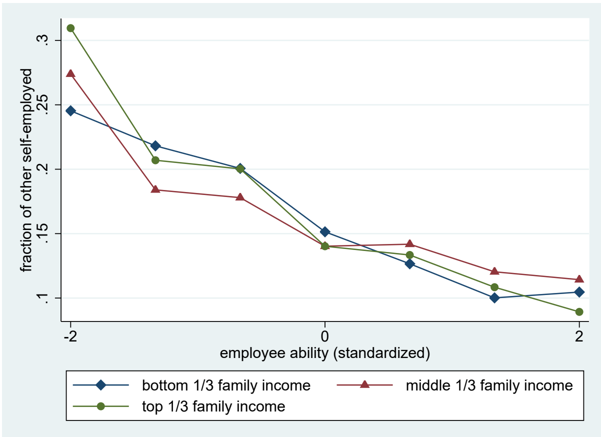
(a) Fraction of elite college graduates



(b) Fraction of non-elite college graduates

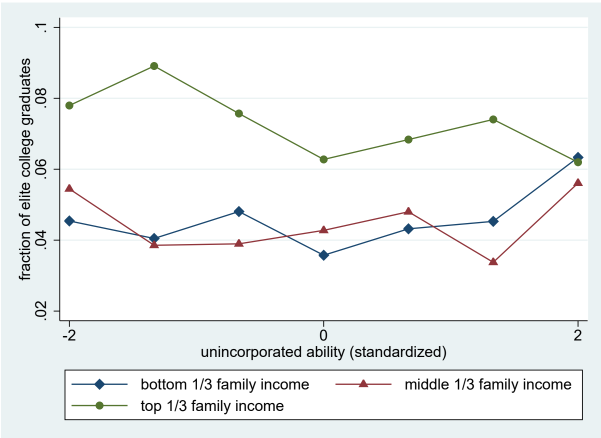


(c) Fraction of entrepreneurs

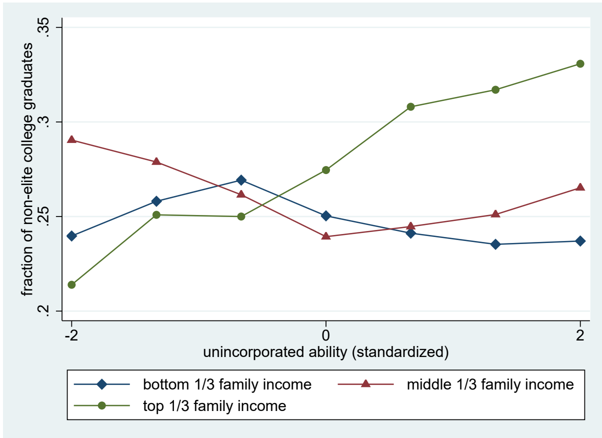


(d) Fraction of other self-employed

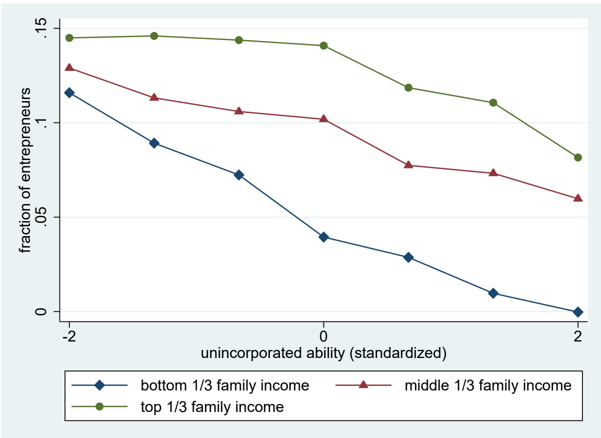
Figure 1: Education and career choices by employee ability and family wealth



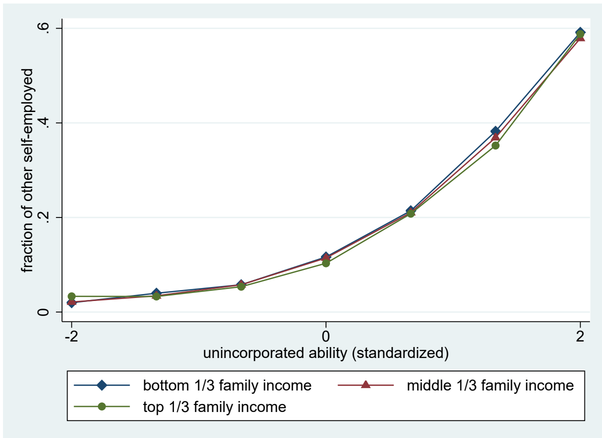
(a) Fraction of elite college graduates



(b) Fraction of non-elite college graduates

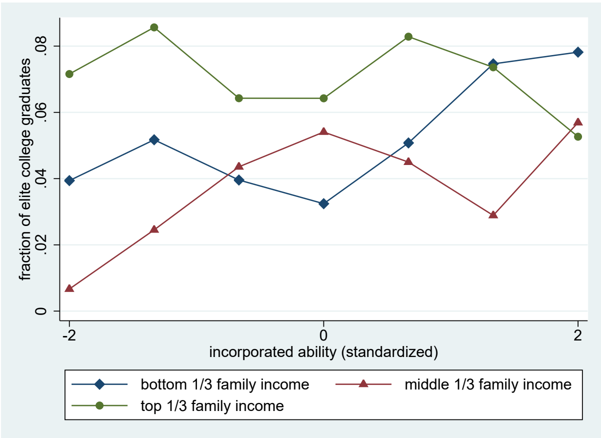


(c) Fraction of entrepreneurs

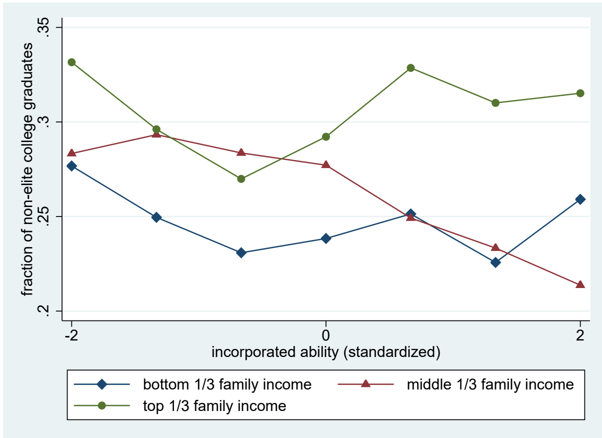


(d) Fraction of other self-employed individuals

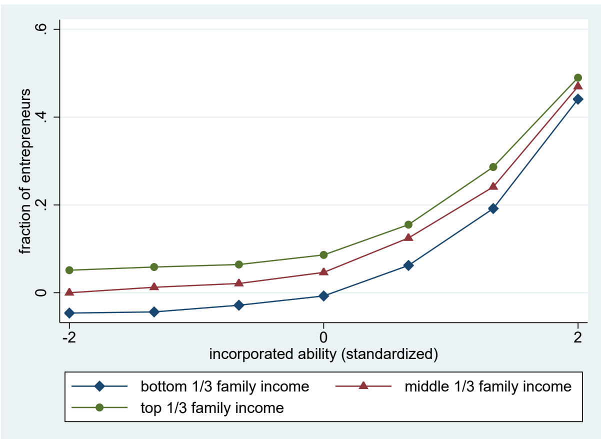
Figure 2: Education and career choices by unincorporated ability and family wealth



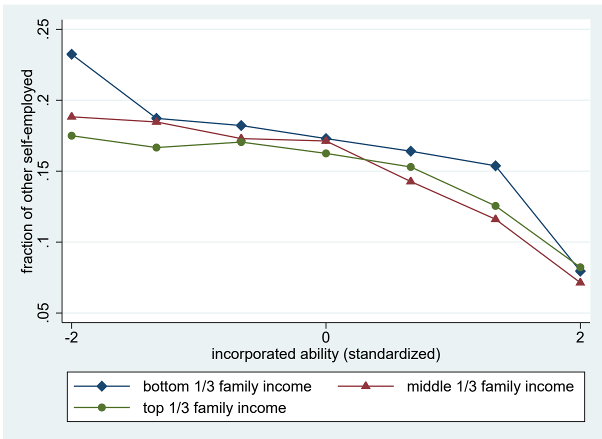
(a) Fraction of elite college graduates



(b) Fraction of non-elite college graduates



(c) Fraction of entrepreneurs



(d) Fraction of other self-employed individuals

Figure 3: Education and career choices by incorporated ability and family wealth

Figure 4: Counterfactual: Subsidy to Elite/non-elite College Students

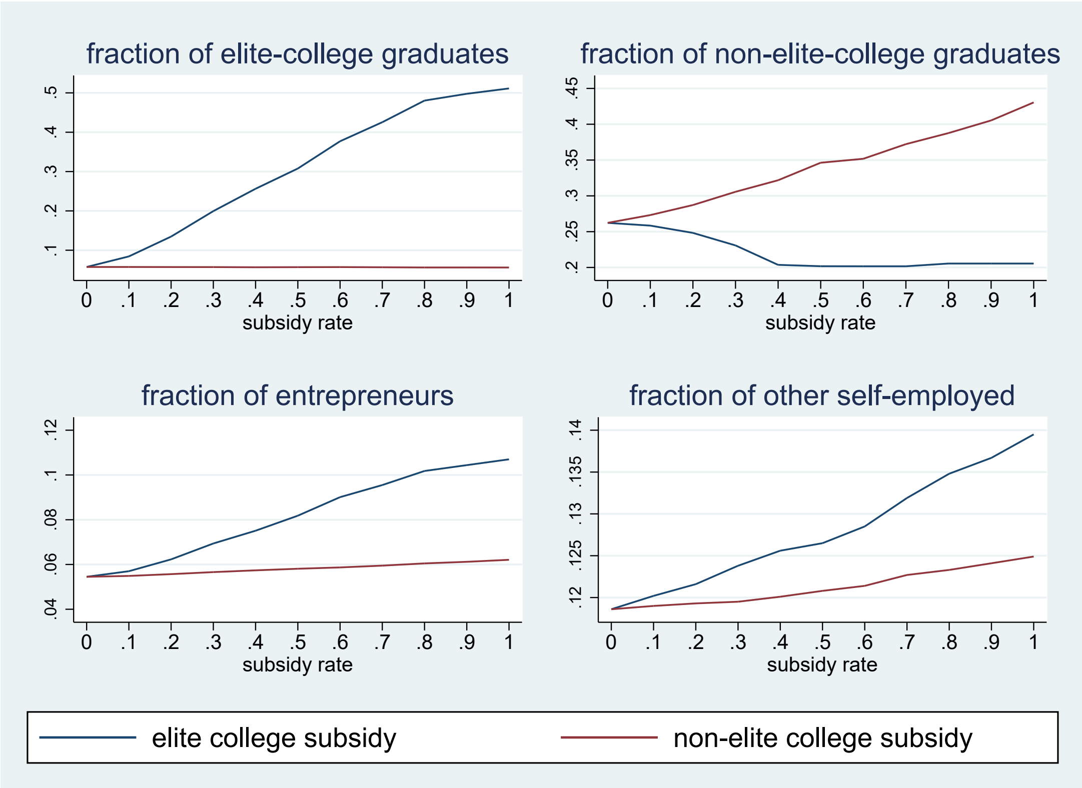


Figure 5: Counterfactual: Subsidy to Elite/non-elite College Students (Cont'd)